

MATCHING INVENTORY REPLENISHMENT  
HEURISTICS TO DEMAND PATTERNS:  
A COST/BENEFIT APPROACH

by

RANDALL A. NAPIER

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ABSTRACT  
MATCHING INVENTORY REPLENISHMENT  
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Randall A. Napier, PhD

The University of Texas at Arlington, 2012

Supervising Professor: Gregory Frazier

Behavioral research indicates that bounded rationality and resource constraints support the use of “fast and frugal heuristics” that intentionally exclude some available information from decision models. Inventory replenishment decisions must be made quickly and efficiently, and as such are a promising realm for the use of fast and frugal heuristics. This research includes a simulation study to identify significant relationships among heuristics and demand patterns, yielding inferences regarding the advantages of selecting replenishment models to match demand patterns. Findings from the simulation are validated against three years of actual usage data for 278 independent demand items from a single industrial company. The research also develops a process-driven analytical framework for identifying best-fit demand patterns for independent demand items. The final section of the study presents a cost/benefit analysis that recognizes the differential costs of implementing and managing alternative replenishment models, and offers inferences regarding the use of simple heuristics in lieu of more data-intensive models for inventory replenishment decisions.

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CHAPTER 1  
INTRODUCTION

1.1 Overview

Behavioral research indicates that bounded rationality and resource constraints support the use of “fast and frugal heuristics” that intentionally exclude some available information from decision processes. Inventory replenishment decisions must be made quickly and efficiently, and as such are a promising realm for the use of fast and frugal heuristics.

Peer-reviewed literature in Operations Management (OM) and related disciplines has focused extensively on the Economic Order Quantity (EOQ) model, and on EOQ-based heuristics for the replenishment of independent demand inventory items. The typical paper examines a specific variant or extension of the EOQ model, or proposes and tests a single heuristic with hypothetical data and simulation. Most papers address the single-item replenishment problem, and ignore practical issues such as the need to use different lot-sizing rules for different item categories.

This research develops and analyzes a process for matching inventory replenishment heuristics to categories of inventory items with different demand patterns. The methodology involves (a) running a simulation study to identify significant relationships among inventory replenishment heuristics and demand patterns, (b) using actual data on multiple years of demand for 278 independent demand items from a single industrial company to validate the results of the simulation study, (c) designing an implementation process for fitting items to demand patterns, and (d) a cost/benefit analysis to evaluate the tradeoffs involved in applying different replenishment models in a multi-item inventory environment.

The remainder of this document is organized as follows. The remaining parts of Chapter 1 discuss the study motivation and research questions, define the underlying business

problem, and establish the scope of this study. Chapter 2 presents a survey of relevant literature with a focus on gap analysis, and Chapter 3 details the methodology applied in the different phases of this research. Chapter 4 presents results and findings from the simulation study; Chapter 5 discusses validation of the simulation results with empirical data drawn from an industrial company. Chapter 6 applies lessons learned from the simulation and validation to design an implementation process for matching inventory items to demand patterns. Chapter 7 uses assumptions drawn from the company that provided the empirical data, along with results from prior phases of this research, to analyze the cost/benefit tradeoffs of using alternative replenishment models. Section 8 presents concluding remarks, discusses contributions of this research, and identifies promising areas for future research.

### 1.2 Motivation and Central Research Questions

Notwithstanding the availability of material requirements planning (MRP) techniques, many industrial companies continue to use EOQ-based reorder point models and related heuristics to replenish purchased independent demand inventory items. The combined effect of the following factors leads many manufacturing and distribution companies to use reorder point models:

- The company handles a large number of purchased independent demand items.
- The company chooses not to allocate staff time to item-level demand forecasting.
- Absent item-level forecasting, MRP is not useful for items with purchasing lead times that exceed customer-required lead times.

In selecting reorder point models, efficient maintenance and ease of application is preferred for the same reasons that lead companies to avoid item-level demand forecasting. Many companies therefore apply a one-rule-fits-all approach to reorder point replenishment. Even companies that apply sophisticated variants of the EOQ model simplistically apply formulas based on the assumption that probabilistic demand adheres to the normal probability distribution.

Similarly, most research on EOQ model variations and heuristics devotes little or no consideration to demand distributions and demand patterns other than the normal distribution. This gives rise to the central research questions presented below. The first two research questions pertain to matching replenishment rules to demand patterns, while the others address related issues.

(1) Do replenishment models matter? In other words, does the choice of replenishment models significantly affect inventory system performance?

(2) Do demand patterns matter? In other words, for a given replenishment model will different demand patterns yield significantly different inventory system performance?

(3) What process impediments are involved in item-demand pattern matching?

(4) Do the advantages of alternative replenishment rules outweigh the costs?

(5) Can efficient heuristics outperform more data-intensive models in OM decisions?

As the literature survey indicates, the most common use of EOQ-based reorder point models involves recognizing demand variability, but assuming that periodic demand is normally distributed. Actual demand for individual items may well follow (a) a time-varying demand pattern, or (b) a non-normal distribution with a stationary mean. With that in mind, a formal EOQ model that assumes normally-distributed demand for all items represents a heuristic (rule of thumb) rather than the application of a purpose-built model. Under that view, even the formal EOQ-based reorder point model as it is used in practice can be evaluated under the fast and frugal heuristics paradigm.

### 1.3 Problem Definition: the EOQ Model and Replenishment Heuristics

Replenishment models and demand patterns have been selected for inclusion in this study pursuant to the results of the literature survey. The selection process was designed to recognize widely-used replenishment heuristics, and frequently-encountered and researched demand patterns, while appropriately limiting the scope of this exploratory study. The four selected replenishment models and seven selected demand patterns are discussed below.

### 1.3.1 Replenishment Heuristics

The four replenishment models investigated, which are overviewed in the Literature Summary, are:

- Wagner-Whitin Algorithm      Baseline for cost-performance evaluation
- EOQ Model ( $R, s, S$ )      Lowest cost EOQ model (assume normality)
- EOQ Range Model      Most promising/administratively efficient heuristic
- Silver-Meal Heuristic      Widely used and researched EOQ-based heuristic

The assumptions underlying these four replenishment models are compared in Table 1.1, and the rationale for including each model is discussed below.

Table 1.1  
Inventory Replenishment Model Comparison

	Demand Assumption	Decision Rule	Role in Current Study
Wagner-Whitin Algorithm	Deterministic	Choose the sequence of period-quantity replenishment lots that minimizes holding costs plus ordering costs for a defined planning period.	Defines the mathematically optimal replenishment strategy for variable but deterministic demand. Used here to calculate best-possible inventory system cost after-the-fact. This provides a baseline for cost-performance evaluation of heuristics.
( $R, s, S$ ) EOQ Model	Stochastic/Normal	Periodic review; use basic EOQ model to calculate the difference between reorder point and order-up-to target; set reorder point to average demand during lead time plus safety stock; use normal probability distribution to calculate safety stock.	This EOQ model variant is widely used in practice; periodic demand is assumed to be normally distributed. This is evaluated as a heuristic method here due to the exclusion of alternative demand pattern information from lot size calculation.
EOQ Range Model	Stochastic	Periodic review; calculate indifference points for holding cost plus ordering cost for period replenishment quantity based on annual spend of individual items. Assume same safety stock level as ( $R, s, S$ ) EOQ model.	This lot sizing heuristic is less calculation-intensive than the ( $R, s, S$ ) EOQ model and may offer comparable inventory system cost performance with lower administrative and staffing costs.
Silver-Meal Heuristic	Deterministic	Periodic review; calculate integer-period replenishment quantity that most nearly equalizes holding cost and ordering cost for each item. Assume same safety stock level as ( $R, s, S$ ) EOQ model.	This widely-used and researched method is simple to calculate (frugal); it may perform nearly as well as the ( $R, s, S$ ) EOQ model while entailing lower administrative & staffing costs.

The Wagner-Whitin Algorithm is included in the study only to provide a baseline for measuring the cost-efficiency of the three alternative replenishment heuristics under stochastic



demand. As noted in the literature survey, the Wagner-Whitin algorithm defines the mathematically optimal cost-minimization scenario for inventory replenishment when demand is *deterministic* (i.e., known with certainty in advance). The deterministic demand requirement makes this algorithm infeasible in the no-forecast scenario that is assumed in this study, but the Wagner-Whitin method can be applied after the fact to calculate the lowest possible inventory system cost that *could have been* achieved. This calculation is applied to simulated and actual demand to yield the optimal baseline against which the results of the three heuristics can be measured to calculate a *penalty cost multiple*.

The  $(R, s, S)$  EOQ reorder point model is treated as a heuristic in this study because it is commonly calculated and applied in practice with the assumption that periodic demand is normally distributed—when in fact this is not always the case. Viewed in that light, the intentional exclusion of information regarding actual demand patterns makes the application of the  $(R, s, S)$  model consistent with the Gigerenzer et al. (1999) definition of a heuristic. The specific  $(R, s, S)$  version of the EOQ model is chosen for the study because (a) it is recognized as the EOQ-based reorder point model that will yield the lowest inventory system cost when demand is normally distributed, while (b) requiring more calculation and administrative intensity than true heuristic methods such as the Range EOQ model and the Silver-Meal Heuristic.

The Range EOQ model, as defined with the notation used by Silver, Pyke and Peterson (1998), involves assigning inventory items to fixed-duration replenishment classes based on the annual amount spent to acquire each item. Items with a large annual spend are ordered more frequently, and a formula is used to calculate the end points of the ranges (annual spend indifference points). The formula for calculating the indifference points is presented below.

Let

$A$  = the fixed cost of processing one replenishment order

$v$  = the unit variable (purchase) cost of an item

$r$  = the carrying cost per year of holding \$1 of item variable cost in inventory

$D$  = the annual demand of an item, in units

$T_1, T_2, \dots, T_n$  = the number of months of supply to be ordered at one time

$DV_{(\text{indifference})}$  = the annual spend indifference point between  $T_n$  and  $T_{n+1}$

for number of months of supply

Then, the annual spend indifference points for period-duration replenishment quantities can be calculated as

$$DV_{(\text{indifference})} = (288A) \div (T_1 T_2) r$$

When this heuristic is used, a larger number of alternative values of  $T_n$  will reduce the resulting cost penalty while increasing the administrative complexity involved in using this method. Fractional values of  $T_n$  can be used to determine period-duration replenishment quantities.

The Silver-Meal Heuristic is an EOQ-based rule for minimizing the total of relevant costs (ordering cost plus holding cost) for each replenishment cycle (Silver and Meal 1973). Assuming that a replenishment order is received at the start of Period 1 and contains a quantity sufficient to meet requirements through the end of period  $T$ , the value of  $T$  that minimizes per-period inventory system costs defined by the following expression is used to establish the period-duration replenishment quantity for an item:

$$(\text{Setup cost} + \text{Total carrying cost to end of period } T) \div T$$

The assumptions underlying the Silver-Meal heuristic make it necessary to use an integer number for the replenishment duration  $T$  (Silver et al. 1998). In practice, the selected period value of  $T$  will represent the period immediately before the period average of total inventory system cost increases for the first time. In fast and frugal heuristics research (e.g., Gigerenzer et al. 1999, citing Hey 1982, 1987) this is known as a “one-bounce rule,” which involves checking values as long as they move in a particular direction (the search rule) and selecting the last value before the direction reverses (the stopping rule and decision rule).

As noted in the literature survey, the Silver-Meal Heuristic is chosen for inclusion in the current study because it is widely used and understood, and because it offers reduced calculation intensity when compared to the  $(R, s, S)$  EOQ model under stochastic demand.

### 1.3.2 Demand Patterns

The choice of demand patterns for this study was shaped by an interest in considering (a) demand distributions with stationary means as well as (b) time-varying demand patterns. Four stationary-mean distributions and three time-varying demand patterns were chosen.

The four stationary-mean distributions to be investigated are discussed in the literature survey. These are:

- |                         |   |
|-------------------------|---|
| • Normal distribution   | Widely assumed in practice                                |
| • Poisson distribution  | Most frequently researched non-normal distribution        |
| • Gamma distribution    | Frequently researched distribution; parameter flexibility |
| • Erlang-C distribution | Special form of the gamma distribution                    |

The three time-varying demand patterns to be investigated are also discussed in the literature survey. Chosen because they are frequently encountered in practice, these are:

- Seasonal demand
- Trend demand
- Seasonal demand with trend

Each demand pattern is used in one high-variability category and one low-variability category in the simulation study, and in the empirical validation study. The variability categories are based on a cutoff value for the coefficient of variation. The validation study also recognizes an “other” demand pattern group, which is used for all items with demand patterns that do not properly fit into one of the six designated patterns. Items with demand patterns designated as “other” are also assigned to high-variability and low-variability categories. The demand pattern categories used in the study are summarized in Table 1.2.

Table 1.2  
Demand Pattern Categories

X = Used in Simulation  
Y = Used in Empirical Validation

	Low Variability (A)	High Variability (B)
Time-Varying Patterns:		
1. Seasonal	X Y	X Y
2. Trend	X Y	X Y
3. Seasonal with Trend	X Y	X Y
Stationary-Mean Distributions:		
4. Normal	X Y	X Y
5. Poisson	X Y	N/A
6. Gamma	X Y	X Y
7. Erlang-C	X Y	X Y
Other Demand Patterns:		
8. Other	Y	Y

#### 1.4 Study Scope and Assumptions

This research addresses a specific problem involving the replenishment of a large number of purchased inventory items that are subject to independent demand. This problem is relevant to many make-to-order manufacturers, and also to many distribution companies. In order to define and focus the study, the following assumptions are applied:

1. No forecasting for individual items: The desire to avoid forecasting demand for a large number of purchased independent demand items is a primary motivation for companies to use reorder point replenishment methods.

2. MRP logic is not applicable: When vendor lead time plus internal processing time exceeds the fulfillment cycle time the customer is willing to accept, MRP logic cannot be applied without individual forecasts for independent demand items.

3. Stochastic periodic demand: Periodic demand for each purchased independent demand item is assumed to be probabilistic (stochastic). Demand that is constant and known in advance (deterministic) is one of the baseline assumptions of the classic EOQ model, but this assumption is relaxed here to reflect empirical reality.

4. No constraints on lot size: It is assumed for simplicity that lot sizes calculated by each of the replenishment models do not require modification to meet quantity restrictions such as case quantities, pallet quantities, or full truckloads. This is consistent with one of the assumptions of the classic EOQ model, and this assumption implies that no joint costing is involved in any item replenishment decision or inventory system cost calculation.

5. Relevant inventory system costs: Relevant costs for comparing the cost-minimization performance of different replenishment models include inventory holding costs, order processing costs, and stockout costs. The classic EOQ model assumes that stockouts or backorder situations do not exist, but stockouts will occur under stochastic demand. A cost per stockout occurrence is calculated as a function of both the order processing cost and variable unit cost of each item. Stockout costs are included in the evaluation of inventory system costs in the simulation study, and in validating the simulation results with actual data.

6. Independent replenishment decisions: It is assumed that replenishment decisions for each item are independent of replenishment decisions for any other item. This reflects the characterization of items included in the study as purchased independent demand items, and is consistent with one of the assumptions of the classic EOQ model.

7. Deterministic lead time: Vendor lead time is assumed to be consistent and predictable enough to be treated as deterministic. This assumption isolates the effect of

stochastic demand with different demand patterns on inventory system costs, and is consistent with one of the baseline assumptions of the classic EOQ model.

8. Stockouts for individual inventory items create backorders that are satisfied on a first come, first served basis as soon as additional units of the item are delivered.

9. Stable pricing for purchased items: Stable purchase prices are assumed for each of the independent demand items over the period considered in the study. This assumption eliminates the effect of price variability on the simulation results, and isolates the effect of different demand patterns on inventory system costs.

10. Historical usage data represent demand: The empirical data set used to validate the simulation study reflects actual usage for the slate of independent demand items. The company that provided the data did not track stockouts, product substitutions, or lost orders during the relevant three-year period, so actual demand history (including unmet demand) is not available. The subject company tended to carry excess inventory for most of the independent demand items over the relevant period, so it is unlikely that actual stockout experience would materially affect the study results.

11. Administrative and staffing costs differ among replenishment models: It is assumed that different administrative and staffing costs would be associated with different levels of data maintenance, professional judgment, and calculation-intensity of the different replenishment models studied. These differences are quantified, based on the simulation results and using information on staff time and costs from the company that provided the empirical usage data, to estimate relevant cost differences among the replenishment models. These estimated costs are compared against the calculated benefits of alternative replenishment methods in the cost-benefit analysis.

## CHAPTER 2

### LITERATURE SURVEY

The literature survey presented in this chapter is organized as follows. Section 2.1 summarizes relevant literature dealing with fast and frugal heuristics. Section 2.2 traces the history of the EOQ model, identifies foundation literature underlying widely-used EOQ-based replenishment heuristics, and summarizes papers dealing with the grouping of inventory items for replenishment. Section 2.3 examines published work dealing with the prevalence of the EOQ model in practice. Section 2.4 discusses research that addresses the significance of demand assumptions on replenishment models, and Section 2.5 examines replenishment research involving demand distributions with stationary means and demand patterns that vary over time. Section 2.6 details different research methodologies that have been used to study EOQ-based inventory replenishment. Section 2.7 presents a gap analysis that identifies potential research contributions of the current study.

#### 2.1 Fast and Frugal Heuristics

The *fast and frugal heuristics* paradigm for decision making under uncertainty was developed in the field of behavioral psychology by Gigerenzer and his colleagues (e.g., Gigerenzer and Goldstein 1996; Gigerenzer, Todd, and The ABC Group 1999; Todd and Gigerenzer 2001). This approach has been applied widely in other fields, but it is evident that the fast and frugal heuristics approach has not yet been embraced by Operations Management researchers. Research relevant to the current study is summarized below.

The fast and frugal heuristics approach recognizes that *bounded rationality*, along with limited availability of time and other resources, leads to reliance on simple decision rules (heuristics) rather than detailed analysis of all available information (Gigerenzer et al. 1999). Heuristics can be applied very effectively if they are *ecologically rational*, which means that they

recognize useful elements (cues) of the decision process at hand (Todd and Gigerenzer 2001). As demonstrated by Hoffrage and Reimer (2004), simple heuristics can be nearly as effective as comprehensive data-based models (such as regression analysis) in explanatory contexts, and can outperform comprehensive models in predictive contexts under certain circumstances. Fast and frugal heuristics can yield better predictive results than more detailed decision models when linear models overfit correlations between variables, where small data sets are in play, or where out-of-range predictions are necessary (Hoffrage and Reimer 2004).

Decision making research typically assumes that more information will yield better decisions, but fast and frugal heuristics research recognizes that the intentional omission of available information from a decision process may be *rational* (Gigerenzer et al. 1999; Hoffrage and Reimer 2004). According to Hoffrage and Reimer (2004), fast and frugal heuristics are most useful when decisions must be made under time pressure (fast), and when additional information is costly (frugal).

Experimental research in behavioral psychology tends to support the validity of fast and frugal heuristics. Bröder and Schiffer (2006) conduct a laboratory experiment leading to the conclusion that higher information processing requirements tend to increase reliance on simple decision heuristics. Bryant (2007) taught experimental subjects to visually classify situations involving potential mid-air collisions, and varied conditions to test the subjects' reliance on information-intensive classification methods vs. fast and frugal heuristics. That study led to the inference that complex decision models did not outperform the heuristics, although no single heuristic emerged as dominant. Newell, Weston, and Shanks (2003) conduct a laboratory experiment in which students are given access to categories of information and asked to select competing stocks for a hypothetical investment portfolio. There the majority of participants opted for simple heuristics, although only about one-third applied the specific search, stop, and decision rules proposed by Gigerenzer et al. (1999).



Published research in other fields supports the potential extension of the fast and frugal heuristics approach to OM and related fields. Elwyn, Edwards, Eccles, and Rovner (2001) address patient decisions in health care, and conclude that fast and frugal heuristics are more promising than decision tree analysis in that context. Dhami and Ayton (2001) conduct survey research on bail decisions by magistrates in the United Kingdom, and find that simple heuristics outperform legal guidelines in predicting the outcome of bail decisions. More recently, Goldstein and Gigerenzer (2009) use data from field studies in sports, marketing, and criminology to demonstrate the superior predictive power of fast and frugal heuristics over linear models in specific settings.

## 2.2 The EOQ Model and Its Progeny

### *2.2.1 Roots and Extensions of the EOQ Model*

It can be argued that every inventory replenishment decision implicitly involves striking a balance between the cost of processing transactions (ordering cost) and the cost of holding inventory (holding cost). The economic order quantity (EOQ) model was originally expressed in mathematical terms and presented by Harris (1913). The EOQ model was widely adopted in practice and studied by management scientists throughout the twentieth century, but the roots of the EOQ model as presented by Harris were obscured until the original paper was rediscovered by Erlenkotter (1989, 1990). References to Harris' work were traced by Erlenkotter through books by Raymond (1931) and Whitin (1953), but these works cited a later compilation for which Harris authored one chapter (Erlenkotter, 1989). In the wake of its rediscovery, the original Harris paper was republished (Harris, 1990).

The Harris (1913) paper is significant not only for presenting a model that has been conceptually useful and widely applied, but also for its frank assessment of the model's unrealistic assumptions. Another significant contribution of the 1913 paper is Harris' recognition that the EOQ model is *robust with regard to cost penalties* under small deviations from the mathematically optimal EOQ value. The perception that small deviations from the calculated

EOQ are insignificant has assumed the status of conventional wisdom among scholars and practitioners. This may explain, at least partially, the relative scarcity of research on the effect of alternative demand patterns on the cost performance of inventory replenishment models.

Modern extensions of the classical EOQ model include reorder point replenishment systems that relax the rigid assumptions of the original model by recognizing variable demand and variable lead time. These models are widely accepted (*e.g.*, Meredith and Shafer 2007; Krajewski, Ritzman and Malhotra 2010) and in practice are applied most frequently in connection with the assumption that demand during lead time is normally distributed (Silver et al. 1998). These systems are commonly distinguished depending on whether inventory levels are *monitored continuously* or *periodically reviewed* to determine if replenishment orders should be placed, and what the replenishment quantity should be. The notation and definitions that follow are drawn from Silver et al. (1998).

The Continuous Order-Point, Order Quantity ( $s, Q$ ) System: This involves continuous review of the inventory position at the individual item level. If the inventory position falls to or below the reorder point ( $s$ ), an order of the fixed quantity ( $Q$ ) is placed. As with each of the replenishment models discussed here, the definition of inventory position includes quantities on order as well as on-hand quantities to avoid redundant orders.

The Continuous Order-Point, Order-Up-To-Level ( $s, S$ ) system: Under this continuous review system, an order is generated whenever the inventory position falls to or below the reorder point level ( $s$ ). In this case the size of the order will tend to vary, depending on the difference between the inventory position and the order-up-to-level ( $S$ ). This is the common definition of a min-max replenishment system.

The Periodic Order-Up-To-Level ( $R, S$ ) System: Under this periodic review system, an order is placed at each time interval ( $R$ ) with a quantity equal to the difference between the order-up-to-level ( $S$ ) and the current inventory position. This system is regarded as simple to

administer, and the periodic review property facilitates the coordination of replenishment orders for related items.

The Periodic Order-Point, Order-Up-To-Level ( $R, s, S$ ) System: This periodic review system essentially combines the properties of the  $(s, S)$  and  $(R, S)$  systems. Here the inventory position is checked at each time interval ( $R$ ) and an order is placed only if the inventory level is at or below the reorder point ( $s$ ). When an order is needed, the quantity of the order is equal to the difference between the order-up-to-level ( $S$ ) and the current inventory position. As explained by Silver et al. (citing Scarf 1960), the  $(R, s, S)$  system tends to produce the lowest total inventory system cost but involves more calculation intensity than the other three reorder point systems.

### 2.2.2 Replenishment Heuristics

This section discusses research that applies EOQ-based principles to those frequently-encountered situations where the rigid assumptions of the classic EOQ model must be relaxed, and where the large number of items being managed makes simplification desirable. This includes heuristic replenishment rules that are relatively simple to apply. The body of research in these areas is extensive, but the focus here is limited to widely-accepted replenishment models that were considered for inclusion in the current study. An overview of each replenishment heuristic is presented here, with more detailed formulations presented in the methodology section for the models included in this study.

The *Wagner-Whitin Algorithm* is an economic lot sizing technique that generates a mathematically optimal least-cost replenishment solution for a defined series of time periods; it assumes time-varying *deterministic* demand and a specified end to the planning horizon. This algorithm was originally presented in Wagner and Whitin (1958). The original paper was later republished some forty-six years later (Wagner and Whitin 2004) along with a reflective commentary by one of the authors (Wagner 2004). Like the classic EOQ model, the Wagner-Whitin method involves minimizing the total of ordering costs and holding costs. Also like the

classic EOQ model, rigid assumptions (deterministic demand and a fixed end-date) minimize the usefulness of the Wagner-Whitin method in practice. The Wagner-Whitin Algorithm is considered for use in the current study as a retroactive baseline measure of the optimal inventory system cost that would result if actual demand had been known in advance (and was therefore deterministic). The operationalization of the Wagner-Whitin Algorithm used in this study is based on the explanation of the technique in Silver et al. (1998).

The *EOQ Range Model* is a technique for reducing the calculation-intensity required to use EOQ-based lot sizing rules over a large number of inventory items with common ordering costs and percentage holding costs. The technique involves using a specific number of *periods of supply* as the order quantity for each item within a range of annual spending amounts (quantity  $\times$  unit cost). Items with a large annual spend are ordered more frequently, and a formula is used to calculate the end points of the ranges (annual spend indifference points). The technique is based on the work of Crouch and Oglesby (1978), Chakravarty (1981), Donaldson (1981), and Goyal and Chakravarty (1982). The technique is given the name used here by Patterson (1982), although the Patterson model is designed to establish percentage cost penalty limits for a range of variability around a single EOQ value. The EOQ Range Model is presented with an implementation framework in Silver et al. (1998). The attractive simplicity of the EOQ Range Model, compared to the volume of calculations required to use the formal EOQ model for a large number of items, played a prominent role in the conceptualization of this study.

The *Silver-Meal Heuristic* is an EOQ-based rule for minimizing the total of relevant costs (ordering cost plus holding cost) for each replenishment period (Silver and Meal 1973). Like the classical EOQ formula, the Silver-Meal Heuristic is based on the assumption of deterministic demand but can be applied in practice to stochastic demand situations. The Silver-Meal approach involves selecting a replenishment quantity that will meet demand for an integer number of periods such that the average cost per period is minimized (Silver et al.

1998). The rule is applied by calculating total ordering plus holding costs for each  $n$ -period replenishment quantity, and ordering the quantity for the first period  $n$  where total costs for  $(n+1)$  periods would exceed total costs for  $n$  periods. If demand is assumed to be constant from period to period, the Silver-Meal Heuristic would yield equal-quantity replenishment orders in each series of  $n$  periods. The Silver-Meal Heuristic is considered for use in the current study because it is widely researched and understood (Silver et al. 1998), and because it offers reduced calculation intensity when compared to the formal EOQ model under stochastic demand.

The *Part-Period Balancing Criterion* is another technique for selecting an individual replenishment quantity for an integer number of periods. Introduced by DeMatteis (1968), this technique involves selecting the integer number of periods of demand  $n$  that minimizes the difference between ordering costs and carrying costs. As such, it is evident that the replenishment quantity calculated under the Part-Period method would equal the calculated EOQ when the EOQ exactly equals demand for an integer number of periods. On the other hand, the Part-Period result would be sub-optimal when compared to the EOQ method in all other cases. As noted by Silver et al. (1998), the Part-Period Balancing Criterion is more calculation-intensive than the Silver-Meal Heuristic but does not generally outperform the Silver-Meal technique for selecting integer-period replenishment quantities.

### *2.2.3 Grouping Items for Replenishment*

Despite the evident advantages of categorizing inventory items for replenishment planning purposes, published research on such categorization is rare (Boylan, Syntetos, and Karakostas 2008). It has been noted that the grouping of items for replenishment planning in practice is often idiosyncratic or arbitrary (Syntetos, Boylan, and Croston 2005). Research dealing with categorization is summarized in the paragraphs that follow.

The most typical approach to grouping inventory items for replenishment planning purposes, in practice and in published research, involves using operational attributes of the

items for classification purposes. Kim (1995) discusses the challenges involved in grouping items, and develops a complex rule for multi-item grouping that relies on neural network modeling. Gupta (2004) offers a conceptual four-dimensional framework yielding a total of 256 item categories; this paper recognizes demand patterns (“consumption pattern”) as one of the classification dimensions but considers only the variability of demand as opposed to different (non-normal) distributions or time-varying patterns. Cohen and Ernst (1988) present an iterative model for determining the optimal number of replenishment groups for a given number of criteria, but assume that operations-related attributes other than demand patterns would serve as primary determinants of any resulting cost advantage. Lenard and Roy (1995) propose a multi-criteria grouping model that is designed to streamline multiple aspects of inventory management and, as such, does not emphasize differing demand patterns. Stone (1980) offers a grouping strategy that considers on-hand quantities, periodic usage quantities, and standard cost but does not differentiate items by demand pattern.

OM researchers who consider demand patterns for grouping inventory items tend to do so for forecasting purposes rather than for the execution of replenishment models. For example, Chen and Ebrahimpour (1997) develop a time-series forecasting model that recognizes seasonal demand for a single class of items. Bradford and Sugrue (1997) present a method for forecasting aggregate demand for class “C” inventory items that is based on the Poisson distribution. Neither of these papers considers the use of demand patterns for developing reorder point replenishment rules. Boylan et al. (2008) develop a categorization method that uses a group-forecasting procedure to arrive at a value for annual demand in calculating reorder point parameters, but applying this procedure would negate the objective of avoiding detailed forecasts in the current study.

### 2.3 EOQ in Practice

The use of EOQ-based replenishment models is widespread in practice and has been studied frequently in OM and related fields. The articles cited below do not exhaustively cover

peer-reviewed research on the practical use of EOQ-based techniques; they are selected to affirm that EOQ logic is widely used, and that consideration of demand patterns other than the normal distribution is rare in practice.

A useful practitioner article on the use of EOQ techniques is presented by Cannon and Crandall (2004); these authors note that EOQ continues to enjoy widespread use in practice and observe that the technique often performs better than expected in spite of operating environments that deviate significantly from the rigid assumptions of the classic EOQ model. Woolsey (1975) recognizes the prevalence of EOQ models in practice, and discusses behavioral reasons for continued reliance on EOQ models. A more recent paper that discusses reasons for choosing specific inventory management approaches is presented by Wallin, Ragtusanatham, and Rabinovich (2006).

Tunc, Kilic, Tarim, and Eksioglu (2011) affirm that EOQ models in practice often assume that demand is stationary; these authors then demonstrate cost penalty calculations, and present algorithms to address non-stationary demand. An alternative view is presented by McLaughlin, Vastag, and Whybark (1994), who discuss situations leading to ineffective application of EOQ models in practice; these authors attribute such problems to organizational factors rather than faulty assumptions regarding demand patterns. Syntelos, Boylan, and Croston (2005) study the categorization of items for EOQ-based replenishment in practice, note that such categorizations are often arbitrary, and propose the use of demand-based criteria for replenishment grouping.

Other published articles illustrate the use of EOQ techniques to recognize resource limitations or bounded rationality. Braglia and Gabrielli (2001) offer a single site case study of a manufacturing company, and note that EOQ techniques are used due to limitations on the applicability of MRP in the particular environment. Buxey (2006) exemplifies the recent shift of focus from single-echelon to multiple-echelon inventory replenishment problems; that author

considers the supplier viewpoint as well as that of the focal firm, but applies classic EOQ analysis to the lot sizing problem without considering the effect of alternative demand patterns.

#### 2.4 The Effect of Demand Patterns

Although the effect of alternative demand patterns on inventory system cost is a generally under-researched area, substantial support exists for the proposition that demand patterns matter. As noted previously, Tunc et al. (2011) observe that EOQ models often assume stationary demand due to the computational complexity involved in recognizing other demand patterns. These authors demonstrate cost penalty calculations for non-stationary demand, and find that cost penalties increase as demand variability increases. McLaughlin, Vastag, and Whybark (1994) discuss flaws in techniques used to simulate demand patterns, and note that simulation results often differ from service levels achieved in practice.

Lau and Wang (1987) present numeric examples to show that significant error can result when inventory decisions ignore alternative demand distributions. Similarly, Mentzer and Krishnan (1985) use simulation to show that the assumption of normality can lead to incorrect estimates of service levels when demand actually follows an alternative pattern. This view is reinforced by Cattani, Jacobs, and Schoenfelder (2011), who study multi-echelon data from a consumer products manufacturer and observe that inconsistencies between assumed demand and actual demand can impede system performance.

Phillipakis (1970) uses historical data to study inventory system cost with EOQ techniques for items with variable demand; this author concludes that EOQ-based rules are not well-suited to variable demand items. Ritchie and Tsado (1986) use hypothetical data to study the use of EOQ models for items with linear increasing demand, and find that the failure of EOQ techniques to recognize changing demand levels could be problematic. Azoury (1985) investigates a Bayesian approach to inventory replenishment with the demand distribution unknown, and finds that the optimality of an inventory replenishment policy depends on the underlying demand distribution.



More recent articles offer other insight on the relevance of demand patterns to inventory replenishment decisions. Chen and Plambeck (2008) show that higher inventory levels are necessary to avoid losing visibility of demand that would be unmet and unobserved due to stockouts. Bijulal, Venkateswaran, and Hemachandra (2011) conduct a simulation study and conclude that inventory system costs and service levels are sensitive to varying demand parameters. Janssen, Strijbosch, and Brekelmans (2009) conduct a simulation study and determine that inventory system performance can be improved by refining the specification of demand assumptions.

## 2.5 Replenishment and Demand Patterns

This subsection addresses research that considers the effect of alternative demand patterns on inventory replenishment. This analysis covers demand distributions with stationary means, time-varying demand patterns, and uncertain demand.

### *2.5.1 Demand Distributions with Stationary Means*

Published research on the effect of demand distributions with stationary means is addressed below. These papers are categorized by the specific demand distributions they consider. Other than the normal distribution, the most frequently considered demand distributions are the Poisson distribution and the gamma distribution. A relatively small number of papers examine the effect of multiple distributions in a single study, and papers that consider other distributions and take novel research approaches are also discussed.

As with research on inventory replenishment in general, papers dealing with the Poisson distribution deal primarily with the single-item replenishment problem rather than multi-item inventory management. Some of these papers present replenishment algorithms tailored to Poisson demand, but evidence of widespread acceptance in practice is scarce for any of these special-purpose algorithms.

Bishop (1972) uses the Poisson distribution to simulate non-normal demand and test alternative replenishment models for Poisson-distributed demand. Single-item replenishment

models or algorithms for compound Poisson replenishment are developed by Katircioglu (1996); Matheus and Gelders (2000); Ohno and Ishigaki (2001), and Bijvank and Johansen (2012).

Other papers investigate the replenishment of Poisson-distributed items with different levels of demand variability or lead time variability. Silver, Ho, and Deemer (1971) model demand with Poisson arrivals and geometrically distributed quantities. Song, Zhang, Hou, and Wang (2010) study the effects of shorter and less-variable lead times with compound Poisson demand items. Babai, Jemai, and Dallery (2011) model and compare inventory system performance for fast- and slow-moving items with compound Poisson demand.

Papers on variants of the Poisson distribution generally have not considered demand patterns other than the normal distribution within a single study. An exception is Nenes, Panagiotidou, and Tagaras (2010); that study considers multiple items with demand modeled by the Poisson and gamma distributions.

Along with the discrete Poisson distribution, the continuous gamma distribution has been frequently considered in research that recognizes the effect of demand distributions on inventory system performance. As is the case with studies on the Poisson distribution, papers addressing the gamma distribution deal primarily with the single-item replenishment problem rather than multi-item inventory management. Some of these papers present replenishment algorithms tailored to gamma-distributed demand, but evidence of widespread acceptance in practice is scarce for any of these special-purpose algorithms.

Some researchers have focused primarily on the nature of the gamma distribution and its potential usefulness in practice. Snyder (1984) advocates the use of the gamma distribution to model inventory replenishment problems due to the inherent flexibility and simplicity of the gamma distribution, which can be modeled with only two or three parameters. Keaton (1995) compares the gamma distribution to the Poisson for modeling demand, and expresses a preference for the gamma distribution due to its simplicity. Tyworth, Guo, and Ganeshan (1996) also advocate the use of the gamma distribution to simulate item demand, but note that

developing an optimization model for gamma-distributed demand is computationally difficult. Moors and Strijbosch (2002) model the performance of an  $(R, s, S)$  replenishment system with gamma-distributed demand, and Yeh (1997) develops a replenishment algorithm for a gamma demand pattern.

The Erlang-C distribution is a form of the gamma distribution that has not been widely considered in OM research, but is regarded as useful for modeling resource consumption in other disciplines. Leven and Segerstedt (2004) consider the performance of an inventory control system with the Erlang demand distribution, but do so with forecasting rather than using reorder point logic in lieu of item-specific forecasts.

After the Poisson and gamma distributions, the stationary mean distribution that appears to have been examined most frequently in OM is the uniform distribution. Naddor (1975b) models the application of heuristic decision rules to demand that follows the uniform distribution. Bookbinder and Heath (1988) consider the uniform distribution along with the normal distribution in a multi-echelon simulation of distribution requirements planning (DRP) logic. Ren (2010) and Wang (2010), respectively, apply simulation and mathematical modeling in studies that consider the normal and uniform distributions. Wanke (2010) frames the single-item replenishment problem in terms of a new product, and presents a replenishment algorithm based on the uniform distribution.

Other peer-reviewed papers examine the effect of stationary mean distributions on inventory system costs. A few of these are noteworthy for considering multiple demand distributions in a single study; others consider less-frequently studied distributions or apply novel research approaches.

Van Ness and Stevenson (1983) observe that the normal and Poisson distributions are used most frequently to calculate lot sizes and safety stock levels, and propose the use of mathematical modeling rather than simulation to calculate probabilities from empirical demand data. Iglehart (1964) considers the effect of exponential and range distributions of demand on

inventory system performance. A sampling-based algorithm for estimating demand from empirical data, without assuming a specific demand distribution, is developed by Levi, Roundy, and Schmoys (2007).

Some researchers have studied inventory system performance with compound Poisson demand. This assumes that instances of demand (“arrivals”) follow the Poisson distribution, but that the quantities demanded for any arrival follow some other stationary-mean distribution. Mizoroki (1981) considers a single-item ( $s, S$ ) reorder point model with compound Poisson demand. Boylan and Johnston (1996) focus on mean to variance relationships for compound Poisson demand. Park (2005) applies compound distribution analysis to estimate demand during lead time, and finds that compound distribution analysis is less accurate for items with short lead times.

Others consider demand distributions that have rarely been investigated. Strijbosch and Moors (2006) study an  $(R, S)$  replenishment model with the normal distribution modified to exclude negative values. Kumaran and Achary (1996) study inventory system performance under the generalized lambda distribution, which is a four-parameter distribution that can recognize variability of lead time as well as variability of periodic demand. Walker (1993) applies the triangle distribution to the single-item, single-period replenishment problem.

The relatively few studies that have investigated inventory system performance with multiple non-normal demand distributions are distinguishable from the current study. Speh and Wagenheim (1978) consider the normal, Poisson, and exponential distributions but find that variability of lead time is more significant than variability of periodic demand. Ha (1989) develops an algorithm for Pearson or Weibull demand, but does not validate this algorithm with empirical data. Similarly, Hayya, Bagchi, and Ramasesh (2011) simulate demand under the Poisson, exponential, and gamma distributions but do not test the simulation results with empirical data.

### *2.5.2 Time-varying Demand Patterns*

The inventory management effects of time-varying demand patterns have been studied less frequently than the effects of stationary-mean distributions. As is true of papers on stationary mean distributions, most studies on time-varying demand patterns focus on the single-item replenishment problem and/or present single-purpose algorithms.

Some papers consider trending demand in the absence of seasonality. Chakravorty (1992) considers level demand and increasing trend demand in the context of a multi-echelon distribution requirements planning (DRP) environment, and concludes that inventory turns are affected by the demand pattern. Yang and Rand (1993); Giri, Jalan, and Chaudhuri (2003); and Rau and OuYang (2007) develop special purpose heuristics and algorithms for demand with a linear upward trend.

Other papers recognize seasonal demand patterns in the absence of an underlying trend. You (2005) presents an optimal replenishment model for seasonal demand, but assumes that demand is deterministic. Mandal and Mahanty (1990) propose the use of variable reorder points based on a three-month seasonal average.

Papers on inventory management that recognize seasonal demand with an underlying trend are relatively rare. Reyman (1989) derives a time series model for trending demand with seasonality, and Zhang (2004) examines demand evolution with a moving average model. Beardslee (2007) examines the inventory replenishment problem in the context of a large spare parts inventory; that paper considers seasonal and trending demand patterns but does not consider seasonal demand combined with an underlying trend.

### *2.5.3 Uncertain Demand*

Some researchers in OM and related fields address the inventory replenishment problem in terms of demand patterns that are unknown or uncertain. These papers typically focus on the single-item replenishment problem and offer special-purpose replenishment algorithms. Naddor (1975a) proposes replenishment rules that are independent of a demand

distribution specification, but these rules are designed to apply only to items for which the probability of zero demand in any period is significant. Azoury (1985) develops an inventory replenishment model for demand that is dynamic. Bulinskaya (1990) presents an optimization algorithm for demand that is asymptotic, while Song and Zipkin (1993) offer algorithms for fluctuating demand. Strijbosch and Heuts (1993) use nonparametric methods to estimate the distribution of lead time demand, and find that cost differences can affect inventory system performance.

Some papers investigate various dimensions of inventory system performance when demand is random or chaotic. Brill and Chaouch (1995) conduct a sensitivity analysis on the expected value of total inventory cost with randomly varying demand. Roundy and Muckstadt (2000) examine the effect of random demand on a base stock inventory replenishment policy. Wang, Wee, Gao, and Chung (2005) develop a replenishment algorithm for demand that is chaotic. Akcay, Biller and Tayur (2011) present an approach for determining the optimal inventory target with limited demand information.

Recent research devoted specifically to the replenishment problem for spare parts considers items for which demand is *sporadic*, meaning that demand is zero for many periods. Li and Ryan (2011) propose an adaptive replenishment heuristic for spare parts. Demand that is unknown and sporadic is addressed via an optimization model based on the Kaplan-Meier estimator by Huh, Levi, Rusmevichientong, and Orlin (2011).

## 2.6 Alternative Research Methodologies

Various research methodologies have been applied to the study of EOQ-based inventory replenishment. Papers discussed below are categorized as literature survey/historical analyses, simulation studies, mathematical modeling papers, case studies, and novel or cross-disciplinary studies.

Historical analyses of EOQ-based research provide a useful point of departure, although these papers are relatively scarce compared to the amount of research that exists on

replenishment models. Zanakis, Evans, and Vazacopoulos (1989) survey 442 published articles on inventory heuristics in sixteen years preceding 1989, identify historical patterns, and suggest directions for future research. Fu (2002) surveys articles on the use of simulation for inventory system optimization, and distinguishes research streams on deterministic vs. stochastic processes. Khouja and Goyal (2008) conduct a survey on research devoted to the joint replenishment problem; these authors observe that research activity in this area has diminished, but note that interest in new variants of this problem is significant. Williams and Tokar (2008) summarize research on inventory management that has been published in logistics journals, and Glock (2012) surveys literature on multi-echelon joint replenishment models and identifies promising avenues for related research.

Simulation studies have contributed significantly to the body of research on inventory replenishment, although some simulation research lacks empirical validation. Bishop (1972) uses simulation to identify the effects of alternative inventory control policies. Bookbinder and Heath (1988) use simulation to study a multi-echelon DRP system, and Ren (2010) uses simulation to test the robustness assumption of the EOQ model in practice. Hayya et al. (2011) use simulation to study the performance of a base stock inventory model

Some papers evaluate the use of simulation from a methodology perspective. Alstrom and Madsen (1992) advocate the use of simulation to study inventory systems, and present one specific model. Olhager and Persson (2006) discuss the use of simulation in production and inventory research in general terms, and find that the technique is useful for process-related learning and process design. Bijulal et al. (2011) discuss simulation from a conceptual perspective, and apply simulation to identify inventory system parameter effects.

Many papers cited elsewhere in this literature survey offer mathematical models for inventory replenishment. Some modeling papers make contributions in this area but diverge from the research patterns discussed previously. Roundy and Muckstadt (2000) address the question of variability in terms of the coefficient of variation, and use a breakpoint value of 2.0 to

distinguish high vs. low variability of periodic demand. Zinn and Charnes (2005) compare EOQ-based replenishment to just-in-time (JIT) inventory management, and conclude that lower order processing costs favor the JIT approach. Minner (2009) studies the capacity-limited multi-product lot sizing problem, compares alternative replenishment heuristics to a goal-programming optimized solution, and finds that an iterative heuristic performs reasonably well in comparison to the optimized solution.

The economic significance and implementation challenges of inventory management make the practical application of EOQ-based techniques a promising area for case studies. Nonetheless, true case studies in this area—as opposed to papers that refer to the use of empirical data to test a model as a case study—are relatively rare. Zomerdijk and de Vries (2003) advocate the case study method to understand inventory control problems in context, and apply the case method to the redesign of inventory control procedures in an African aviation organization. Garcia-Flores, Wang, and Burgess (2003) present a case study involving the development of inventory replenishment rules in a small U.K. chemical company, and identify some of the practical issues involved in identifying demand patterns for specific items. Nenes et al. (2010) detail the development of inventory replenishment rules for multiple items with sporadic and intermittent demand in a Greek distribution company.

Two papers published in recent years apply principles rooted in the physical sciences to inventory replenishment. Tsou and Kao (2008) present and test a multi-objective inventory control metaheuristic that is based on the principles underlying electromagnetism. Lisboa (2010) develops an inventory replenishment model that is based on the principles of fluid dynamics. These two papers offer interesting possibilities, although evidence of significant follow-on research and practical application of these principles has yet to emerge.

### 2.7 Gap Analysis

This study makes contributions that are distinguishable from any prior work in OM. As noted above, the fast and frugal heuristics research paradigm has yet to be embraced by OM



researchers. Also as noted, most published papers dealing with reorder point logic focus on the single-item replenishment problem, and apply EOQ logic to varying special situations. The relatively few papers that address multiple-item replenishment are focused on manufacturing capacity issues, joint-setup costs, or other special situations that do not apply to the purchased-item scenario that is the focus of the current study.

Additionally, most published papers on inventory replenishment assume normally distributed demand without considering the effect of other demand distributions. Papers dealing with multiple-item replenishment may address the need to group items for replenishment purposes, but use characteristics other than underlying demand patterns to test this. Other papers examine reorder point replenishment with different demand scenarios, but do so to test a newly-developed replenishment model that is applicable only to a specific demand situation. The few papers that do consider multiple replenishment models and demand patterns in a single study have addressed single-mean demand patterns but not time-varying demand patterns, or vice-versa, without considering both types of demand variability. It is typical for studies on replenishment methods to evaluate models in terms of inventory system costs, but the literature review has turned up no studies that compare the relevant administrative and staffing costs associated with different models. In addition, few papers dealing with EOQ and related replenishment models address implementation issues.

Based on the literature gap analysis summarized above, opportunities to extend the body of research on reorder point replenishment for purchased independent demand items exist with regard to:

- Extending application of the fast and frugal heuristics paradigm in OM;
- Considering the effect of non-normal demand patterns on inventory system costs;
- Using demand patterns rather than physical or administrative characteristics to group inventory items for replenishment purposes;

- Studying the performance of multiple heuristics with non-normal stationary-mean distributions *and* time-varying demand patterns in a single study;
- Developing an implementation framework to apply best practices for matching replenishment heuristics to demand patterns in a multi-item environment; and
- Comparing the benefits of alternative replenishment models against the relevant differential costs to achieve a full cost/benefit analysis.

CHAPTER 3  
METHODOLOGY

3.1 Methodology Overview

Methodologies applied in different phases of this research were conceptualized in advance and adapted as the study unfolded. One section of this chapter details the methodology underlying each phase of the study. Section 3.2 presents the methodology for the simulation study. Section 3.3 details the methodology applied in the empirical validation study. Section 3.4 discusses the methodology of the demand-pattern fitting implementation study, and Section 3.5 sets out the methodology used in the cost/benefit analysis.

3.2 Simulation

*3.2.1 Experimental Design and Software Selection*

At this point it is useful to note that application of the simulation methodology to evaluate decision rules is supported by published research in OM and related fields (e.g., Bijulal et al. 2011; Cattani et al. 2011; Hayya et al. 2011; Strijbosch & Moors 2005; Mandal & Mahanty 1990; Bookbinder & Heath 1988), and also by the fast & frugal heuristics research stream (Hoffrage & Reimer 2004, Gigerenzer et al. 1999). Design of the simulation study is consistent with the principles outlined by Law and Kelton (2000), with the empirical validation phase discussed in a separate chapter from the simulation study.

Here the design of the proposed simulation study includes factors with various numbers of levels as shown below:

<u>Factor</u>	<u>Levels</u>
Replenishment models (including Wagner-Whitin baseline)	4
Demand patterns (4 stationery-mean, 3 time-varying)	7
Levels of variability for each demand pattern	2

This yields a total of  $(4 \times 7 \times 2)$  or 56 simulations. Each simulation includes 1,000 iterations, and uses a hypothetical set of 36 inventory items with different item cost, usage, and lead time profiles. The Oracle *Crystal Ball*<sup>®</sup> software package is used to generate simulated demand for one year (52 weekly periods) for each item/distribution pattern combination, and the resulting inventory system costs are tabulated in Microsoft *Excel*<sup>®</sup>.

Output from the simulation study includes an absolute estimate of inventory system cost (holding cost + order processing cost + stockout cost), and a percentage comparison of the cost under each replenishment model to the optimal result that would be achieved under the Wagner-Whitin model *if* actual demand could be determined in advance. This output is used to conduct *t*-tests of statistical significance for the differences in estimated inventory system costs. The *t*-tests are conducted in the *NCSS*<sup>®</sup> statistical software package. The *t*-test results are used to support inferences regarding the potential usefulness of alternative replenishment rules with different underlying demand patterns.

Most of the effort devoted to the simulation study was spent in (a) developing the model to calculate the Wagner-Whitin system costs under deterministic demand through 52 weekly periods, and (b) developing the model that works through 19 data tables with baseline assumptions and simulated weekly demand values for the 36 independent demand inventory items. Each model was used for the 1,000 iterations under each replenishment rule for each demand pattern case. With seven demand patterns and a low- and high-variability scenario tested for each demand pattern, fourteen separate Excel spreadsheet models were coded and used in the simulation study.

### *3.2.2 Model Definition: Assumptions, Issues and Iterations*

Each model was initially developed as a prototype with four time periods. The prototype was used to pilot-test the calculations and optimize the layout of the multiple worksheets that comprise each model. The lot size calculation for each stochastic-demand replenishment model is consistent with the relevant formula presented in Silver et al. (1998) as

discussed above, and the same (normal-demand based) safety stock calculation is used for each replenishment model in order to isolate the effect of the lot-sizing decision on inventory system costs. Safety stock is not applicable under the Wagner-Whitin algorithm due to the limiting assumption of deterministic demand.

The simulation study is meant to be broadly applicable to multi-item independent demand inventory replenishment, but it was necessary to analyze the empirical demand data and use some underlying characteristics of that data set to select relevant parameters for the simulation. The starting point was three years of actual usage data on 402 independent demand items. After eliminating (a) items that were not active for the entire three-year period, and (b) items with minimal demand that would be ordered on an as-needed basis, 278 items remained. Sample means and standard deviations of weekly demand for the entire three-year period were calculated, and these values were used to calculate the coefficient of variation (*cv*) for each item. The coefficient of variation measures the variability of the values in a data set in relation to their mean, and is calculated by dividing the standard deviation of the observations by their mean (Keller 2005). If *s* represents the sample standard deviation and  $\bar{x}$  represents the mean of the sample, then

$$cv = \frac{s}{\bar{x}}$$

The 278 actual demand items were sorted by coefficient of variation value in ascending order, and that sequencing was used in the empirical validation study. The arithmetic average *cv* values were calculated separately for the 139 of 278 items with the lowest demand variability, and for the 139 items with the highest demand variability. These values came in close to 1.50 for the items with the lowest variability and 4.00 for those with the highest variability, and these were chosen as the target *cv* values for the low-variability and high-variability cases in the simulation, respectively. Historical data on the 278 inventory items, along with summary statistics including the coefficient of variation, are shown in Appendix A.

With the simulation case assumptions established for the two levels of demand variability, the assumptions for other variables and factor levels were determined and added to the simulation model. The list of inventory items used in the simulation and the associated values for cost, demand, and lead time for each item are presented in Appendix B. The calculation assumptions used in the simulation model for all of the low-variability cases are summarized in Table 3.1.

**Table 3.1**  
**EOQ Simulation Study**  
**Assumptions for Low-Variability Cases**

<b>A = Order cost, fixed per order</b>	<b>\$75.00</b>	<b>Estimate used by company that provided empirical data</b>
<b>v = Item purchase cost/unit</b>	<b>Ordering cost factor levels</b>	<b>Use 0.1x, 1x, 10x</b>
<b>r = Annual holding \$ per \$/Year</b>	<b>\$0.12</b>	<b>Estimate used by company that provided empirical data</b>
<b>D = annual item demand</b>	<b>Units per Week factor levels</b>	<b>Use 1, 10, 20</b>
<b><math>T_n</math> = weeks of supply in lot size</b>	<b>n = number of weeks</b>	<b>Use n = 1, 2, 3, 4, 6, 8, 13, 26, 52</b>
<b>Number of items in simulation:</b>	<b>36</b>	<b>Factor levels for cost (3), demand (3), and lead time (4)</b>
<b>Item lead times, in Weeks</b>	<b>Varying long lead times</b>	<b>Use 4, 6, 8, 10</b>
<b>Indifference point formula</b>	<b><math>(Dv)_{indifference} = \frac{288A}{T_1 T_2 r}</math></b>	<b>Indifference point for period order quantity (POQ) of <math>T_1</math> vs. <math>T_2</math></b>
<b>Coefficient of Variation <math>c_v = \frac{\sigma}{\mu}</math></b>	<b>1.50</b>	<b>Assumed for Safety Stock calculation for all items and models</b>
<b>Reorder interval, in Weeks</b>	<b>2</b>	<b>Same for all items</b>
<b>Initial On-Hand Quantity % of S</b>	<b>100%</b>	<b>On-hand quantity at start of simulation as % of order up-to level</b>
<b>Stockout cost per incident:</b>	<b>Ordering cost + item cost</b>	<b>Ordering cost represents expediting; item cost is lost opportunity.</b>
<b>Order cost factor</b>	<b>1.00</b>	
<b>Item cost factor</b>	<b>0.05</b>	

The assumptions used in the high-variability cases are identical to those displayed in Table 3.1 except that the coefficient of variation value is 4.00 for the high-variability cases.

The assumptions were adapted as needed for the low- and high-variability cases for each of the 7 demand patterns studied. This yielded 14 self-contained simulation models, each of which included the following components:

- Lot size calculations
- Lot size comparison among the different replenishment models

- Simulated demand
- Wagner-Whitin inventory system costs
- $(R, s, S)$  EOQ inventory system costs
- EOQ Range Model inventory system costs
- Silver-Meal Heuristic inventory system costs
- Inventory system cost and summary statistics for all models

With the general assumptions established, a safety stock and lot sizing calculation was conducted for each of the 14 simulation cases (7 demand patterns x 2 variability levels). The safety stock and lot size calculation for the  $(R, s, S)$  EOQ model in the Normal Demand/Low Variability case is shown in Table 3.2. These calculations were performed for each of the replenishment models in each of the 14 simulation cases, and the formulas used are consistent with those presented in Silver et al. (1998).

Table 3.2  
EOQ Simulation Study  
(R, s, S) EOQ Model Lot Sizing Calculations

Seq #	Item #	Item Cost (c)	Weekly Unit Demand (d)	Annual Unit Demand (D)	Lead Time Weeks (L)	EOQ = $\sqrt{2AD/vr}$ (R, s, S) EOQ Lot Size	Reorder Interval Wks (P)	Protection Interval Wks (P + L)	[ROP] = $\bar{d}(P + L)$ Average Demand During Protection Interval (Units)	$\sigma_P = c_P \times \bar{d}$ Std Deviation of Weekly Demand (Units)	$(\sigma_{P+L}) = \sigma_P \sqrt{P+L}$ Std Deviation of Demand During Protection Interval	[SL] Service Level (1 - Stockout Probability)	[z] Service Level Expressed in Std Deviations	[SS] = [z] * $(\sigma_{P+L})$ Safety Stock (Units)	[ROP] = [ROP] + SS Reorder Point (Units)	[T] = [ROP] + [EOQ] Order Up To Level (Units)
1	C10L1	\$7.50	1	52	4	93	2	6	6	1,500	3,674	95.0%	1.65	6	12	105
2	C20L1	\$75.00	1	52	4	29	2	6	6	1,500	3,674	95.0%	1.65	6	12	41
3	C30L1	\$750.00	1	52	4	9	2	6	6	1,500	3,674	95.0%	1.65	6	12	21
4	C10L2	\$7.50	1	52	6	93	2	8	8	1,500	4,243	95.0%	1.65	7	15	108
5	C20L2	\$75.00	1	52	6	29	2	8	8	1,500	4,243	95.0%	1.65	7	15	44
6	C30L2	\$750.00	1	52	6	9	2	8	8	1,500	4,243	95.0%	1.65	7	15	24
7	C10L3	\$7.50	1	52	8	93	2	10	10	1,500	4,743	95.0%	1.65	8	18	111
8	C20L3	\$75.00	1	52	8	29	2	10	10	1,500	4,743	95.0%	1.65	8	18	47
9	C30L3	\$750.00	1	52	8	9	2	10	10	1,500	4,743	95.0%	1.65	8	18	27
10	C10L4	\$7.50	1	52	10	93	2	12	12	1,500	5,196	95.0%	1.65	9	21	114
11	C20L4	\$75.00	1	52	10	29	2	12	12	1,500	5,196	95.0%	1.65	9	21	50
12	C30L4	\$750.00	1	52	10	9	2	12	12	1,500	5,196	95.0%	1.65	9	21	30
13	C10L1	\$7.50	10	520	4	294	2	6	60	15,000	36,742	95.0%	1.65	61	121	415
14	C20L1	\$75.00	10	520	4	93	2	6	60	15,000	36,742	95.0%	1.65	61	121	214
15	C30L1	\$750.00	10	520	4	29	2	6	60	15,000	36,742	95.0%	1.65	61	121	150
16	C10L2	\$7.50	10	520	6	294	2	8	80	15,000	42,426	95.0%	1.65	70	150	444
17	C20L2	\$75.00	10	520	6	93	2	8	80	15,000	42,426	95.0%	1.65	70	150	243
18	C30L2	\$750.00	10	520	6	29	2	8	80	15,000	42,426	95.0%	1.65	70	150	179
19	C10L3	\$7.50	10	520	8	294	2	10	100	15,000	47,434	95.0%	1.65	78	178	472
20	C20L3	\$75.00	10	520	8	93	2	10	100	15,000	47,434	95.0%	1.65	78	178	271
21	C30L3	\$750.00	10	520	8	29	2	10	100	15,000	47,434	95.0%	1.65	78	178	207
22	C10L4	\$7.50	10	520	10	294	2	12	120	15,000	51,952	95.0%	1.65	86	206	500
23	C20L4	\$75.00	10	520	10	93	2	12	120	15,000	51,952	95.0%	1.65	86	206	299
24	C30L4	\$750.00	10	520	10	29	2	12	120	15,000	51,952	95.0%	1.65	86	206	235
25	C10L1	\$7.50	20	1,040	4	416	2	6	120	30,000	73,485	95.0%	1.65	121	241	657
26	C20L1	\$75.00	20	1,040	4	132	2	6	120	30,000	73,485	95.0%	1.65	121	241	373
27	C30L1	\$750.00	20	1,040	4	42	2	6	120	30,000	73,485	95.0%	1.65	121	241	283
28	C10L2	\$7.50	20	1,040	6	416	2	8	160	30,000	84,853	95.0%	1.65	140	300	716
29	C20L2	\$75.00	20	1,040	6	132	2	8	160	30,000	84,853	95.0%	1.65	140	300	432
30	C30L2	\$750.00	20	1,040	6	42	2	8	160	30,000	84,853	95.0%	1.65	140	300	342
31	C10L3	\$7.50	20	1,040	8	416	2	10	200	30,000	94,868	95.0%	1.65	157	357	773
32	C20L3	\$75.00	20	1,040	8	132	2	10	200	30,000	94,868	95.0%	1.65	157	357	489
33	C30L3	\$750.00	20	1,040	8	42	2	10	200	30,000	94,868	95.0%	1.65	157	357	399
34	C10L4	\$7.50	20	1,040	10	416	2	12	240	30,000	103,923	95.0%	1.65	171	411	827
35	C20L4	\$75.00	20	1,040	10	132	2	12	240	30,000	103,923	95.0%	1.65	171	411	543
36	C30L4	\$750.00	20	1,040	10	42	2	12	240	30,000	103,923	95.0%	1.65	171	411	453



The lot size calculation for the EOQ Range model is simpler but significantly different from the lot size calculation for the (R, s, S) EOQ model. As explained in Subsection 1.3.1, the formula

$$Dv_{(\text{indifference})} = (288A) \div (T_1 T_2) r$$

is used to calculate the indifference points for the number of periods of demand that define the order quantity for individual items based on the expected annual spend of each item. The indifference point calculations for the EOQ Range period order quantities are shown in Table 3.3.

Table 3.3  
EOQ Simulation Study  
EOQ Range Model Lot Sizing Calculations

Calculated Indifference Points:

Time period values	Indifference Point	Period Order Quantity (POQ) Rule	POQ Value (# of Periods to Order)
T1 vs. T2	\$90,000	POQ = 1 Week if $\$90,000 \leq Dv$	1
T2 vs. T3	\$30,000	POQ = 2 Weeks if $\$30,000 \leq Dv \leq \$90,000$	2
T3 vs. T4	\$15,000	POQ = 3 Weeks if $\$15,000 \leq Dv \leq \$30,000$	3
T4 vs. T6	\$7,500	POQ = 4 Weeks if $\$7,500 \leq Dv \leq \$15,000$	4
T6 vs. T8	\$3,750	POQ = 6 Weeks if $\$3,750 \leq Dv \leq \$7,500$	6
T8 vs. T13	\$1,731	POQ = 8 Weeks if $\$1,731 \leq Dv \leq \$3,750$	8
T13 vs. T26	\$533	POQ = 13 Weeks if $\$533 \leq Dv \leq \$1,731$	13
T26 vs. T52	\$133	POQ = 26 Weeks if $\$133 \leq Dv \leq \$533$	26
T52	\$0	POQ = 52 Weeks if $Dv \leq \$133$	52

Lookup Table for Period Order Quantities:

Per calculated indifference poi	Threshold Value of $Dv$	POQ Value (Weeks)
	0	52
	133	26
	533	13
	1,731	8
	3,750	6
	7,500	4
	15,000	3
	30,000	2
	90,000	1

The Indifference Point formula is used to calculate the values in the Indifference Point column. The lot sizing calculation in the EOQ Range Model simulation compares the product of (52 x the average weekly demand) with the values in the lookup table to determine the reorder quantity for each simulated item.

The lot size calculation for the Silver-Meal heuristic is the simplest among the three stochastic replenishment models included in this study. The criterion at issue is the average inventory system cost per period. The heuristic inherently assumes that average periodic demand is constant, and defines the period-duration replenishment quantity for an item by searching for the value of the number of periods  $T$  that minimizes the value of the expression

$$(\text{Setup cost} + \text{Total carrying cost to end of period } T) \div T$$

As such, the only values needed to calculate the period order quantity under the Silver-Meal Heuristic are the average periodic demand, the order processing cost, and the periodic inventory holding cost per unit. This calculation is performed in the simulation model by calculating the cumulative inventory system cost per period for each item. This assumes that an order is placed in Period 1, and conditional formatting is used to identify the last period before the average inventory system cost per period would increase—which implies that it would be optimal to place a new order to meet requirements for the next and subsequent period. A screen print of the Silver-Meal Heuristic lot sizing calculation is shown in Figure 3.1.

Figure 3.1  
Silver-Meal Heuristic Lot Sizing Calculation

Figure 3.1 EOQ Simulation Study Silver-Meal Heuristic Lot Sizing Calculations										Average System Cost per Period for POQ = $T_n$ $APC = \{A + [\sum_{t=1}^{T-1} x T]\} \div T$ where $T =$		
Silver-Meal Heuristic Lot Sizes for Simulation:										1	2	3
Seq #	Item #	Item Cost (v)	Weekly Unit Demand (d)	Annual Unit Demand (D)	Lead Time Weeks (L)	Order Cost (Setup) Fixed per Order (A)	Carrying Cost per Unit/Period (vr / 52)	Carrying Cost per Period CP = (vr / 52) x d				
22	C1D2L4	\$7.50	10	520	10	\$75.00	0.0173	0.17	75.00	37.59	25.17	
23	C2D2L4	\$75.00	10	520	10	\$75.00	0.1731	1.73	75.00	38.37	26.73	
24	C3D2L4	\$750.00	10	520	10	\$75.00	1.7308	17.31	75.00	46.16	42.31	
25	C1D3L1	\$7.50	20	1,040	4	\$75.00	0.0173	0.35	75.00	37.68	25.35	
26	C2D3L1	\$75.00	20	1,040	4	\$75.00	0.1731	3.46	75.00	39.23	28.46	
27	C3D3L1	\$750.00	20	1,040	4	\$75.00	1.7308	34.62	75.00	54.81	59.62	
28	C1D3L2	\$7.50	20	1,040	6	\$75.00	0.0173	0.35	75.00	37.68	25.35	
29	C2D3L2	\$75.00	20	1,040	6	\$75.00	0.1731	3.46	75.00	39.23	28.46	
30	C3D3L2	\$750.00	20	1,040	6	\$75.00	1.7308	34.62	75.00	54.81	59.62	
31	C1D3L3	\$7.50	20	1,040	8	\$75.00	0.0173	0.35	75.00	37.68	25.35	
32	C2D3L3	\$75.00	20	1,040	8	\$75.00	0.1731	3.46	75.00	39.23	28.46	
33	C3D3L3	\$750.00	20	1,040	8	\$75.00	1.7308	34.62	75.00	54.81	59.62	
34	C1D3L4	\$7.50	20	1,040	10	\$75.00	0.0173	0.35	75.00	37.68	25.35	
35	C2D3L4	\$75.00	20	1,040	10	\$75.00	0.1731	3.46	75.00	39.23	28.46	
36	C3D3L4	\$750.00	20	1,040	10	\$75.00	1.7308	34.62	75.00	54.81	59.62	

With the lot sizes, safety stock, reorder point, and order-up to levels established for the stochastic demand replenishment models it was necessary to develop a model capable of calculating the minimum inventory system cost for a 52-week planning horizon with deterministic demand under the Wagner-Whitin algorithm. This is possible with a path-dependent spreadsheet model that tests each successive period to determine whether the minimum cumulative inventory system cost results from (a) placing a new order, or (b) adding the new period's demand to the last order that was placed. The minimum cumulative cost at the end of the planning horizon defines the optimal (lowest) Wagner-Whitin inventory system cost.

This model was developed, tested, and copied 36 times into a single Excel worksheet with formulas linked to other worksheets in the overall model for each demand/viability case. That allows the new set of simulated demand values for each successive iteration to be applied to the Wagner-Whitin calculation model, with the results automatically captured along with other statistics for that iteration. Screen prints that illustrate the assumptions and results of the Wagner-Whitin calculation for a single item is shown in Figure 3.2.

Figure 3.2  
Screen Print of Wagner-Whitin Inventory Cost Model

Table X-2								
Wagner-Whitin Inventory System Cost Calculation C2D1L1								
Input Assumptions:				Calculated Values:				
A	Processing Cost per Order		\$75.00	$\bar{D}$	Average demand per period			2
v	Variable item cost per unit		\$75.00	r/n	Carrying Cost: per /Period			\$0.0023
r	Carrying Cost per /Year		\$0.12	WWC	Inventory System Cost			\$323.71
n	Number of periods		52					
Demand	2	0	0	1	1	1	0	3
Week	1	2	3	4	5	6	7	8
1	75.00	75.00	75.00	75.52	76.21	77.07	77.07	80.69
2		150.00	150.00	150.35	150.86	151.55	151.55	154.66
3			150.00	150.17	150.52	151.04	151.04	153.62
4				150.00	150.17	150.52	150.52	152.59
5					150.52	150.69	150.69	152.25
6						151.21	151.21	152.25
7							152.07	152.59
8								152.07
9								
10								
11								
12								
13								
14								
15								
16								

Table X-2													C1	CW	C2	CY	C3	DA	DI	DC
Wagner-Whitin Inventory System Cost Calculation C2D1L1																				
Input Assumptions:				Calculated Values:																
A	Processing Cost per Order		\$75.00	$\bar{D}$	Average demand per period			2												
v	Variable item cost per unit		\$75.00	r/n	Carrying Cost: per /Period			\$0.0023												
r	Carrying Cost per /Year		\$0.12	WWC	Inventory System Cost			\$323.71												
n	Number of periods		52																	
Demand	2	0	0	1	1	1	0	3	1	1	0		83							
Week	1	2	3	4	5	6	7	8	50	51	52		Total							
23									343.37	348.20	348.20									
24									337.34	342.00	342.00									
25									327.51	331.99	331.99									
26									321.99	326.30	326.30									
27									334.75	338.89	338.89									
28									325.95	329.92	329.92									
29									326.81	330.61	330.61									
30									328.36	331.99	331.99									
31									325.44	328.89	328.89									
32									328.20	331.45	331.45									
33									320.61	323.71	323.71									
34									324.40	327.34	327.34									
35									335.23	337.99	337.99									
36									334.02	336.61	336.61									
37									330.75	333.16	333.16									
38									332.82	335.06	335.06									
39									334.20	336.27	336.27									
40									339.37	334.27	334.27									

With the lot sizing calculations and Wagner-Whitin model development complete, it was necessary to review the results of the lot sizing calculations for accuracy and reasonableness. A worksheet was created within each of the 14 simulation models to support a visual review and comparison of the calculated lot size, reorder point, and order-up to values for each of the 36 inventory items in the simulation. Figure 3.3 shows a screen print of the Lot Size Comparison

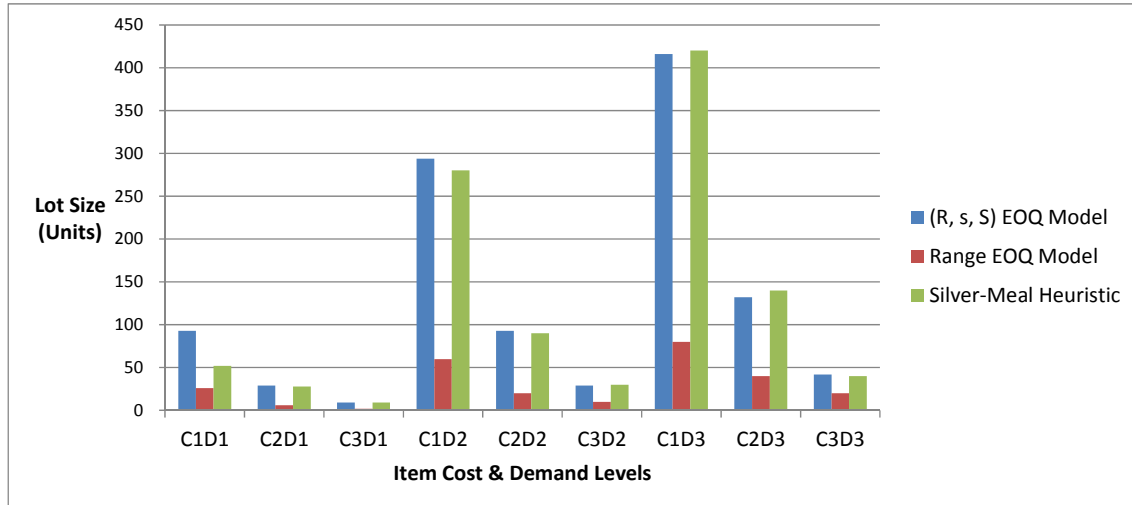
worksheet for the Normal Demand / Low Variability case. It is evident in this case, as was true in virtually all cases, that the lot sizes for the  $(R, s, S)$  EOQ model and the Silver-Meal heuristic are close in magnitude, but that the lot sizes for the EOQ Range model differ from those for the other two models.

Figure 3.3  
Screen Print of Lot Size Comparison

Figure 3.3 EOQ Simulation Study Lot Size Comparison: Normal Demand / Low Variability														
Seq #	Item #	Item Cost (v)	Weekly Unit Demand ( $\theta$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	(R, s, S) EOQ Model			EOQ Range Model			Silver-Meal		
						Lot Size	Reorder Point	Order Up To Level	Lot Size	Reorder Point	Order Up To Level	Lot Size	Reorder Point	
19	C1D2L3	\$7.50	10	520	8	294	178	472	60	178	238	280		
20	C2D2L3	\$75.00	10	520	8	93	178	271	20	178	198	90		
21	C3D2L3	\$750.00	10	520	8	29	178	207	10	178	188	30		
22	C1D2L4	\$7.50	10	520	10	294	206	500	60	206	266	280		
23	C2D2L4	\$75.00	10	520	10	93	206	299	20	206	226	90		
24	C3D2L4	\$750.00	10	520	10	29	206	235	10	206	216	30		
25	C1D3L1	\$7.50	20	1,040	4	416	241	657	80	241	321	420		
26	C2D3L1	\$75.00	20	1,040	4	132	241	373	40	241	281	140		
27	C3D3L1	\$750.00	20	1,040	4	42	241	283	20	241	261	40		
28	C1D3L2	\$7.50	20	1,040	6	416	300	716	80	300	380	420		
29	C2D3L2	\$75.00	20	1,040	6	132	300	432	40	300	340	140		
30	C3D3L2	\$750.00	20	1,040	6	42	300	342	20	300	320	40		
31	C1D3L3	\$7.50	20	1,040	8	416	357	773	80	357	437	420		
32	C2D3L3	\$75.00	20	1,040	8	132	357	489	40	357	397	140		
33	C3D3L3	\$750.00	20	1,040	8	42	357	399	20	357	377	40		
34	C1D3L4	\$7.50	20	1,040	10	416	411	827	80	411	491	420		
35	C2D3L4	\$75.00	20	1,040	10	132	411	513	40	411	463	140		
36	C3D3L4	\$750.00	20	1,040	10	42	411	515	20	411	463	40		

Lot sizes were also compared for the simulation items grouped by the three cost levels and the three levels of demand variability. This was done to verify that the different levels of cost and demand had plausible effects on the lot size calculations. The different levels of item lead time are not considered in this analysis because the different lead times affect the safety stock requirement but not the lot size. The factor-level lot size comparison for the Normal Demand/Low Variability case is shown in Figure 3.4. For all factor levels, it is apparent that the  $(R, s, S)$  EOQ and Silver-Meal lot sizes are similar while the Range EOQ lot sizes differ from those for the other two models.

Figure 3.4  
 Lot Size Comparison  
 Normal Demand / Low Variability



With the lot size calculations verified, the next step was to create the worksheet that would simulate demand according to the relevant stationary-mean probability distribution or time-varying demand pattern for each demand pattern/variability case. The same basic worksheet structure was adapted to recognize the relevant parameters for each distribution or pattern. One row was assigned to each of the 36 simulation items, and columns were established for the parameter values and for the 52 weekly time periods for which demand was simulated.

For the stationary mean cases, Crystal Ball probability distribution formulas are nested in each weekly demand cell, and these formulas reference the parameter values for the item. Each weekly demand cell is recalculated when any value is changed in the worksheet, and this capability is used to generate and capture values for each iteration of the simulation.

Parameter values for each of the stationary mean distributions used in the study were determined with the interactive Distribution Gallery utility in the Crystal Ball software. To the extent possible, the parameters of each relevant distribution were set to yield the target value for mean weekly demand while generating a coefficient of variation equal to 1.50 for the low-

variability cases and 4.00 for the high-variability cases. The parameter values for the normal and Poisson distributions are shown in Table 3.4. Screen prints of the Distribution Gallery values for the non-normal stationary mean distributions are shown in Appendix C.

Table 3.4  
EOQ Simulation Study  
Normal and Poisson Distribution Parameter Values

Normal Distribution Parameter Values:

4A Low Variability $cv = 1.50$	Mean	Standard Deviation
Mean Weekly Demand = 1	1.00	1.50
Mean Weekly Demand = 10	10.00	15.00
Mean Weekly Demand = 20	20.00	30.00

4B High Variability $cv = 4.0$	Mean	Standard Deviation
Mean Weekly Demand = 1	1.00	4.00
Mean Weekly Demand = 10	10.00	40.00
Mean Weekly Demand = 20	20.00	80.00

Poisson Distribution Parameter Values:

5A Low Variability	$\lambda$	Memo: $cv$ Value
Mean Weekly Demand = 1	1.00	1.0000
Mean Weekly Demand = 10	10.00	0.3162
Mean Weekly Demand = 20	20.00	0.2236

Simulated demand formulas for the normal distribution were modified to show a minimum demand value of zero in any given week, as the presence of a standard deviation in excess of the mean would otherwise generate a large number of negative demand values. This treatment is consistent with the approach applied in Strijbosch and Moors (2006). The Poisson distribution presents a problem in terms of targeting different levels of variability, as the single-parameter character of the Poisson makes it impossible to target the weekly mean demand level and simultaneously alter the resulting variability. This phenomenon is addressed in the

study by treating the Poisson demand distribution as a low-variability case, and excluding the Poisson from the slate of high-variability cases in the study.

Parameter values for the gamma and Erlang-C distributions are shown in Table 3.5.

Table 3.5  
EOQ Simulation Study  
Gamma and Erlang-C Distribution Parameter Values

Gamma Distribution Parameter Values:

Low Variability $cv = 1.5$	Location	Scale	Shape
Mean Weekly Demand = 1	0.00	2.25	0.4450
Mean Weekly Demand = 10	0.00	22.48	0.4450
Mean Weekly Demand = 20	0.00	44.95	0.4450

High Variability $cv = 4.0$	Location	Scale	Shape
Mean Weekly Demand = 1	0.00	16.00	0.0625
Mean Weekly Demand = 10	0.00	160.00	0.0625
Mean Weekly Demand = 20	0.00	320.00	0.0625

Erlang-C Distribution Parameter Values:

7A Low Variability $cv = 0.7071$	Location	Scale	Shape
Mean Weekly Demand = 1	0.00	0.50	2.0
Mean Weekly Demand = 10	0.00	5.00	2.0
Mean Weekly Demand = 20	0.00	10.00	2.0

7B High Variability $cv = 1.0$	Location	Scale	Shape
Mean Weekly Demand = 1	0.00	1.00	1.0
Mean Weekly Demand = 10	0.00	10.00	1.0
Mean Weekly Demand = 20	0.00	20.00	1.0

The gamma distribution has three parameters: Location, Scale, and Shape. Setting the Location parameter to 0 precludes the generation of negative demand values. From there the Scale and Shape parameters are selected to yield the targeted weekly demand value as the mean and the target value for the coefficient of variation. The Erlang-C distribution is a special variation of the gamma distribution that can have only integer values as its Shape parameter. This made only two Shape parameter values feasible for this study in order to yield the target values for mean weekly demand; these Shape values are 1.0 and 2.0. These values were used



and assigned to the low-variability and high-variability cases accordingly—in spite of large differences between the resulting coefficient of variation values and the target cv values for low- and high-variability.

After working through the issues and assumptions discussed above, the relevant parameter values for stationary-mean cases were used to create the 36-item weekly demand values for each of the stationary-mean cases. A screen print of the demand simulation worksheet for the normal demand/low variability case is shown in Figure 3.5.

Figure 3.5  
Screen Print of Simulated Demand Worksheet  
Normal Demand / Low Variability

Item #	Item Cost (v)	Weekly Unit Demand (θ)	Annual Unit Demand (D)	Lead Time Weeks (L)	Simulation Demand Pattern Parameters			Simulated Demand by Week in Units →				
					Mean (μ)	Coefficient of Variation	Std Deviation (σ)	1	2	3	4	
C1D1L4	\$7.50	1	52	10	1	1.50	1.50	2	1	2		
C2D1L4	\$75.00	1	52	10	1	1.50	1.50	0	3	2		
C3D1L4	\$750.00	1	52	10	1	1.50	1.50	0	1	2		
C1D2L1	\$7.50	10	520	4	10	1.50	15.00	4	25	0		2
C2D2L1	\$75.00	10	520	4	10	1.50	15.00	16	31	0		1
C3D2L1	\$750.00	10	520	4	10	1.50	15.00	0	5	12		
C1D2L2	\$7.50	10	520	6	10	1.50	15.00	0	11	11		1
C2D2L2	\$75.00	10	520	6	10	1.50	15.00	3	4	0		
C3D2L2	\$750.00	10	520	6	10	1.50	15.00	16	0	13		
C1D2L3	\$7.50	10	520	8	10	1.50	15.00	17	10	12		1
C2D2L3	\$75.00	10	520	8	10	1.50	15.00	11	0	21		1
C3D2L3	\$750.00	10	520	8	10	1.50	15.00	14	14	2		2
C1D2L4	\$7.50	10	520	10	10	1.50	15.00	15	28	9		2
C2D2L4	\$75.00	10	520	10	10	1.50	15.00	1	0	7		2
C3D2L4	\$750.00	10	520	10	10	1.50	15.00	10	0	18		1
C1D3L1	\$7.50	20	1,040	4	20	1.50	30.00	0	63	40		2
C2D3L1	\$75.00	20	1,040	4	20	1.50	30.00	16	93	0		2
C3D3L1	\$750.00	20	1,040	4	20	1.50	30.00	0	0	0		2

For the time-varying demand cases, the simulation calculation was more complex. A basic worksheet structure was created to calculate level, trend, and seasonal demand as separate elements of total demand. This calculation is based on the formula for the multiplicative seasonal-trend model provided by Silver et al. (1998) as follows:

$$x_t = (a + bt)F_t + \epsilon_t$$

Where

a = a level

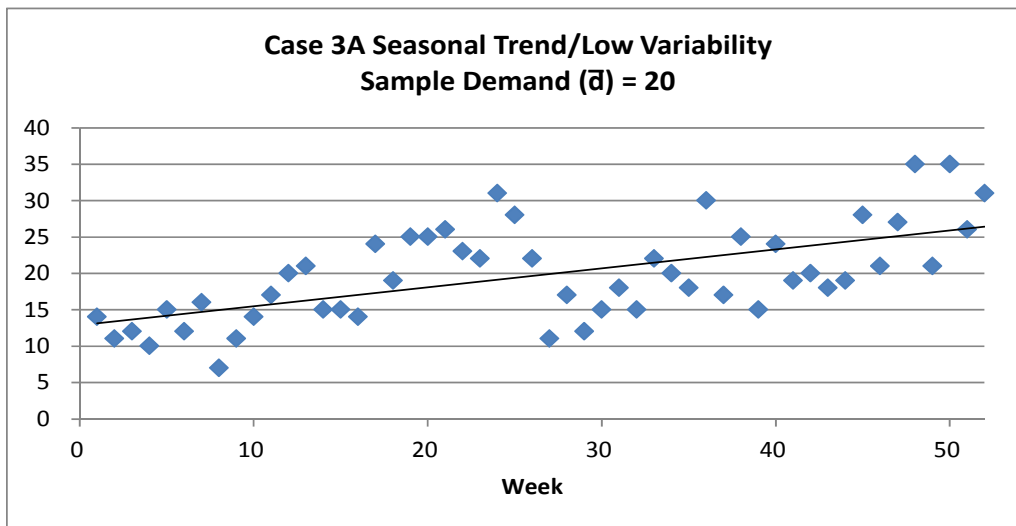
b = a linear trend factor

$F_t$  = a seasonal coefficient or index value for period  $t$

$\varepsilon_t$  = the period error term, which is an independent random variable with a mean of 0 and a constant variance  $\sigma^2$ .

The worksheet template for time-varying demand simulation includes the ability to create trend, seasonal, or seasonal with trend models by varying the values of the parameter values. For example, an  $F_t$  value of 1 for all periods yields a pure trend model. The time-varying demand pattern simulation for each case computes an additive estimate of demand for the period based on the relevant values of  $a$ ,  $b$ , and  $F_t$ , and then adds a value for  $\varepsilon_t$  that is randomly generated based on the assumed coefficient of variability value: 1.50 for the low-variability cases, and 4.00 for the high-variability cases. The simulated error term is recalculated when any value in the worksheet changes, and this capability is used to generate and capture values for each iteration of the simulation. Simulated demand values for each of the time-varying demand cases were plotted, and the plots were visually evaluated for conformance to the relevant demand pattern for each demand factor level. The time series plot for seasonal with trend demand, low variability, and high-level demand is shown in Figure 3.6.

Figure 3.6  
Time Series Plot:  
Seasonal with Trend Demand / Low Variability



Screen prints illustrating the flow of data through the demand simulation worksheets are presented in Appendix D.

With calculations in place for reorder point settings and simulated demand, it is appropriate to consider the model that works through the inventory consumption and replenishment logic for each of the 52 weekly periods for the 36 simulation items to generate inventory system cost and other values. As noted above, this involves working through 19 tables in a single worksheet for each of the inventory replenishment models in each of the 14 demand pattern/variability models. The system cost worksheets are substantially identical for each model, with formulas used to import the appropriate reorder point parameters and simulated periodic demand values from the other worksheets. The 19 tables, and relevant information on the function performed by each, are described below.

1. Beginning On-Hand Quantity (Units): This contains the opening quantity on hand for each week. An assumption is needed in Week 1 to initialize the simulation; the assumption used is that the opening quantity for each item is equal to the reorder point for the item. That quantity is equal to demand during the relevant protection interval plus the calculated safety stock. This means that an order will be placed as soon as possible for each item, but no item is subject to an unusual risk of a stockout.

2. Replenishment Quantity Received: This contains units received against previously-generated replenishment orders. No receipts are allowed for the number of weeks equal to the replenishment lead time for an item at the start of the simulation. As an example, the first replenishment quantity received for an item with a four-week lead time would arrive in Week 5 for the order that is generated in Week 1.

3. Total Quantity Available: This represents the number of units of each item available to meet demand in the current week. This value is the sum of the beginning on-hand quantity and the replenishment quantity received during the current week.

4. Simulated Weekly Demand (Units): Formulas are used to bring the simulated weekly demand values from the Simulated Demand worksheet into this table.

5. Ending On-Hand Quantity for Reorder Point Test and Stockout Calculations (Units): This is an interim measure of the inventory position before new replenishment orders are generated in the current week. It is calculated by subtracting the simulated weekly demand from the total quantity available.

6. Ending On-Hand Quantity Net of Stockouts--Positive Quantities Only (Units): This table replaces any stockout values from Table 5 with zeros. The values in this table are used to calculate inventory holding cost by item for each week, and the negative quantities must be suppressed in order to avoid the generation of negative values for inventory holding cost.

7. Prior Open Replenishment Order Quantity Less Current Receipts (Units): The values in this table are used to calculate the current inventory position in determining whether a new replenishment order is to be generated in the current week.

8. Inventory Position for Reorder Point Test (Units): The values in this table are measured against the reorder point value for each item to determine whether a new replenishment order is generated in the current week. This calculation uses the ending on-hand quantity from Table 5 (which recognizes backorders by including negative quantities) plus the open replenishment order quantities calculated in Table 7.

9. Reorder Point (s) in Units: This table uses formulas to import the reorder point value from the Lot Size Calculations worksheet. These values are repeated for all 52 weeks for each simulation item, primarily for consistency in the documentation and to facilitate verification of the matrix algebra used in the overall flow of calculations within the simulation model.

10. Reorder Point Test (1 = Order; 0 = No Order): This table is used to generate a value of 1 or 0 depending on whether the value for each week in Table 8 is less than or equal to the reorder point value from Table 9. Given the assumption that a periodic replenishment model is in use with a period of two weeks between replenishment assessments for all items,

the even-numbered weeks are “blocked out” in this table so that the reorder point test is conducted bi-weekly.

11. Order Up To Target (S) Units: Using logic similar to that applied in Table 9, this table uses formulas to import the order up to target value from the Lot Size Calculations worksheet.

12. Order Quantity (Units): This table multiplies the 1 or 0 value from Table 10 by the difference between the inventory position in Table 8 and the order up to target in Table 11. If the value from Table 10 is a one, a new replenishment order is generated with a quantity equal to the difference between the order up to target and the inventory position.

13. Ending Open Replenishment Order Quantity (Units): The values in this table are calculated by adding the current week’s new order quantity from Table 12 to the prior open order quantity net of current week receipts from Table 7. This table is used to provide beginning open replenishment order quantities for the subsequent week in Table 7.

14. Ending Inventory Cost ( $v \times$  Ending On Hand Quantity): The values in this table are calculated by multiplying the ending on-hand quantities excluding stockouts from Table 6 by the variable purchase cost of each item. This value is needed to calculate the inventory carrying cost.

15. Ordering Cost: This table calculates the cost of processing each replenishment order. The values are calculated by multiplying the fixed cost per order from the Lot Size Calculations worksheet by the 1 or 0 values from Table 10.

16. Inventory Holding Cost: This table calculates the inventory holding cost. The values are calculated by multiplying the Ending Inventory Cost from Table 14 by the calculated inventory holding cost per \$/period from the Lot Size Calculations worksheet.

17. Inventory Stockout Cost: This table calculates the stockout cost for each item and weekly period. If the ending on-hand quantity from Table 5 is less than zero, the assumed fixed

and variable stockout cost values from the Lot Size Calculations spreadsheet are used to calculate an inventory stockout cost for that item and period.

18. Total Inventory System Cost: This table summarizes the ordering cost, holding cost, and stockout cost values from Tables 15, 16, and 17 to show total inventory system cost by item and period.

19. Inventory System Performance Statistics: This table draws values from other tables in the same worksheet to calculate inventory system cost and other values by item, by period, and in the aggregate for all 36 simulation items. These values are refreshed for all replenishment models anytime a change is made in the worksheet, and these summary values are captured in the Simulation Results worksheet for each demand/variability case.

Each demand/variability model has a Simulation Results worksheet that uses formulas to capture inventory system costs and other potentially useful statistics for each iteration of the simulation. A stored procedure (“macro”) is used to expeditiously generate each new iteration of the simulation, copy the resulting summary values into a static table, and then repeat these steps until summary values for 1,000 iterations have been recorded.

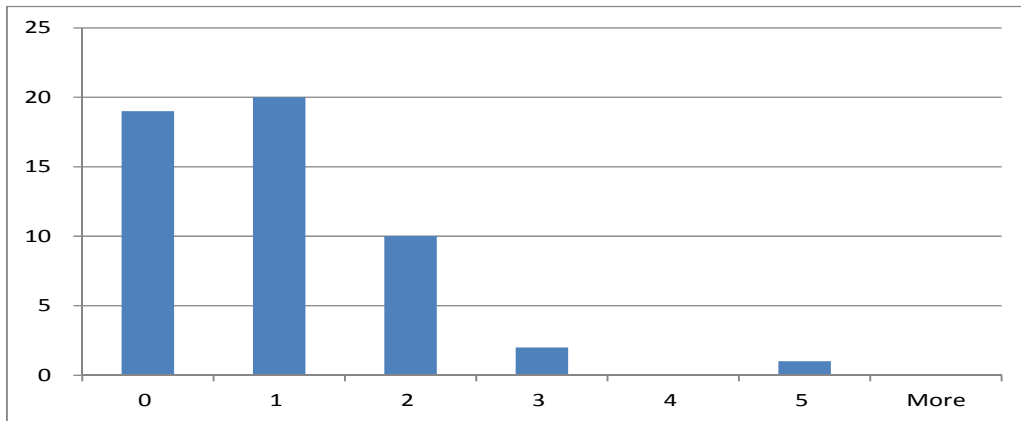
### *3.2.3 Model Verification*

As detailed in Law and Kelton (2000), two separate processes are involved in reviewing a simulation model to ensure that it accurately represents the system or process that is being modeled. These processes are (a) verification, which involves reviewing the model to ensure that the calculations work as intended; and (b) validation, which involves comparing output from the simulation to actual results from the system or process to determine that the simulation accurately represents or predicts the real-world process. Verification of the simulation model is discussed in the paragraphs that follow, while validation of the simulation results is addressed in Chapter 4 and Chapter 5.

Verification of the various sub-models that comprise the simulation model for each of the 14 demand pattern/variability categories was undertaken as a continuous process as each model was developed and replicated. Four general approaches to verification were applied: review and manual reperformance of calculations; visual inspection of scatterplots, bar charts, and histograms for logical patterns and consistency among subsets of calculated data; nested audit verifications to confirm that mathematical relationships that should exist are actually in effect; and evaluation of summary output values for logical patterns and consistency.

The review and reperformance of calculations was done routinely after each new calculation was added or adapted, and as changes to the formulas and assumptions were applied. Examples of visual inspection of scatterplots and bar charts are presented in the preceding subsection. An example of a histogram of simulated demand values in the Poisson demand case is shown in Figure 3.7.

Figure 3.7  
Sample Histogram  
Poisson Demand  
Mean Weekly Demand = 1



Nested audit verifications are used in locations where formulas are intended to import data values from another worksheet, and control totals for the source data series and the imported values should agree. Conditional formatting is used to generate a visual signal when, for whatever reason, these totals fail to agree. An example of two adjacent verification cells,

with one of them intentionally subjected to a disparity of values that should agree, is shown in Figure 3.8.

Figure 3.8  
Screen Print of Nested Audit/Verification Cells

Total Inventory System Cost Wagner-Whitin	Percentage Cost Penalty (PCP) vs. Wagner-Whitin	Cost Level 1 Items			Cost Level 2 Items			Cost Level 3 Items		
		Inventory System Cost per Model	Inventory System Cost Wagner-Whitin	Cost Penalty (PCP) vs. Wagner-Whitin	Inventory System Cost per Model	Inventory System Cost Wagner-Whitin	Cost Penalty (PCP) vs. Wagner-Whitin	Inventory System Cost per Model	Inventory System Cost Wagner-Whitin	Cost Penalty (PCP) vs. Wagner-Whitin
		29,624.93	413.3%	4,522.43	2,988.51	51.3%	18,910.73	8,461.01	123.5%	128,611.76
Cost Level System Costs = Total System Costs					TRUE					
Cost Level W-W Costs = Total W-W Costs					FALSE					

### 3.2.4 Model Execution and Evaluation of Results

With the simulation model developed, adapted to all 14 demand pattern/variability cases, and duly verified, the stored procedure was used to generate inventory system cost values and other summary data for 1,000 iterations in each case. A screen print of the worksheet used to capture the iteration values and calculated the summary statistics for the Normal Demand/Low Variability case is shown in Figure 3.9.

Figure 3.9  
Screen Print of Simulation Data Summary Worksheet

Table X-1 EOQ Simulation Study Inventory System Performance Summary Statistics: All Models										
(R, s, S) EOQ Model -->										
	Number of Stockout Wks by Item	% of Stockout Wks by Item	Number of Periods w/ at Least 1 Stockout	% of Periods w/ at Least 1 Stockout	Number of Periods w/ at Least 10 Stockouts	% of Periods w/ at Least 10 Stockouts	Average Inventory Cost	Cost of Sales COS = (D × v)	Inventory Turnover Ratio (COS ÷ Avg Inv Cost)	
Total or Average--Current Simulation Iteration	3	0.2%	3	5.8%	0	0.0%	1,028,557.35	6,548,580.00	6.37	

Table X-2 EOQ Simulation Study Inventory System Performance Summary Statistics: All Simulation Iterations										
(R, s, S) EOQ Model -->										
Iteration #	Number of Stockout Wks by Item	% of Stockout Wks by Item	Number of Periods w/ at Least 1 Stockout	% of Periods w/ at Least 1 Stockout	Number of Periods w/ at Least 10 Stockouts	% of Periods w/ at Least 10 Stockouts	Average Inventory Cost	Cost of Sales COS = (D × v)	Inventory Turnover Ratio (COS ÷ Avg Inv Cost)	
1	4	0.2%	4	7.7%	0	0.0%	1,028,348.95	6,699,997.50	6.52	
2	4	0.2%	4	7.7%	0	0.0%	991,097.15	6,841,057.50	6.90	
3	10	0.5%	8	15.4%	0	0.0%	992,071.32	6,993,420.00	7.05	
4	2	0.1%	2	3.8%	0	0.0%	1,090,846.58	6,131,715.00	5.62	
5	7	0.4%	7	13.5%	0	0.0%	1,017,162.70	6,441,337.50	6.33	

The simulation summary data for inventory system costs were tabulated for comparison and analysis. In addition, the 1,000 observation sets of total inventory system cost values for



the alternative replenishment model and demand pattern combinations were evaluated for statistical significance of the difference between sample means using two-sample *t*-tests in the NCSS software.

The specific *t*-test evaluation procedure relied upon in this study is the Aspin-Welch Unequal-Variance test. This test is regarded as appropriate for comparing sample means when the underlying populations may be non-normal and may have unequal variances (Sawilowsky 2002, citing Welch 1947). As explained in Hintze (2007), the null and alternative hypotheses in the NCSS output for the Aspin-Welch *t*-test cases are:

Two-tail test:	$H_0: \mu_x - \mu_y = 0$	$H_a: \mu_x - \mu_y \neq 0$
Left-tail test:	$H_0: \mu_x - \mu_y = 0$	$H_a: \mu_x - \mu_y < 0$
Right-tail test:	$H_0: \mu_x - \mu_y = 0$	$H_a: \mu_x - \mu_y > 0$

Analysis of summary data from the simulation study, including evaluation of the statistical significance of differences in the mean inventory system cost results for alternative combinations of replenishment models and demand patterns, is presented in Chapter 4.

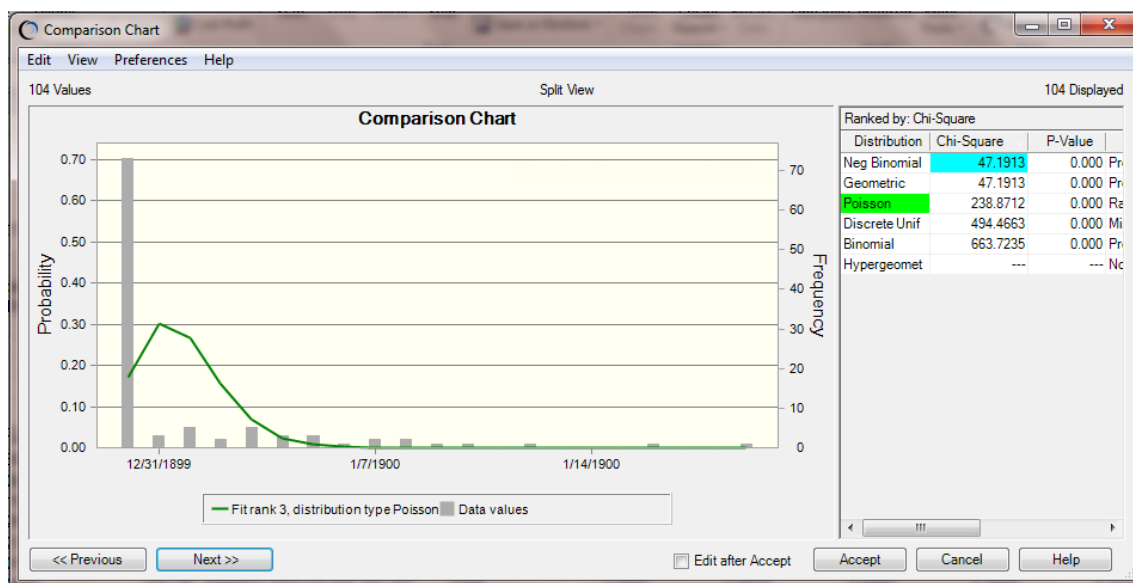
### 3.3 Empirical Validation

The empirical validation study serves two purposes. The first is to validate the results of the simulation study with actual data, which is regarded as an important part of the simulation study methodology prescribed by Law and Kelton (2000). The second purpose is the use of archival data to identify and understand the practical challenges of classifying independent demand items by demand pattern for replenishment management. The methodology and processes used in the empirical validation study are described in this section. The results of the validation study are presented and analyzed in Chapter 5.

The first step in the empirical validation study was to analyze Year 1 and Year 2 demand for each of the 278 actual demand items with the Crystal Ball Demand Fit function to identify the best stationary demand pattern in terms of the Chi-Square goodness of fit statistic. The Chi-Square statistic is widely used to measure how well a given data set fits a particular

model (Keller 2005, Hintze 2007). The Crystal Ball Demand Fit function was executed separately for each of the 278 items, and the following values were recorded for each item: best-fit distribution, Chi-Square value, probability value, and the item-specific parameter values for the identified best-fit distribution. A screen print showing the Crystal Ball Demand Fit analysis is presented in Figure 3.10.

Figure 3.10  
Screen Print of Crystal Ball Demand Fit Utility (Line 83)



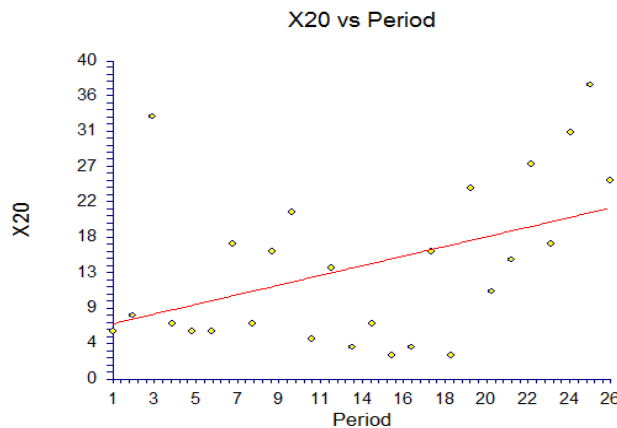
Distributions like the Geometric distribution or the Negative Binomial distribution that are used to measure variables such as trials between successes are deemed not applicable to the current study and are disregarded. In some cases the best fit was one of the four stationary demand distributions used in the simulation study. In other cases some other distribution emerged as the “winner.” Items for which a non-study distribution is the best fit, or for which no distribution is identified as a fit, were placed in the “other” demand pattern category.

In addition to the stationary-mean demand analysis described above, Year 1 and Year 2 demand for each of the 278 items was used to calculate parameter values for the three time-varying demand patterns used in the study: seasonal, trend, and seasonal with trend. This

required calculating the seasonal index for the seasonal case as a proportion above or below the average value for each season, doing a regression analysis to identify the intercept and slope values for the trend case, and combining seasonal and trend components of demand for the seasonal with trend case. For the sake of consistency, Year 1 and 2 weekly demand values were grouped and analyzed in terms of 13 equal-length periods of four weeks each. This step was taken to prevent random variability from obscuring seasonal patterns in each 52-week time series.

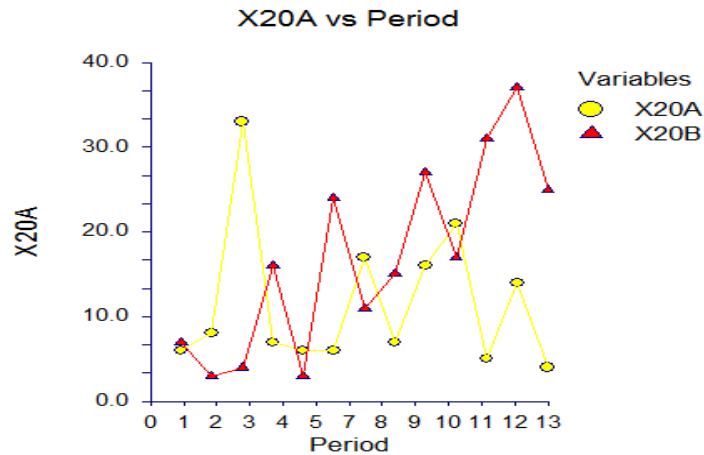
The NCSS statistical software package was used to run the regression analysis that identified the y-intercept and slope values for the demand trend for each item. These values were recorded and the NCSS regression report, which included a time series plot with trend line, was saved. A screen print of time series plot for one item is shown in Figure 3.11. The coding scheme used to name the variables uses the character “X” followed by the digits of the line number assigned to the individual inventory item in the empirical validation model.

Figure 3.11  
Time Series Plot with Trend Line



NCSS was also used to prepare a stacked time series plot of Year 1 and Year 2 demand for each item. Each stacked time series plot was visually evaluated for evidence of seasonality. The visual impression with regard to seasonality was recorded for each item, and these plots were saved for verification. A screen print of the stacked time series plot for one item is shown in Figure 3.12.

Figure 3.12  
Stacked Time Series Plot



With two base years of demand data in hand, a 13-period Year 3 demand forecast was calculated for each of the 278 items using four methods:

- (a) the best-fit stationary demand pattern, using the Crystal ball distribution formula for that pattern and the previously-identified parameter values for that distribution/item combination. If an item was placed in the “other” demand pattern category and Crystal Ball did not identify any demand distribution as being a fit for the item, the normal distribution with the appropriate mean and standard deviation values were used to generate the stationary-mean demand forecast for that item.
- (b) seasonal demand, using the seasonal index values identified above.
- (c) trend demand, using the intercept and slope values identified above.
- (d) seasonal with trend demand, using the seasonal index values around the trend line as discussed above.

For each of the 278 items, each of the four 13-period forecasts was compared against actual Year 3 demand to calculate two relevant forecast accuracy metrics. These metrics are the cumulative forecast error (CFE) and the mean absolute deviation (MAD). The MAD is regarded as a useful measure of forecast accuracy because it measures the precision of each

observation without offsetting positive vs. negative differences (Krajewski et al. 2010). For each item, the forecast method for Year 3 demand yielding the best value for forecast accuracy (lowest MAD) was chosen as the best-fit demand pattern for that item.

With the best-fit demand pattern identified for each item, each item was assigned to one of the relevant cases: a high-variability and low-variability case for each of the four stationary demand patterns, the three time-varying demand patterns, and the “other” demand pattern category. The previously-calculated coefficient of variation values were used to assign items to the high- or low-variability cases, with the cutoff value of the coefficient of variation set at 2.00. This is the approximate median value among the 278 items, and it is also consistent with the variability cutoff applied by Roundy and Muckstadt (2000).

Independently of the assignment of items to cases, the same inventory system cost analysis used in the simulation study was applied to each of the 278 items for the 52 weeks of actual demand in Year 3. That required adapting and replicating a single-case model used in the simulation study for use with the 278 actual items rather than 36 simulation items.

The general assumptions used in the inventory system cost calculation are similar, but not identical to, the assumptions used in the simulation study. The general assumptions used in the empirical validation study are summarized in Table 3.6.

Table 3.6  
EOQ Retrofit Study  
Assumptions for Inventory System Cost Calculations

$A$ = Order cost, fixed per order	\$75.00	Estimate used by company that provided empirical data
$v$ = Item purchase cost/unit	Per actual cost & demand data	Assume constant cost; use 3-Year maximum value
$r$ = Annual holding \$ per \$/Year	\$0.12	Estimate used by company that provided empirical data
$D$ = annual Item demand	Per actual cost & demand data	Use forecast of Year 3 demand for lot size & safety stock calculations
$T_n$ = weeks of supply in lot size	$n$ = number of weeks	Use $n = 1, 2, 3, 4, 6, 8, 13, 26, 52$
Number of items in simulation:	278	Actual demand items after eliminating inactive items, etc.
Item lead times, in Weeks	8	Same for all items; actuals not in company data
Indifference point formula	$(Dv)_{indifference} = \frac{288A}{T_1 T_2 r}$	Indifference point for period order quantity (POQ) of $T1$ vs. $T2$
Standard deviation of weekly demand	Per actual demand data	Use Year 2 values to calculate values for Year 3
Reorder interval, in Weeks	2	Same for all items
Initial On-Hand Qty % of Reorder Point	100%	On-hand quantity at start of year as % of order up-to level
Stockout cost per incident:	Ordering cost + item cost	Ordering cost represents expediting; item cost is lost opportunity.
Order cost factor	1.00	
Item cost factor	0.05	

Comparison of Table 3.6 against the assumptions used in the simulation study, as shown in Table 3.1, reveals some structural differences in the assumptions for the validation study. Actual purchase costs, actual demand data, and actual standard deviations are used in the empirical validation study. And the empirical validation study assumes that all items have an identical lead time of 8 weeks. This assumption is used due to a limitation in the actual data, as the company that provided the data did not accurately track vendor lead times throughout the three-year period from which the data were drawn.

Following the basic data flow of the simulation study, this yields a model with the following components:

- Lot size calculations
- Lot size comparison among the different replenishment models
- Actual Year 3 demand
- Wagner-Whitin inventory system costs
- $(R, s, S)$  EOQ inventory system costs

- EOQ Range Model inventory system costs
- Silver-Meal Heuristic inventory system costs
- Inventory system cost and summary statistics for Year 3 actual demand

Each of the three inventory system cost worksheets in the empirical validation study executed the same set of 19 tabular calculations that were used to calculate inventory system costs in the simulation study. A screen print of the inventory system cost summary table for the (R, s, S) EOQ model is shown in Figure 3.13.

Figure 3.13  
Screen Print of Empirical Validation: (R, s, S) EOQ Model

Table 3.18 EOQ Retrofit Study Total Inventory System Cost (Ordering Cost + Carrying Cost + Stockout Cost)												
Line ID #	Item #	Item Description	Item Cost (v)	Best Pattern or Distribution	Variability Level Low or High	Demand Retrofit Case Assignment	Lead Time Weeks (L)	Time Period (Week #) -->				
								1	2	3		
4920	10	10201442										
4921	10	10201442	11.71	Trend	Low	2A	8	79.32	4.98	3.86		
4922	11	CRB3890240	5.08	Trend	Low	2A	8	76.54	1.43	1.40		
4923	12	90240041	20.16	Trend	Low	2A	8	79.00	3.49	3.30		
4924	13	10431903	33.52	Trend	Low	2A	8	81.96	6.11	6.11		
4925	14	10432608	17.48	Trend	Low	2A	8	78.31	2.86	2.70		
4926	15	80572116	3.59	Trend	Low	2A	8	76.34	1.56	1.09		
4927	16	10100162	10.55	Trend	Low	2A	8	76.95	1.73	1.63		
4928	17	80100466	12.83	Trend	Low	2A	8	77.69	2.37	2.28		
4929	18	90132008	4.08	Trend	Low	2A	8	76.68	1.47	1.41		
4930	19	CRG2848096	185.36	Seasonal w/Trend	Low	3A	8	126.31	42.92	42.40		
4931	20	10100154	11.05	Trend	Low	2A	8	77.83	2.55	2.47		
4932	21	90550428	31.68	Trend	Low	2A	8	80.70	5.05	4.75		
4933	22	CRG2072144	179.46	Trend	Low	2A	8	151.29	66.99	66.14		
4934	23	80252901	12.42	Trend	Low	2A	8	77.49	2.49	2.38		
4935	24	10130188	4.80	Trend	Low	2A	8	75.89	0.79	0.74		
4936	25	10610122	3.71	Trend	Low	2A	8	76.50	1.34	1.28		
4937	26	90010100	40.07	Trend	Low	2A	8	81.66	5.83	5.46		
4938	27	10100163	13.29	Trend	Low	2A	8	78.44	3.10	3.01		
4939	28	90122002	2.49	Trend	Low	2A	8	75.61	0.56	0.54		
4940	29	10100147	2.11	Trend	Low	2A	8	75.53	0.49	0.47		
4941	30	10611700	5.67	Trend	Low	2A	8	76.95	1.71	1.61		
4942	31	90122001	18.94	Seasonal w/Trend	Low	3A	8	80.95	5.96	5.60		
4943	32	90132001	4.28	Trend	Low	2A	8	76.75	1.75	1.67		

This inventory system cost analysis was run only once for the single year of actual demand for each item. In other words, this part of the study was not a simulation with multiple iterations. The validation study is designed to estimate the inventory system cost result that would actually have occurred in Year 3 if techniques identified in the simulation study had been applied.

The inventory system cost and summary data from the validation study were tabulated for comparison and analysis. In addition, the 278 inventory system cost observations for the three alternative replenishment models were tested to evaluate the statistical significance of the differences among sample means using two-sample *t*-tests in the NCSS software. As was true

in the simulation study, the specific  $t$ -test evaluation procedure relied upon in the empirical validation study is the Aspin-Welch Unequal-Variance test.

Inventory system cost as calculated for Year 3 for all 278 items was analyzed to evaluate the overall system cost performance for each of the heuristics, and for consistency of the results of individual heuristic/demand category pairings with the results of the simulation study. For each heuristic/demand category pairing, and for application of each heuristic to all items, an absolute inventory system cost value and a percentage cost penalty against the optimal replenishment model for that category was calculated.

The procedures followed and time required to fit actual demand data to stationary-mean distributions and time-varying demand patterns were logged. This information was used in the item-demand pattern fitting implementation study. The actual inventory system cost results from this analysis were used in the cost/benefit study involving the differential staff and administrative costs of using the different inventory replenishment models. The inventory system cost value for each replenishment method is used to calculate the benefits (inventory system cost difference) of the alternative replenishment methods in the cost/benefit analysis.

Analysis of summary data from the empirical validation study, including evaluation of the statistical significance of differences in the inventory system cost for the alternative replenishment models, is presented in Chapter 5.

#### 3.4 Item-Demand Pattern Fitting Implementation Study

The item-demand pattern fitting implementation study incorporates findings from the simulation study and the empirical validation study. This includes a discussion of inferences drawn and lessons learned from other parts of this research as they affect implementation issues. It also includes a process narrative and flow chart that identifies and explains the sequence of steps followed to assign individual items to demand pattern categories. The results of the item-demand pattern fitting study are presented in Chapter 6.



### 3.5 Cost/Benefit Analysis

The cost/benefit analysis incorporates findings from the simulation process, the empirical validation, and the demand-pattern fitting implementation study. The *a priori* expectation was that a more calculation-intensive reorder point model, such as the  $(R, s, S)$  EOQ model that assumes normality, might yield lower inventory system costs than a more frugal heuristic like the EOQ Range Model or the Silver-Meal Heuristic. The cost/benefit analysis is included in this research to determine whether the lower staff, administrative and consulting cost of a frugal heuristic might offset the incremental benefits of the more precise but more costly and complex model.

The cost/benefit analysis considers a multi-item replenishment environment similar in size and scope to the industrial company that provided actual demand data for the study. Based on cost and staffing information from that company, and additional specified assumptions, the relevant annual costs of managing and administering the alternative replenishment models are estimated and compared. Constraints such as the availability of in-house quantitative expertise are considered to distinguish activities that could be performed by in-house staff vs. work performed by outside consultants. The results are used to draw inferences regarding the economic viability of a more precise but more costly and complex replenishment system as opposed to a less precise but more frugal heuristic.

The assumptions, calculations, and results of the cost/benefit analysis are presented in Chapter 7, which includes analysis and discussion of the results.

## CHAPTER 4

### SIMULATION

#### 4.1 Simulation: Overview

Output from the simulation study includes an average value of the inventory system cost (holding cost + order processing cost + stockout cost) that would be result (a) under the Wagner-Whitin model if actual demand could be determined in advance, (b) under the  $(R, s, S)$  EOQ replenishment model for all items, (c) under the EOQ Range model for all items, and (d) under the Silver-Meal Heuristic for all items. These four estimates are provided for each of the fourteen demand pattern/variability scenarios, following the methodology detailed in Chapter 3. This output was used to conduct  $t$ -tests tests of statistical significance for the differences in estimated inventory system costs in the NCSS statistical software package.

The results of the simulation study are presented and analyzed below. Section 4.2 provides an overview of the simulation results and addresses verification of the simulation model. Section 4.3 analyzes the results of the simulation in terms of the use of alternative models for a given demand pattern. Section 4.4 takes an alternate perspective, analyzing simulation results in terms of the effect of alternative demand patterns given the use of a single replenishment model. Section 4.5 analyzes the inventory system cost results at the different factor levels of item cost, periodic demand, and lead time. Section 4.6 offers inferences that can be drawn from the simulation study.

#### 4.2 Simulation Results: Inventory System Cost for All Items

A summary of average inventory system cost resulting from the simulation for different replenishment models and demand patterns is presented in Table 4.1.

Table 4.1  
EOQ Simulation Study  
Total Inventory System Cost Comparison

Case #	Description		Total Inventory System Cost			
			Wagner-Whitin Algorithm	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic
1A	Seasonal	Low Variability	34,286	156,527 x	171,197	156,975
2A	Trend	Low Variability	34,379	159,663 x	173,386	159,937
3A	Seasonal w/ Trend	Low Variability	34,476	159,452 x	173,436	159,785
4A	Normal	Low Variability	30,632	143,498 x	150,780	143,522
5A	Poisson	Low Variability	33,702	156,001 x	168,178	156,805
6A	Gamma	Low Variability	25,770	170,959	177,958	170,860 x
7A	Erlang-C	Low Variability	31,271	156,957	165,291	156,839 x
1B	Seasonal	High Variability	33,093	305,970	316,581	305,967 x
2B	Trend	High Variability	33,160	308,741 x	318,619	308,752
3B	Seasonal w/ Trend	High Variability	33,242	308,734 x	318,855	308,784
4B	Normal	High Variability	32,817	257,686 x	272,107	257,915
5B	Poisson	N/A				
6B	Gamma	High Variability	14,938	457,040 x	463,118	457,052
7B	Erlang-C	High Variability	29,178	308,594	313,668	308,431 x

x = Lowest inventory system cost among the three replenishment models for each simulated demand case.

It is useful to consider Table 4.1 in two dimensions. Horizontal analysis offers a comparison of inventory system costs that result from using different replenishment models for a given demand pattern and variability level. Vertical analysis offers a comparison of inventory system costs that result from different demand patterns and variability levels given the use of a single replenishment model.

One relationship that emerges from horizontal analysis is the fact that normally-distributed demand (Case 4A and 4B) yields the lowest inventory system cost for a given level of variability regardless of which replenishment model is used. This finding tends to reinforce the validity of the simulation model: given that each of the stochastic-demand replenishment models is based on a relaxed version of the classic EOQ model that assumes normally-distributed demand, we would expect each of those models to perform best in terms of minimizing inventory system cost when demand is, in fact, normally distributed.

Conducting a vertical analysis at the level of low- vs. high-variability cases reveals that inventory system costs are higher for the high-variability case than for the low-variability case for every stochastic model and demand pattern combination. This is intuitively plausible, as the

high-variability cases involve higher safety stock and more stockout exposure than the related low-variability cases. This is consistent with the findings of Tunc et al. (2011), and is further evidence in favor of the validity of the simulation model.

Vertical analysis at the individual demand pattern/model level indicates that, among the three replenishment models considered, the  $(R, s, S)$  EOQ model yields the best result under most demand scenarios. It is also evident that the Silver-Meal Heuristic performs nearly as well as the  $(R, s, S)$  EOQ model in most cases and even yields slightly lower inventory system costs in some scenarios. The EOQ Range model, regarded at the outset of the study as a promising frugal heuristic due to its simplicity, finishes a distant third for all of the demand scenarios.

Vertical analysis of Table 4.1 also indicates that the inventory system cost for the deterministic Wagner-Whitin algorithm is far below the cost of any stochastic replenishment model for the same demand case. This is further evidence in favor of the validity of the simulation model. We would expect the Wagner-Whitin inventory system cost to be significantly lower because neither the costs of holding safety stock (not needed for deterministic demand) nor any stockout costs are present under the Wagner-Whitin paradigm. Table 4.2 compares the calculated system cost penalty multiple against the optimal Wagner-Whitin cost for each demand simulation case.

Table 4.2  
EOQ Simulation Study  
Total Inventory System Cost Comparison: Penalty Multiple vs. Wagner-Whitin Algorithm

Case #	Description		System Cost Penalty Multiple vs. Wagner-Whitin		
			(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic
1A	Seasonal	Low Variability	4.57 x	4.99	4.58
2A	Trend	Low Variability	4.64 x	5.04	4.65
3A	Seasonal w/ Trend	Low Variability	4.62 x	5.03	4.63
4A	Normal	Low Variability	4.68 x	4.92	4.69
5A	Poisson	Low Variability	4.63 x	4.99	4.65
6A	Gamma	Low Variability	6.63 y	6.91	6.63 y
7A	Erlang-C	Low Variability	5.02 y	5.29	5.02 y
1B	Seasonal	High Variability	9.25 y	9.57	9.25 y
2B	Trend	High Variability	9.31 y	9.61	9.31 y
3B	Seasonal w/ Trend	High Variability	9.29 y	9.59	9.29 y
4B	Normal	High Variability	7.85 x	8.29	7.86
5B	Poisson	N/A			
6B	Gamma	High Variability	30.60 y	31.00	30.60 y
7B	Erlang-C	High Variability	10.58	10.75	10.57 x

x = Lowest inventory system cost penalty multiple vs. Wagner-Whitin algorithm for each simulated case.  
y = Tie among two models for lowest system cost penalty multiple vs. W-W rounded to two decimal places.

A review of Table 4.2 indicates that the  $(R, s, S)$  EOQ model offers the best overall performance as measured by the Wagner-Whitin cost penalty multiple. It is evident, however, that rounding the cost penalty multiple to two decimal places brings about a virtual tie between the  $(R, s, S)$  EOQ model and the Silver-Meal Heuristic for many demand cases. The inventory system cost differences between these two models are measured and tested for statistical significance in the next section.

#### 4.3 $t$ -Tests for Equal Means: Same Demand / Alternative Models

This section considers the horizontal analysis of inventory system costs from Table 4.1 in statistical terms. Absolute and percentage differences between the inventory system cost results for different replenishment models under each demand scenario are calculated, and two-sample  $t$ -tests are used to evaluate the significance of the differences among the sample means. In other words, this section addresses the question, "Do replenishment rules matter?"

As noted in Chapter 2, the two-way  $t$ -tests conducted in NCSS to identify the statistical significance of the different inventory system cost results rely on the Aspin-Welch test, which allows for non-normality and unequal variances among the samples that are compared. The calculated differences and  $t$ -test results are displayed in separate tables for the time-varying demand/low variability cases, the stationary-mean demand/low variability cases, the time-varying demand/high variability cases, and the stationary-mean demand/high variability cases. In each comparison, the differences are evaluated for both statistical significance and managerial importance. Samples of NCSS output for the two-sample  $t$ -tests conducted for the horizontal analysis are presented in Appendix E.

Statistical significance is evaluated at the  $\alpha = .05$  level, while managerial importance is deemed to exist if the difference among models or demand patterns is greater than 5% of the baseline inventory system cost measure. The baseline inventory cost measure for the horizontal analysis is the inventory system cost that would result under the best-performing stochastic  $(R, s, S)$  EOQ model.

Results for the time-varying demand/low variability cases are presented in Table 4.3.

Table 4.3  
EOQ Simulation Study  
*t*-Test Results: Total System Costs / Same Demand / Alternative Replenishment Models  
Time-Varying Demand - Low Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail <i>t</i> -Test			Directional <i>t</i> -Test		
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
1A-1	Seasonal	(R, s, S) EOQ	156,527	-362.7515	0.000000	Yes	-362.7515	0.000000	Yes
1A-2	Seasonal	EOQ Range	171,197						
		Difference	(14,670)	-9.4%					
1A-1	Seasonal	(R, s, S) EOQ	156,527	-11.9449	0.000000	Yes	-11.9449	0.000000	Yes
1A-3	Seasonal	Silver-Meal	156,975						
		Difference	(448)	-0.3%					
1A-2	Seasonal	EOQ Range	171,197	353.6762	0.000000	Yes	353.6762	0.000000	Yes
1A-3	Seasonal	Silver-Meal	156,975						
		Difference	14,222	8.3%					
2A-1	Trend	(R, s, S) EOQ	159,663	-356.89	0.000000	Yes	-356.89	0.000000	Yes
2A-2	Trend	EOQ Range	173,386						
		Difference	(13,723)	-8.6%					
2A-1	Trend	(R, s, S) EOQ	159,663	-7.5738	0.000000	Yes	-7.5738	0.000000	Yes
2A-3	Trend	Silver-Meal	159,937						
		Difference	(274)	-0.2%					
2A-2	Trend	EOQ Range	173,386	349.3433	0.000000	Yes	349.3433	0.000000	Yes
2A-3	Trend	Silver-Meal	159,937						
		Difference	13,449	7.8%					
3A-1	Seasonal w/ Trend	(R, s, S) EOQ	159,452	-360.4624	0.000000	Yes	-360.4624	0.000000	Yes
3A-2	Seasonal w/ Trend	EOQ Range	173,436						
		Difference	(13,984)	-8.8%					
3A-1	Seasonal w/ Trend	(R, s, S) EOQ	159,452	-9.1079	0.000000	Yes	-9.1079	0.000000	Yes
3A-3	Seasonal w/ Trend	Silver-Meal	159,785						
		Difference	(333)	-0.2%					
3A-2	Seasonal w/ Trend	EOQ Range	173,436	356.3639	0.000000	Yes	356.3639	0.000000	Yes
3A-3	Seasonal w/ Trend	Silver-Meal	159,785						
		Difference	13,651	7.9%					

As Table 4.3 indicates, all of the differences among the sample means for inventory system cost are statistically significant for the low-variability, time-varying demand cases. But in terms of managerial importance, the result is different. We see that the differences against the (R, s, S) EOQ inventory system costs are important (greater than 5%) for the EOQ Range Model but not for the Silver-Meal Heuristic. In absolute terms, the difference is less than \$1,000 against an inventory system cost of more than \$156,000, or 0.2% to 0.3%, for the Silver-Meal Heuristic.

Inventory system costs are compared for the low-variability set of stationary-mean demand cases in Table 4.4.

Table 4.4  
EOQ Simulation Study  
*t*-Test Results: Total System Costs / Same Demand / Alternative Replenishment Models  
Stationary Mean Demand - Low Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail <i>t</i> -Test			Directional <i>t</i> -Test		
				<i>t</i> -Value	Probability	Reject H0 at 0.05	<i>t</i> -Value	Probability	Reject H0 at 0.05
4A-1	Normal	(R, s, S) EOQ	143,498	-30.1089	0.000000	Yes	-30.1089	0.000000	Yes
4A-2	Normal	EOQ Range	150,780						
		Difference	(7,282)	-5.1%					
4A-1	Normal	(R, s, S) EOQ	143,498	-0.1085	0.913642	No	-0.1085	0.456821	No
4A-3	Normal	Silver-Meal	143,522						
		Difference	(24)	0.0%					
4A-2	Normal	EOQ Range	150,780	29.8527	0.000000	Yes	29.8527	0.000000	Yes
4A-3	Normal	Silver-Meal	143,522						
		Difference	7,258	4.8%					
5A-1	Poisson	(R, s, S) EOQ	156,001	-261.7804	0.000000	Yes	-261.7804	0.000000	Yes
5A-2	Poisson	EOQ Range	168,178						
		Difference	(12,177)	-7.8%					
5A-1	Poisson	(R, s, S) EOQ	156,001	-19.018	0.000000	Yes	-19.018	0.000000	Yes
5A-3	Poisson	Silver-Meal	156,805						
		Difference	(804)	-0.5%					
5A-2	Poisson	EOQ Range	168,178	245.9202	0.000000	Yes	245.9202	0.000000	Yes
5A-3	Poisson	Silver-Meal	156,805						
		Difference	11,373	6.8%					
6A-1	Gamma	(R, s, S) EOQ	170,959	-9.6031	0.000000	Yes	-9.6031	0.000000	Yes
6A-2	Gamma	EOQ Range	177,958						
		Difference	(6,999)	-4.1%					
6A-1	Gamma	(R, s, S) EOQ	170,959	0.1462	0.883771	No	0.1462	0.441885	No
6A-3	Gamma	Silver-Meal	170,860						
		Difference	99	0.1%					
6A-2	Gamma	EOQ Range	177,958	9.7079	0.000000	Yes	9.7079	0.000000	Yes
6A-3	Gamma	Silver-Meal	170,860						
		Difference	7,098	4.0%					
7A-1	Erlang-C	(R, s, S) EOQ	156,957	-67.6965	0.000000	Yes	-67.6965	0.000000	Yes
7A-2	Erlang-C	EOQ Range	165,291						
		Difference	(8,334)	-5.3%					
7A-1	Erlang-C	(R, s, S) EOQ	156,957	0.9904	0.322123	No	0.9904	0.161061	No
7A-3	Erlang-C	Silver-Meal	156,839						
		Difference	118	0.1%					
7A-2	Erlang-C	EOQ Range	165,291	68.7143	0.000000	Yes	68.7143	0.000000	Yes
7A-3	Erlang-C	Silver-Meal	156,839						
		Difference	8,452	5.1%					

The situation presented in Table 4.4 is more complicated. Again the differences are statistically significant for the EOQ Range Model vs. the (R, s, EOQ) Model for all four of the

stationary-mean demand patterns. But the Silver-Meal Heuristic yields inventory system cost results that are significantly different from (R, s, S) EOQ results only in the case of Poisson demand. For the other three demand patterns, Silver-Meal results are so close to the (R, s, S) EOQ results that the difference is not statistically significant at the  $\alpha = .05$  level. When we consider managerial importance, the differences for the EOQ Range Model exceed the 5% threshold vs. the (R, s, S) EOQ for normal, Poisson, and Erlang-C demand, and comes in at 4.1% for the gamma distribution case. But the differences for the Silver-Meal Heuristic are not important for any demand pattern, again falling below \$1,000 in each case and ranging from 0.0% to 0.5%.

The inventory system costs for the high-variability cases with time-varying demand are compared in Table 4.5.

Table 4.5  
EOQ Simulation Study  
t-Test Results: Total System Costs / Same Demand / Alternative Replenishment Models  
Time-Varying Demand - High Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail t-Test			Directional t-Test		
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
1B-1	Seasonal	(R, s, S) EOQ	305,970	-114.9492	0.000000	Yes	-114.9492	0.000000	Yes
1B-2	Seasonal	EOQ Range	316,581						
		Difference	(10,611)						
1B-1	Seasonal	(R, s, S) EOQ	305,970	0.0242	0.980668	No	0.0242	0.490334	No
1B-3	Seasonal	Silver-Meal	305,967						
		Difference	3						
1B-2	Seasonal	EOQ Range	316,581	114.9004	0.000000	Yes	114.9004	0.000000	Yes
1B-3	Seasonal	Silver-Meal	305,967						
		Difference	10,614						
2B-1	Trend	(R, s, S) EOQ	308,741	-112.4839	0.000000	Yes	-112.4839	0.000000	Yes
2B-2	Trend	EOQ Range	318,619						
		Difference	(9,878)						
2B-1	Trend	(R, s, S) EOQ	308,741	-0.1325	0.894632	No	-0.1325	0.447316	No
2B-3	Trend	Silver-Meal	308,752						
		Difference	(11)						
2B-2	Trend	EOQ Range	318,619	112.1832	0.000000	Yes	112.1832	0.000000	Yes
2B-3	Trend	Silver-Meal	308,752						
		Difference	9,867						
3B-1	Seasonal w/ Trend	(R, s, S) EOQ	308,734	-113.92	0.000000	Yes	-113.92	0.000000	Yes
3B-2	Seasonal w/ Trend	EOQ Range	318,855						
		Difference	(10,121)						
3B-1	Seasonal w/ Trend	(R, s, S) EOQ	308,734	-0.574	0.566025	No	-0.574	0.283012	No
3B-3	Seasonal w/ Trend	Silver-Meal	308,784						
		Difference	(50)						
3B-2	Seasonal w/ Trend	EOQ Range	318,855	113.4949	0.000000	Yes	113.4949	0.000000	Yes
3B-3	Seasonal w/ Trend	Silver-Meal	308,784						
		Difference	10,071						



As Table 4.5 indicates, differences against the (R, s, S) EOQ Model are again statistically significant for the EOQ Range Model for each demand pattern. The differences are not statistically significant for the Silver-Meal Heuristic in any case, and in fact the Silver-Meal outperforms the (R, s, S) EOQ model in the Seasonal Demand case by a miniscule \$3. Differences for the EOQ Range Model vs. the (R, s, S) EOQ run between 3.2% and 3.5%, thus falling below the importance threshold. All of the Silver-Meal differences are unimportant, with the largest absolute value at \$50 and all rounding to 0.0%.

Rounding out the horizontal analysis, inventory system costs for the high-variability cases with stationary-mean demand are presented in Table 4.6.

Table 4.6  
EOQ Simulation Study  
t-Test Results: Total System Costs / Same Demand / Alternative Replenishment Models  
Stationary Mean Demand - High Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail t-Test			Directional t-Test		
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
4B-1	Normal	(R, s, S) EOQ	257,686	-10.8452	0.000000	Yes	-10.8452	0.000000	Yes
4B-2	Normal	EOQ Range	272,107						
		Difference	(14,421)	-5.6%					
4B-1	Normal	(R, s, S) EOQ	257,686	-0.1857	0.852711	No	-0.1857	0.426355	No
4B-3	Normal	Silver-Meal	257,915						
		Difference	(229)	-0.1%					
4B-2	Normal	EOQ Range	272,107	10.6406	0.000000	Yes	10.6406	0.000000	Yes
4B-3	Normal	Silver-Meal	257,915						
		Difference	14,192	5.2%					
6B-1	Gamma	(R, s, S) EOQ	457,040	-1.1156	0.264749	No	-1.1156	0.132374	No
6B-2	Gamma	EOQ Range	463,118						
		Difference	(6,078)	-1.3%					
6B-1	Gamma	(R, s, S) EOQ	457,040	-0.0023	0.998201	No	-0.0023	0.499101	No
6B-3	Gamma	Silver-Meal	457,052						
		Difference	(12)	0.0%					
6B-2	Gamma	EOQ Range	463,118	1.1123	0.266144	No	1.1123	0.133072	No
6B-3	Gamma	Silver-Meal	457,052						
		Difference	6,066	1.3%					
7B-1	Erlang-C	(R, s, S) EOQ	308,594	-29.3827	0.000000	Yes	-29.3827	0.000000	Yes
7B-2	Erlang-C	EOQ Range	313,668						
		Difference	(5,074)	-1.6%					
7B-1	Erlang-C	(R, s, S) EOQ	308,594	0.959	0.337654	No	0.959	0.168827	No
7B-3	Erlang-C	Silver-Meal	308,431						
		Difference	163	0.1%					
7B-2	Erlang-C	EOQ Range	313,668	30.2813	0.000000	Yes	30.2813	0.000000	Yes
7B-3	Erlang-C	Silver-Meal	308,431						
		Difference	5,237	1.7%					

Table 4.6 indicates that differences between the EOQ Range Model and the  $(R, s, S)$  EOQ Model are statistically significant for the normal and Erlang-C distributions but not for the gamma distribution. The differences against the  $(R, s, S)$  EOQ are not significant for the Silver-Meal Heuristic under any of the three demand scenarios. In terms of managerial importance, the EOQ Range differences exceed the threshold for importance at 5.6% for the normal distribution, but are only 1.3% for the gamma distribution and 1.6% for the Erlang-C distribution. The Silver-Meal differences are again unimportant for all three demand patterns, with percentage differences at 0.0% or 0.1% for each pattern.

The horizontal analysis is reviewed from an aggregate perspective at the end of this chapter. In general, differences between the EOQ Range Model and the  $(R, s, S)$  EOQ Model are significantly different at the  $\alpha = .05$  level in most cases, and these differences are managerially important in some but not all cases. Differences between the Silver-Meal Heuristic and the  $(R, s, S)$  EOQ Model are so small as to be statistically insignificant and managerially unimportant in most cases.

#### 4.4 $t$ -Tests for Equal Means: Same Model / Alternative Demand

This section considers the vertical analysis of inventory system costs from Table 4.1 in statistical terms. Absolute and percentage differences between the inventory system cost results for different demand patterns under each stochastic replenishment model are calculated, and two-sample  $t$ -tests are used to evaluate the significances of the differences among the sample means. In other words, this section addresses the question, "Do demand patterns matter?"

The calculated differences and  $t$ -test results are displayed in three separate tables for the  $(R, s, S)$  EOQ Model, the EOQ Range Model, and the Silver-Meal Heuristic for the low-variability demand cases, and in three other tables for high-variability demand cases. For purposes of the vertical analysis, the normal distribution inventory system cost is treated as the baseline, and the calculated inventory system cost for each demand pattern under the same

replenishment model is compared to the result for the normal distribution. In each comparison, the differences are evaluated for both statistical significance and managerial importance. Samples of the NCSS output for the *t*-tests used in the vertical analysis are provided in Appendix F.

Inventory system cost results are compared for the (R, s, S) EOQ Model with low demand variability in Table 4.7.

Table 4.7  
EOQ Simulation Study  
*t*-Test Results: Total System Costs / Same Model / Alternative Demand Patterns  
(R, s, S) EOQ Model / Low Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail <i>t</i> -Test			Directional <i>t</i> -Test		
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
4A	Normal	(R, s, S) EOQ	143,498	-82.5257	0.000000	Yes	-82.5257	0.000000	Yes
1A	Seasonal	(R, s, S) EOQ	156,527						
		Difference	(13,029)	-9.1%					
4A	Normal	(R, s, S) EOQ	143,498	-102.5066	0.000000	Yes	-102.5066	0.000000	Yes
2A	Trend	(R, s, S) EOQ	159,663						
		Difference	(16,165)	-11.3%					
4A	Normal	(R, s, S) EOQ	143,498	-101.1044	0.000000	Yes	-101.1044	0.000000	Yes
3A	Seasonal w/ Trend	(R, s, S) EOQ	159,452						
		Difference	(15,954)	-11.1%					
4A	Normal	(R, s, S) EOQ	143,498	-78.8883	0.000000	Yes	-78.8883	0.000000	Yes
5A	Poisson	(R, s, S) EOQ	156,001						
		Difference	(12,503)	-8.7%					
4A	Normal	(R, s, S) EOQ	143,498	-54.5576	0.000000	Yes	-54.5576	0.000000	Yes
6A	Gamma	(R, s, S) EOQ	170,959						
		Difference	(27,461)	-19.1%					
4A	Normal	(R, s, S) EOQ	143,498	-75.96	0.000000	Yes	-75.96	0.000000	Yes
7A	Erlang-C	(R, s, S) EOQ	156,957						
		Difference	(13,459)	-9.4%					

This set of comparisons shows that differences from inventory system costs under normal demand are statistically significant at the  $\alpha = .05$  level for every demand pattern considered. These differences are all managerially important, ranging from 8.7% for Poisson demand to 19.1% for gamma-distributed demand.

Inventory system cost results are compared for the EOQ Range Model with low demand variability in Table 4.8.

Table 4.8  
EOQ Simulation Study  
*t*-Test Results: Total System Costs / Same Model / Alternative Demand Patterns  
EOQ Range Model / Low Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail <i>t</i> -Test			Directional <i>t</i> -Test		
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
4A	Normal	EOQ Range	150,780	-108.7935	0.000000	Yes	-108.7935	0.000000	Yes
1A	Seasonal	EOQ Range	171,197						
		Difference	(20,417)	-13.5%					
4A	Normal	EOQ Range	150,780	-120.6291	0.000000	Yes	-120.6291	0.000000	Yes
2A	Trend	EOQ Range	173,368						
		Difference	(22,588)	-15.0%					
4A	Normal	EOQ Range	150,780	-120.9076	0.000000	Yes	-120.9076	0.000000	Yes
3A	Seasonal w/ Trend	EOQ Range	173,436						
		Difference	(22,656)	-15.0%					
4A	Normal	EOQ Range	150,780	-92.2693	0.000000	Yes	-92.2693	0.000000	Yes
5A	Poisson	EOQ Range	168,178						
		Difference	(17,398)	-11.5%					
4A	Normal	EOQ Range	150,780	-46.8617	0.000000	Yes	-46.8617	0.000000	Yes
6A	Gamma	EOQ Range	177,958						
		Difference	(27,178)	-18.0%					
4A	Normal	EOQ Range	150,780	-70.5829	0.000000	Yes	-70.5829	0.000000	Yes
7A	Erlang-C	EOQ Range	165,291						
		Difference	(14,511)	-9.6%					

When the EOQ Range Model is applied across the full set of low-variability demand patterns, the inventory system cost difference from the cost result under normal demand is statistically significant for all demand patterns. These differences are all managerially important, running from 9.6% for the Erlang-C distribution to 18.0% for the gamma distribution. It is evident that these differences are larger in percentage terms than the differences observed for the (*R*, *s*, *S*) EOQ Model with low variability.

Inventory system cost results are compared for the Silver-Meal Heuristic with low demand variability in Table 4.9.

Table 4.9  
EOQ Simulation Study  
t-Test Results: Total System Costs / Same Model / Alternative Demand Patterns  
Silver-Meal Heuristic / Low Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail t-Test			Directional t-Test		
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
4A	Normal	Silver-Meal	143,522	-84.2083	0.000000	Yes	-84.2083	0.000000	Yes
1A	Seasonal	Silver-Meal	156,975						
		Difference	(13,453)	-9.4%					
4A	Normal	Silver-Meal	143,522	-102.8203	0.000000	Yes	-102.8203	0.000000	Yes
2A	Trend	Silver-Meal	159,937						
		Difference	(16,415)	-11.4%					
4A	Normal	Silver-Meal	143,522	-101.8859	0.000000	Yes	-101.8859	0.000000	Yes
3A	Seasonal w/ Trend	Silver-Meal	159,785						
		Difference	(16,263)	-11.3%					
4A	Normal	Silver-Meal	143,522	-82.8385	0.000000	Yes	-82.8385	0.000000	Yes
5A	Poisson	Silver-Meal	156,805						
		Difference	(13,283)	-9.3%					
4A	Normal	Silver-Meal	143,522	-53.8811	0.000000	Yes	-53.8811	0.000000	Yes
6A	Gamma	Silver-Meal	170,860						
		Difference	(27,338)	-19.0%					
4A	Normal	Silver-Meal	143,522	-74.4551	0.000000	Yes	-74.4551	0.000000	Yes
7A	Erlang-C	Silver-Meal	156,839						
		Difference	(13,317)	-9.3%					

Again in Table 4.9, all of the inventory system cost differences from the average value with normal demand are statistically significant at  $\alpha = .05$ . As was the case for the analogous set of comparisons for the  $(R, s, S)$  EOQ Model, all of these differences are managerially important—with percentage values between 9.3% for Poisson and Erlang-C demand, and 11.4% for Trend demand. The symmetry of these results with the results for the  $(R, s, S)$  EOQ Model are consistent with expectations due to the small differences between results for these two models in many cases.

Moving on to the high-variability cases, the inventory system cost results are compared for the  $(R, s, S)$  EOQ Model with high demand variability in Table 4.10.

Table 4.10  
EOQ Simulation Study  
t-Test Results: Total System Costs / Same Model / Alternative Demand Patterns  
(R, s, S) EOQ Model / High Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail t-Test		Directional t-Test			
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
4B	Normal	(R, s, S) EOQ	257,686	-55.2765	0.000000	Yes	-55.2765	0.000000	Yes
1B	Seasonal	(R, s, S) EOQ	305,970						
		Difference	(48,284)	-18.7%					
4B	Normal	(R, s, S) EOQ	257,686	-58.4625	0.000000	Yes	-58.4625	0.000000	Yes
2B	Trend	(R, s, S) EOQ	308,741						
		Difference	(51,055)	-19.8%					
4B	Normal	(R, s, S) EOQ	257,686	-58.4469	0.000000	Yes	-58.4469	0.000000	Yes
3B	Seasonal w/ Trend	(R, s, S) EOQ	308,734						
		Difference	(51,048)	-19.8%					
4B	Normal	(R, s, S) EOQ	257,686	-51.3405	0.000000	Yes	-51.3405	0.000000	Yes
6B	Gamma	(R, s, S) EOQ	457,040						
		Difference	(199,354)	-77.4%					
4B	Normal	(R, s, S) EOQ	257,686	-57.8844	0.000000	Yes	-57.8844	0.000000	Yes
7B	Erlang-C	(R, s, S) EOQ	308,954						
		Difference	(51,268)	-19.9%					

Table 4.10 shows that differences from inventory system costs under normal demand are statistically significant at the  $\alpha = .05$  level with the (R, s, S) EOQ Model for every demand pattern considered. These differences are all managerially important, ranging from 18.7% for Seasonal demand to 77.4% for gamma-distributed demand. Comparing these results to the results in Table 4.7 for the (R, s, S) EOQ Model under low demand variability indicates that the differences are larger in absolute and relative terms for the set of high-variability cases.

Inventory system cost results are compared for the EOQ Range Model with high demand variability in Table 4.11.

Table 4.11  
EOQ Simulation Study  
*t*-Test Results: Total System Costs / Same Model / Alternative Demand Patterns  
EOQ Range Model / High Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail <i>t</i> -Test			Directional <i>t</i> -Test		
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
4B	Normal	EOQ Range	272,107	-44.1745	0.000000	Yes	-44.1745	0.000000	Yes
1B	Seasonal	EOQ Range	316,581						
		Difference	(44,474)	-16.3%					
4B	Normal	EOQ Range	272,107	-46.21	0.000000	Yes	-46.21	0.000000	Yes
2B	Trend	EOQ Range	318,619						
		Difference	(46,512)	-17.1%					
4B	Normal	EOQ Range	272,107	-46.4445	0.000000	Yes	-46.4445	0.000000	Yes
3B	Seasonal w/ Trend	EOQ Range	318,855						
		Difference	(46,748)	-17.2%					
4B	Normal	EOQ Range	272,107	-47.2034	0.000000	Yes	-47.2034	0.000000	Yes
6B	Gamma	EOQ Range	463,118						
		Difference	(191,011)	-70.2%					
4B	Normal	EOQ Range	272,107	-41.0628	0.000000	Yes	-41.0628	0.000000	Yes
7B	Erlang-C	EOQ Range	313,668						
		Difference	(41,561)	-15.3%					

Applying the EOQ Range Model across all of the high-variability demand patterns yields inventory system cost differences from the cost result under normal demand that are statistically significant for all demand patterns. These differences are all managerially important to a large extent, running from 15.3% for the Erlang-C distribution to 70.2% for the gamma distribution. As was true with the (*R*, *s*, *S*) EOQ model, these differences are larger in absolute and percentage terms than the differences observed for the EOQ Range Model with low variability.

Inventory system cost results are compared for the Silver-Meal Heuristic with high demand variability in Table 4.12.

Table 4.12  
EOQ Simulation Study  
t-Test Results: Total System Costs / Same Model / Alternative Demand Patterns  
Silver-Meal Heuristic / High Variability Cases

Case	Demand	Model	Total Inventory System Cost	2-Tail t-Test			Directional t-Test		
				t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
4B	Normal	Silver-Meal	257,915	-54.6315	0.000000	Yes	-54.6315	0.000000	Yes
1B	Seasonal	Silver-Meal	305,967						
		Difference	(48,052)	-18.6%					
4B	Normal	Silver-Meal	257,915	-57.8099	0.000000	Yes	-57.8099	0.000000	Yes
2B	Trend	Silver-Meal	308,752						
		Difference	(50,837)	-19.7%					
4B	Normal	Silver-Meal	257,915	-57.84	0.000000	Yes	-57.84	0.000000	Yes
3B	Seasonal w/ Trend	Silver-Meal	308,784						
		Difference	(50,869)	-19.7%					
4B	Normal	Silver-Meal	257,915	-51.1727	0.000000	Yes	-51.1727	0.000000	Yes
6B	Gamma	Silver-Meal	457,052						
		Difference	(199,137)	-77.2%					
4B	Normal	Silver-Meal	257,915	-57.0443	0.000000	Yes	-57.0443	0.000000	Yes
7B	Erlang-C	Silver-Meal	308,431						
		Difference	(50,516)	-19.6%					

In Table 4.12, all of the inventory system cost differences from the average value with normal demand are statistically significant at  $\alpha = .05$ . All of these differences are managerially important—with percentage values between 18.6% for Seasonal demand, and 77.2% for gamma-distributed demand. As with the other high-variability cases, the differences from baseline inventory system costs are larger with high-variability demand patterns than with the low-variability patterns under the Silver-Meal Heuristic. We also see that inventory system cost results and differences are very similar between the  $(R, s, S)$  EOQ Model and the Silver-Meal Heuristic.

The vertical analysis is discussed from an aggregate perspective in the Section 4.6. In general, differences in inventory system cost under normal demand vs. the other demand patterns are significantly different at the  $\alpha = .05$  level and managerially important in all cases. This is true at both low- and high-variability demand levels.



#### 4.5 Factor Level Analysis: Cost, Demand, and Lead Time

Tables comparing the inventory system cost results for the different factor levels of cost, demand, and lead time are presented in Appendix G. As discussed in the Methodology section, the simulation featured a balanced design with three levels of item cost, three levels of periodic demand, and four levels of lead time. These results are summarized below, with primary emphasis on implications for verification of the simulation model.

In terms of the two levels of variability, higher inventory system costs are calculated for higher levels of variability for all of the factor levels, models, and demand patterns considered. This is consistent with the findings of Tunc et al. (2011), and serves to support the validity of the simulation model.

As noted above, the normal distribution yields the lowest total inventory system cost of any demand distribution for each of the three stochastic-demand replenishment models considered in the simulation study. This relationship holds for most of the factor levels, with the exception of the lowest level of item cost ( $v = \$7.50$ ), and the lowest level of weekly unit demand ( $\bar{d} = 1$ ). The Poisson distribution yields the lowest total inventory system cost under the  $(R, s, S)$  EOQ model for the lowest level of item cost, and the gamma and Erlang-C distributions yield lower inventory system costs than the normal distribution with the EOQ Range Model or the Silver-Meal Heuristic for the lowest level of item cost and the lowest level of weekly unit demand.

Inventory system costs are lower in all cases for items at the lowest levels of item cost and weekly demand, so this relationship does not invalidate the results with regard to aggregate inventory system costs. But this relationship does raise a caveat regarding the generalizability of results from the simulation study to multi-item inventory environments that are heavily tilted toward low-cost or low levels of periodic demand.

When we consider the horizontal analysis of the application of different models for the same demand pattern the same overall relationships observed at the aggregate level are in

place at all of the factor levels. Inventory system cost results are lowest overall for the  $(R, s, S)$  EOQ Model, with the calculated results for the Silver-Meal Heuristic very close to the  $(R, s, S)$  EOQ results in most cases. The EOQ Range Model generally yields higher inventory system cost, although that model tends to perform better relative to the other models for items at the highest level of item cost ( $v = \$750.00$ ). This provides evidence that the EOQ Range Model could perform better relative to the other models in multi-item inventory environments that are weighted toward items with purchase costs that are high relative to order processing costs.

In terms of the vertical analysis of applying a single model to different demand patterns within a variability level, the relationships that emerge at the factor level are consistent with the aggregate-level relationships. The inventory costs that result from applying a given model to alternative demand patterns will differ, although the absolute magnitude of these differences will be smaller for lower levels of items cost or periodic demand.

As a whole, the factor-level analysis of inventory system cost supports the validity of the simulation model while revealing some factor-level distinctions that may be relevant in inventory environments that are unbalanced with regard to the range of item costs and demand levels that are present.

#### 4.6 Inferences from the Simulation Study

In looking at results from the simulation study, it is useful to begin with inferences regarding the validity of the simulation model that can be drawn from an overview of inventory system cost results for the different replenishment models, demand patterns and demand variability levels as shown in Table 4.1. The validity of the simulation model is supported by the fact that inventory system costs are lowest when demand is normally distributed—regardless of which replenishment model is used, and across both levels of demand variability. This is explained by the fact that the three stochastic-demand models used in the study are all based on a relaxed version of the classic EOQ model that assumes normally-distributed demand.

The validity of the simulation model is also supported by the observation that inventory system costs are higher for high-variability demand cases than for the related low-variability demand case for all demand patterns, which is consistent with the findings in Tunc et al. (2011). Validity is also supported by the fact that inventory system costs are much higher for all of the stochastic replenishment models than for the deterministic Wagner-Whitin Algorithm under every demand scenario. Further evidence that will be useful in evaluating the simulation model will be presented in the empirical validation study in Chapter 5.

It is helpful to recap the horizontal analysis of results from alternative models with the same demand pattern, and the vertical analysis of results from alternative demand patterns with the same model. A summary of results from the horizontal analysis is shown in Table 4.13.

Table 4.13  
EOQ Simulation Study  
Summary of Results: Same Demand / Different Models

Case	Demand Pattern	Variability	EOQ Range vs. (R, s, S) EOQ			Silver-Meal vs. (R, s, S) EOQ		
			% Penalty	Significant at .05?	Important (> 5%) ?	% Penalty	Significant at .05?	Important (> 5%) ?
1A	Seasonal	Low	9.4%	Yes	Yes	0.3%	Yes	No
2A	Trend	Low	8.6%	Yes	Yes	0.2%	Yes	No
3A	Seasonal w/ Trend	Low	8.8%	Yes	Yes	0.2%	Yes	No
4A	Normal	Low	5.1%	Yes	Yes	0.0%	No	No
5A	Poisson	Low	7.8%	Yes	Yes	0.5%	Yes	No
6A	Gamma	Low	4.1%	Yes	No	0.1%	No	No
7A	Erlang-C	Low	5.3%	Yes	Yes	0.1%	No	No
1B	Seasonal	High	3.5%	Yes	No	0.0%	No	No
2B	Trend	High	3.2%	Yes	No	0.0%	No	No
3B	Seasonal w/ Trend	High	3.3%	Yes	No	0.0%	No	No
4B	Normal	High	5.6%	Yes	Yes	0.1%	No	No
5B	Poisson	N/A						
6B	Gamma	High	1.3%	No	No	0.0%	No	No
7B	Erlang-C	High	1.6%	Yes	No	0.1%	No	No

For purposes of the horizontal analysis, the (R, s, S) EOQ Model, which provides the best overall inventory system cost performance against the stochastic-demand replenishment models considered, is treated as the baseline for comparison. Comparing the performance of the EOQ Range Model to the (R, s, S) EOQ Model indicates that the inventory system cost differences are both statistically significant at the  $\alpha = .05$  level, and managerially important with percentage differences greater than 5%, in nearly all cases. We can infer that the (R, s, S)

EOQ Model generally outperforms the EOQ Range Model with regard to inventory system cost given the assumptions used in the simulation.

On the other hand, comparing the performance of the Silver-Meal Heuristic against the (R, s, S) EOQ Model indicates that the inventory system cost differences are statistically significant at the  $\alpha = .05$  level for only some of the low-variability demand scenarios. These differences are small in absolute and percentage terms in all cases, and are not managerially important in any case, with these percentage differences never exceeding 0.5%. We can infer that the (R, s, S) EOQ Model does not significantly outperform the Silver-Meal Heuristic with regard to inventory system cost given the assumptions used in the simulation.

A summary of results from the vertical analysis is shown in Table 4.14.

Table 4.14  
EOQ Simulation Study  
Summary of Results: Same Model / Different Demand Patterns

Model	Variability	Differences vs. Normal Demand		
		% Penalty	Significant at .05?	Important (> 5%) ?
(R, s, S) EOQ Model	Low	8.7%-11.3%	Yes	Yes
EOQ Range Model	Low	9.6%-18%	Yes	Yes
Silver-Meal Heuristic	Low	9.3%-11.4%	Yes	Yes
(R, s, S) EOQ Model	High	18.7%-77.4%	Yes	Yes
EOQ Range Model	High	15.3%-77.2%	Yes	Yes
Silver-Meal Heuristic	High	18.6%-77.2%	Yes	Yes

For purposes of the vertical analysis, normally distributed demand—which provides the best overall inventory system cost result across all stochastic models for a given level of demand variability, is treated as the baseline for comparison. Comparing the performance of each model across the range of demand patterns studied indicates that the inventory system cost differences are both statistically significant at the  $\alpha = .05$  level and managerially important, with percentage differences greater than 5%, in nearly all cases. We can infer that the cost performance of any of the replenishment models considered will be affected significantly if the

actual demand pattern encountered is different from the demand pattern that is expected. This inference would be valid under the set of assumptions used in the simulation. The identified relationships might not apply to inventory environments containing a slate of items that are weighted differently with regard to item costs and periodic demand in comparison to the balanced representation of the different factor levels assumed in this simulation study.

The inferences developed in this section can be offered to answer the two relevant research questions in the affirmative: replenishment models matter, and demand patterns matter. With these inferences grounded in the assumptions used in the simulation, it is appropriate to gather further evidence regarding the validity of the model and the generalizability of simulation results. That purpose is served by the empirical validation study, which is presented in Chapter 5.

## CHAPTER 5

### EMPIRICAL VALIDATION

#### 5.1 Empirical Validation: Overview

As detailed in Section 3.3, inventory system costs for each of the four models were compared and analyzed across the 278 actual inventory items after the items had been assigned to the different demand pattern categories. Output from the empirical validation study includes the total Year 3 inventory system cost (holding cost + order processing cost + stockout cost) that would be result (a) under the Wagner-Whitin model if actual demand could be determined in advance, (b) under the  $(R, s, S)$  EOQ replenishment model for all items, (c) under the EOQ Range model for all items, and (d) under the Silver-Meal Heuristic for all items. These four estimates are broken down by the demand pattern/variability scenarios, following the methodology detailed in Chapter 3. This output was used to conduct  $t$ -tests tests of statistical significance for the differences in estimated inventory system costs in the NCSS statistical software package.

Samples of regression reports and stacked time series plots used in the validation study are presented in Appendix H. Sample screen prints from the model used to calculate inventory system costs for the validation study are shown in Appendix I, and screen prints of the  $t$ -test output used in the validation study are presented in Appendix J.

The results of the empirical validation study are detailed and analyzed below. Section 5.2 provides an overview of the validation results, and discusses these results with respect to the simulation model. Section 5.3 presents the results of  $t$ -tests that compare the inventory system cost results for the alternative models as applied to actual Year 3 demand. Section 5.4 offers inferences that can be drawn from the empirical validation study.

## 5.2 Validation Results: Inventory System Cost for All Items

A summary of inventory system cost results for Year 3 for all items, broken into demand pattern categories and showing the number of items assigned to each demand pattern category, is shown in Table 5.1.

Table 5.1  
Empirical Validation Study  
Total Inventory System Cost: Optimized Match of Models to Demand Patterns

Case #	Description		# of Items	Total Inventory System Cost				
				Wagner-Whitin Algorithm	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	Optimized Model-Demand
1A	Seasonal	Low Variability	2	220	386	674	358 x	358
2A	Trend	Low Variability	110	45,465	156,816 x	238,112	163,489	156,816
3A	Seasonal w/ Trend	Low Variability	9	3,611	8,828 x	10,494	8,846	8,828
4A	Normal	Low Variability	1	161	229	362	223 x	223
5A	Poisson	Low Variability	23	5,252	40,473	37,777 x	40,019	37,777
6A	Gamma	Low Variability	0	N/A	N/A	N/A	N/A	N/A
7A	Erlang-C	Low Variability	0	N/A	N/A	N/A	N/A	N/A
8A	Other Distributions	Low Variability	10	1,503	7,155 x	8,988	8,533	7,155
Subtotal: Low Variability			155	56,211	213,887 x	296,408	221,467	211,157
1B	Seasonal	High Variability	31	4,707	25,334 x	33,297	28,612	25,334
2B	Trend	High Variability	46	8,627	104,548 x	133,966	114,890	104,548
3B	Seasonal w/ Trend	High Variability	17	4,085	22,815 x	32,260	23,815	22,815
4B	Normal	High Variability	2	526	988 x	2,536	1,033	988
5B	Poisson	N/A	0	N/A	N/A	N/A	N/A	N/A
6B	Gamma	High Variability	0	N/A	N/A	N/A	N/A	N/A
7B	Erlang-C	High Variability	0	N/A	N/A	N/A	N/A	N/A
8B	Other Distributions	High Variability	27	5,017	52,798 x	64,330	56,155	52,798
Subtotal: High Variability			123	22,962	206,483 x	266,390	224,505	206,483
Total: All Items			278	79,173	420,370 x	562,797	445,973	417,640

x = Lowest inventory system cost among the three replenishment models for each demand pattern group.

One relationship that becomes evident immediately is the lack of symmetry in the breakdown of the 278 items by demand category. This does not bear on the validity of the simulation model, as no attempt was made to weight the items in the simulation study to represent the distribution of the actual items by demand pattern.

Over half of the 278 items are assigned to the Trend demand pattern category, including 110 of the low-variability items and 46 of the high-variability items. Summing items in the Seasonal, Trend, and Seasonal with Trend categories at both levels of demand variability indicates that 215 or 77.3% of the actual inventory items have time-varying demand patterns. This can be attributed to the fact that the company that provided the historical demand data

experienced significant increases in business activity during the three years for which the historical data were provided.

Turning to the stationary-mean demand patterns, 23 or 8.3% of the items are assigned to the Poisson demand category. Only 3 or 1.1% of the 278 items have demand that is normally distributed, which is surprising given the widespread assumption of normally-distributed demand in practice. None of the 278 items had the gamma or Erlang-C distribution identified as its best-fit distribution.

Among the 37 items or 13.3% of the total items assigned to the Other demand category, 36 are assigned to the discrete uniform distribution and one item is assigned to the Weibull distribution.

Continuing with the total system cost analysis presented in Table 5.1, the reliance on a single actual demand stream in the validation study precludes a vertical analysis of the effect of a given replenishment model on alternative demand patterns. But it is possible to apply a horizontal analysis to consider the effect of applying the alternative stochastic-demand replenishment models to the given demand stream. A visual scan of Table 5.1 reveals the same pattern identified in the simulation study: the inventory system cost results for the  $(R, s, S)$  EOQ Model are the lowest resulting for any single model in most demand categories and overall.

As was true in the simulation study, Silver-Meal Heuristic results are close to those for the  $(R, s, S)$  EOQ in most cases and in total, and the EOQ Range Model generally finishes a distant third. An exception occurs for Poisson demand, for which the EOQ Range Model yields the lowest inventory system cost. This can be attributed to the small sample size, with only 23 items assigned to the Poisson category.

The absolute and percentage differences among inventory system cost results will be evaluated further in Section 5.3. Meanwhile, an analysis of the relative cost performance of



each replenishment model for each demand pattern category represented in the actual data is presented in Table 5.2.

Table 5.2  
Empirical Validation Study  
Total Inventory System Cost Penalty vs. Optimal Model by Variability Level

Case #	Description		# of Items	Absolute \$ Cost Penalty vs. Optimal Model			Percentage Cost Penalty vs. Optimal Model		
				(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic
1A	Seasonal	Low Variability	2	28	317	0	7.8%	88.7%	0.0%
1B	Seasonal	High Variability	31	0	7,963	3,278	0.0%	31.4%	12.9%
2A	Trend	Low Variability	110	0	81,296	6,673	0.0%	51.8%	4.3%
2B	Trend	High Variability	46	0	29,418	10,342	0.0%	28.1%	9.9%
3A	Seasonal w/ Trend	Low Variability	9	0	1,666	18	0.0%	18.9%	0.2%
3B	Seasonal w/ Trend	High Variability	17	0	9,444	999	0.0%	41.4%	4.4%
4A	Normal	Low Variability	1	6	139	0	2.7%	62.4%	0.0%
4B	Normal	High Variability	2	0	1,548	46	0.0%	156.7%	4.7%
5A	Poisson	Low Variability	23	2,696	0	2,242	7.1%	0.0%	5.9%
5B	Poisson	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A
6A	Gamma	Low Variability	0	N/A	N/A	N/A	N/A	N/A	N/A
6B	Gamma	High Variability	0	N/A	N/A	N/A	N/A	N/A	N/A
7A	Erlang-C	Low Variability	0	N/A	N/A	N/A	N/A	N/A	N/A
7B	Erlang-C	High Variability	0	N/A	N/A	N/A	N/A	N/A	N/A
8A	Other Distributions	Low Variability	10	0	1,833	1,378	0.0%	25.6%	19.3%
8B	Other Distributions	High Variability	27	0	11,533	3,357	0.0%	21.8%	6.4%
Total: All Items			278	2,730	145,157	28,333	0.6%	34.5%	6.7%

Overall, the results of the empirical validation study are consistent with the results of the simulation study. Again it is evident that the absolute cost penalty against the optimal replenishment model is higher for high-variability items than it is for low-variability items in most cases. The  $(R, s, S)$  EOQ model performs better than the EOQ Range model or the Silver-Meal Heuristic across the full set of items, but the absolute cost advantage over the Silver-Meal Heuristic is small relative to the total of inventory system costs across all items.

It is also helpful to evaluate the inventory system cost penalty multiple against the optimal Wagner-Whitin inventory system cost. This analysis is provided in Table 5.3.

Table 5.3  
Empirical Validation Study  
Total Inventory System Cost Comparison: Penalty Multiple vs. Wagner-Whitin Algorithm

Case #	Description		# of Items	System Cost Multiple vs. Wagner-Whitin		
				(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic
1A	Seasonal	Low Variability	2	1.8	3.1	1.6 x
2A	Trend	Low Variability	110	3.4 x	5.2	3.6
3A	Seasonal w/ Trend	Low Variability	9	2.4 x	2.9	2.5
4A	Normal	Low Variability	1	1.4 y	2.3	1.4 y
5A	Poisson	Low Variability	23	7.7	7.2 x	7.6
6A	Gamma	Low Variability	0	N/A	N/A	N/A
7A	Erlang-C	Low Variability	0	N/A	N/A	N/A
8A	Other Distributions	Low Variability	10	4.8 x	6.0	5.7
Subtotal: Low Variability			155	3.8 x	5.3	3.9
1B	Seasonal	High Variability	31	5.4 x	7.1	6.1
2B	Trend	High Variability	46	12.1 x	15.5	13.3
3B	Seasonal w/ Trend	High Variability	17	5.6 x	7.9	5.8
4B	Normal	High Variability	2	1.9 x	4.8	2.0
5B	Poisson	N/A	0	N/A	N/A	N/A
6B	Gamma	High Variability	0	N/A	N/A	N/A
7B	Erlang-C	High Variability	0	N/A	N/A	N/A
8B	Other Distributions	High Variability	27	10.5 x	12.8	11.2
Subtotal: High Variability			123	9.0 x	11.6	9.8
Total: All Items			278	5.3 x	7.1	5.6

x = Lowest inventory system cost-multiple vs. Wagner-Whitin algorithm for actual demand pattern group.  
y = Tie among two models for lowest system cost penalty multiple vs. W-W rounded to two decimal places.

The pattern observed here is consistent with the pattern that is evident in Table 4.2 for the simulation study. The system cost penalty against the deterministic Wagner-Whitin Algorithm is larger for items with high demand variability than for items with low variability.

The Wagner-Whitin penalty multiple offers another opportunity to compare the validation study results with the results of the simulation study. The Wagner-Whitin penalty multiple calculated for all items for Year 3 under the (R, s, S) EOQ Model stands at 5.3 for the 278 items the validation study. This result can be compared to the Wagner-Whitin penalty multiple for the (R, s, S) EOQ Model with different demand patterns in the simulation study in Table 4.2. We can exclude the gamma and Erlang-C multiples in Table 4.2 from consideration,

as none of the items in the validation study adhere to these distributions. The aggregate value of 5.3 for the Wagner-Whitin penalty multiple in the validation study lies in the range between the low-variability and high-variability demand categories for the  $(R, s, S)$  EOQ Model in Table 4.2. This consistency is evidence that supports the validity of the simulation model.

The inventory system cost differences among the stochastic-demand replenishment models are measured and tested for statistical significance in the next section.

### 5.3 *t*-Tests for Equal Means: Alternative Models

Inventory system costs for the third year of actual demand for the 278 items as computed under the three competing replenishment models were subjected to *t*-tests in NCSS to evaluate the statistical significance of the calculated differences. The *t*-test results are summarized in Table 5.4.

Table 5.4  
Empirical Validation Study  
*t*-Test Results: Total Inventory System Cost / Alternative Replenishment Models

Model	Total Inventory System Cost	2-Tail <i>t</i> -Test			Directional <i>t</i> -Test		
		t-Value	Probability	Reject H0 at 0.05	t-Value	Probability	Reject H0 at 0.05
(R, s, S) EOQ	420,370	-1.0784	0.281323	No	-1.0784	0.140661	No
EOQ Range	562,797						
Difference	(142,427)	-33.9%					
(R, s, S) EOQ	420,370	-0.2117	0.832458	No	-0.2117	0.416229	No
Silver-Meal	445,973						
Difference	(25,603)	-6.1%					
EOQ Range	562,797	0.8841	0.377057	No	0.8841	0.188528	No
Silver-Meal	445,973						
Difference	116,824	20.8%					

The *t*-tests fail to reject the null hypothesis of equal means for all models. This can be attributed to the fact that the sample was based on a single calculation for the third year of actual demand, as compared to the 1,000 replications used in *t*-tests for the simulation results. In terms of the magnitude of the calculated differences in inventory system costs, it is evident that the 33.9% difference between the cost under the  $(R, s, S)$  EOQ Model and the EOQ Range model would be managerially important. The total inventory system cost difference between the

( $R, s, S$ ) EOQ Model and the Silver-Meal Heuristic stands at 6.1%, or just above the 5% threshold used in this study for managerial importance.

Notwithstanding the failure to reject the hypothesis of equal means among the inventory system costs calculated with the three replenishment models, we might consider the cost differences as managerially relevant to the extent that they are consistent with the simulation—and assuming that the simulation model is valid. The light that the validation study sheds on the simulation model is discussed in the next section.

#### 5.4 Inferences from the Empirical Validation

As noted in section 3.3, the empirical validation study serves two purposes. The first is to validate the results of the simulation study with actual data. The second purpose is the use of archival data to identify and understand the practical challenges of classifying independent demand items by demand pattern for replenishment management. Inferences regarding validation of the simulation model are discussed below. Process issues involved in classifying items by demand pattern, as identified during the execution of the validation study, are addressed in Chapter 6.

When the results of the validation study are compared to the results of the simulation study, four relationships that tend to support the validity of the simulation model emerge:

1. Inventory system cost performance of different replenishment models: The ( $R, s, S$ ) EOQ model yielded the lowest inventory system cost in the simulation study and the empirical validation study, with the Silver-Meal Heuristic performing nearly as well in both studies.

2. Penalty vs. optimal model is higher for high-variability patterns and items: Items with high-variability were associated with higher levels of inventory system cost penalties against the optimal stochastic replenishment model in both the simulation study and the empirical validation study.

3. The Wagner-Whitin penalty multiple is higher for high-variability patterns and items: This pattern is observed in both the simulation study and the empirical validation study.

4. The Wagner-Whitin penalty multiple value range is consistent: The inventory system cost penalty multiple against the Wagner-Whitin algorithm for the full slate of 278 items falls within the range of values calculated for different demand patterns and variability levels in the simulation study.

One finding that emerges from the empirical validation study is the revelation that the demand patterns actually observed in a multi-item inventory environment may not be consistent with the patterns that are presumed to exist, or with the patterns that are most frequently researched in peer-reviewed literature. The company that provided the empirical data has traditionally based its replenishment rules on the assumption that periodic demand is normally distributed—but the validation study indicated that only three out of 278 independent demand items had demand that fit the normal distribution during the three years studied. Trend demand, which is researched frequently in forecasting literature, and Poisson demand were present among the items studied, but none of the 278 items was found to follow a gamma-distributed or Erlang-C demand pattern.

Allowing for the fact that the simulation model was not designed to specifically reflect the mix of item cost, demand, and lead time that was present in the historical demand data, it can be argued that the simulation model is valid, and that inferences drawn from the simulation study can be applied to operating environments similar to that of the company that provided the historical demand data. These findings are applied to the demand-pattern fitting implementation study in Chapter 6, and to the cost/benefit analysis in Chapter 7.

## CHAPTER 6

### ITEM-DEMAND PATTERN FITTING IMPLEMENTATION STUDY

#### 6.1 Implementation Study Overview

To the extent that using different replenishment rules for independent demand inventory items with different demand patterns is desirable, it becomes necessary to design and follow a consistent process for fitting inventory items to demand patterns. Identifying relevant demand patterns can also be useful for other inventory management decisions.

From that point, it becomes necessary to work through the effects of market complexity, multiple-item obfuscation, and random demand variability to design an efficient process. The process defined below is based on the steps followed and lessons learned during the empirical validation study. The process developed during the research is adapted to provide a replicable set of steps that can be followed for independent demand items in any operating environment.

As other researchers have observed, practicing managers rarely apply the full range of quantitative inventory management techniques that are available (McLaughlin et al. 1994). This chapter addresses the following research question: What process impediments are involved in item-demand pattern matching?

#### 6.2 Process Narrative and Flow Chart

The defined process for fitting items to demand patterns is explained in a step-by-step narrative, and supported by a process flow chart. The narrative assumes that at least three years of item-specific historical demand data are available, and that this time series demand information can be used to assign items to demand pattern groups for the upcoming target year. As noted above in the Methodology section, the Crystal Ball software Fit Distribution function was used in the current study—but any statistical software package with the ability to fit time series data to probability distributions or forecast models can be used in this process. This

process recognizes the possibility that a given time series may be associated with a stationary mean probability distribution, a time-varying demand pattern, or both. The process narrative follows.

1. Analyze multiple years of historical demand for each of the independent demand items with the statistical software package to identify the best stationary demand pattern in terms of the Chi-Square goodness of fit statistic. For each independent demand item, record the identified best-fit demand pattern and the parameter values for the actual demand data series. The year prior to the target year (Year  $T-1$ ) would be excluded from this analysis.

2. In addition to the stationary demand analysis described in step 1 above, use historical demand data prior to Year  $T-1$  for each independent demand item to calculate parameter values for relevant time-varying demand patterns such as seasonal, trend, and seasonal with trend demand. This will involve calculating the seasonal index for the seasonal case, doing a regression analysis to identify the intercept and slope values for the trend case, and calculating a seasonal index for variability around the trend line for the seasonal with trend case. For the sake of consistency, each year can be analyzed in terms of 13 equal-length periods of four weeks each. This eliminates the need to address issues like 4-week vs. 5-week calendar months.

3. For each independent demand item, calculate a 13-period demand forecast for the Year  $T-1$  with each of the following four methods:

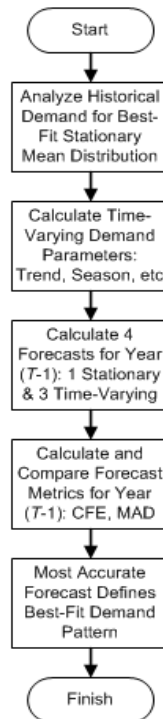
- the best-fit stationary demand pattern, using the previously-identified parameter values for the distribution/item combination.
- seasonal demand, using the seasonal index values identified in step 2.
- trend demand, using the intercept and slope values identified in step 2.
- seasonal with trend demand, using the seasonal index values around the trend line as identified in step 2.

4. For each independent demand item, compare each of the four annual forecasts against actual Year  $T-1$  demand to calculate two relevant forecast accuracy metrics. These metrics will be the cumulative forecast error (CFE) value and the mean absolute deviation (MAD). Offsetting positive and negative values via the CFE may be preferable for purposes of optimizing inventory system costs if upward or downward bias exists for the item-specific forecast.

5. For each independent demand item, the forecast method for Year  $T-1$  demand that yields the best value for forecast accuracy (lowest CFE or lowest MAD) will be chosen as the best-fit demand pattern for that item.

The process flow chart for the item-demand fitting process is presented in Figure 6.1.

Figure 6.1  
Process Flow Chart  
Item-Demand Pattern Fitting





### 6.3 Process Impediments and Practical Challenges

This brings the discussion back to the research question. What process impediments are involved in item-demand pattern matching? Information gained during the execution of the empirical validation study provides some insight. Possible reasons for the rarity of item-demand pattern matching include resource limitations, perceived cost/benefit relationships, and inertia.

Resource limitations come into play when practicing managers would like access to more information for inventory management, but are unable or unwilling to commit the necessary resources. The item-demand pattern matching on 278 items in the empirical validation study required 100 hours. Limited staff, lack of necessary expertise among the staff, limited budgets for consulting services, and the lack of specialized software or training in the specialized functions of existing software could all come into play. And this limitation is not confined to small- and medium-sized business settings. These resource limitations exist in the company that provided the actual demand data for this research, and that company is a subsidiary of one of the fifty largest U.S.-based manufacturing companies.

Perceived cost/benefit relationships may also prevent the adoption of item-demand pattern fitting. As noted in Chapter 1, it is widely understood that the EOQ model is robust in terms of small cost penalties for deviations from the optimal target. It is also possible that experienced supply chain and financial professionals have intuitively recognized that the cost of diligently matching items to demand patterns may exceed the resulting benefits—which may be true in many cases. In this regard, these decision makers may have already applied a fast and frugal heuristic.

Inertia is another possible explanation for the rarity of item-demand pattern fitting. The practice is not followed in any given company because that company has never done this, and as far as anyone knows their competitors have never done it either. Such inertia may result from the historical absence of a well-defined process for matching items to demand patterns—a gap that could be filled by the defined implementation process offered here.

Exploratory research to better understand the value of item-demand pattern matching is mentioned as a possibility in the concluding section of this paper. As this point it is appropriate to review the inferences that can be drawn from the item-demand fitting implementation study.

#### 6.4 Inferences from the Implementation Study

The process presented above defines an implementation process for analyzing a large number of independent demand items to identify the best-fit demand pattern for each item. It is possible that the presence of a well-defined five-step process for item-demand pattern matching, like the one presented here, could serve to remove one of the aforementioned impediments.

As the results of the cost/benefit analysis will indicate, matching replenishment rules to items by demand distribution may not be cost-effective in many situations. Nonetheless, this framework is defined and offered here because some enterprises may find the use of different replenishment rules to be advantageous. In addition, identifying relevant demand patterns may be useful for other inventory management decisions.

CHAPTER 7  
COST/BENEFIT ANALYSIS

7.1 Cost/Benefit Analysis Overview

The approach applied here begins with inventory system costs calculated via the alternative replenishment models for the various demand categories in the empirical validation study. The relative cost advantage of matching replenishment rules to different demand categories or using the (R, s, S) EOQ model for all items can be regarded as “benefits” for this analysis. The differential cost of implementing and managing each replenishment model are then applied to compare the benefits of each model after recognizing the differential costs.

This chapter addresses the following research questions: Do the advantages of alternative replenishment rules outweigh the costs? And, can efficient heuristics outperform more data-intensive models in OM decisions?

7.2 Assumptions and Calculations

The general assumptions used in the cost/benefit analysis are presented in Table 7.1.

Table 7.1  
Cost/Benefit Analysis  
General Assumptions

Description	General Assumptions	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	Match Model to Demand Pattern
Year 3 Inventory System Cost per Validation		<u>\$420,370</u> y	<u>\$562,797</u>	<u>\$445,973</u>	<u>\$417,640</u> x
Average Annual Salary-Procurement Professional	\$120,000				
Regular Full-Time Work Hours per Year	2,000				
Salary Cost per Hour-Procurement Professional	\$60.00				
Benefit Cost as % of Salary	40.0%				
Overhead as % of Annual Salary	30.0%				
Total Benefit & Overhead as % of Annual Salary	70.0%				
Salary, Benefits & Overhead Full Cost per Hour	\$102.00				
Average Consulting Cost/Hour Incl Travel	\$200.00				

x = Lowest inventory system cost (holding cost + order processing cost + stockout cost) of among all replenishment methods.  
y = Lowest inventory system cost of any single replenishment model as applied to all all items.

The estimated differential staff, administrative, and consulting costs associated with implementing and managing the alternative replenishment methods are developed in Table 7.2.

Table 7.2  
Cost/Benefit Analysis  
Annual Staff, Administrative, and Consulting Cost

Description	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	Match Model to Demand Pattern	
<u>Staff Professional Hours for:</u>					
Annual Review and Update of Model Values	60	2	2	64	
Periodic/Interim Update of Model Values	40	0	0	40	
Managing Consulting Support Services	20	2	2	24	
Total Annual Staff Professional Hours	<u>120</u>	<u>4</u>	<u>4</u>	<u>128</u>	
<u>Consulting Hours for:</u>					
Developing/Updating replenishment software	40	2	2	44	
Annual retrofit study of demand patterns	0	0	0	100	
Business intelligence/Data extraction	20	0	0	20	
Ongoing support services	40	2	2	44	
Total Annual Consulting Hours	<u>100</u>	<u>4</u>	<u>4</u>	<u>208</u>	
<u>Annual Staff, Admin &amp; Consulting Cost:</u>					
Staff hours at full rate of	\$102.00	\$12,240	\$408	\$408	\$13,056
Consulting hours at full rate of	\$200.00	20,000	800	800	41,600
Total Annual Staff, Admin & Consulting Cost	<u>\$32,240</u>	<u>\$1,208</u>	<u>\$1,208</u>	<u>\$1,208</u>	<u>\$54,656</u>

These estimates are based on information gathered from the company that provided the actual demand data, and on actual time logged in classifying items by demand pattern in the empirical validation study. It is assumed for purposes of the cost/benefit analysis that application of either of the more frugal heuristics—the EOQ Range Model or the Silver-Meal

Heuristic—would entail the use of a base stock inventory policy or an efficient heuristic for establishing safety stock levels.

The total annual costs (inventory system cost plus differential staff, administrative, and consulting cost) of the alternative replenishment methods are compared in Table 7.3.

Table 7.3  
Cost/Benefit Analysis  
Total Annual Cost of Alternative Replenishment Methods

Description	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	Match Model to Demand Pattern
Year 3 Inventory System Cost per Validation	\$420,370 y	\$562,797	\$445,973	\$417,640 x
Annual Staff, Admin & Consulting Cost	32,240	1,208	1,208	54,656
Total Annual Cost of Replenishment Method	<u>\$452,610</u>	<u>\$564,005</u>	<u>\$447,181 z</u>	<u>\$472,296</u>

x = Lowest inventory system cost (holding cost + order processing cost + stockout cost) of among all methods.

y = Lowest inventory system cost of any single replenishment model as applied to all all items.

z = Lowest total annual cost (inventory system cost + differential staff, admin, & consulting) among alternative methods.

### 7.3 Inferences from the Cost/Benefit Analysis

#### *7.3.1 Cost/Benefit Analysis Meets Fast and Frugal Heuristics*

The results of the simulation study and the empirical validation study are consistent in indicating that the more calculation-intensive (R, s, S) EOQ model yields the lowest inventory system cost when applied to the full slate of independent demand items. As the validation study indicates, a small reduction in inventory system cost could be achieved by using different replenishment models for items with certain demand patterns. But this aspect of the research, like most peer-reviewed research on inventory replenishment, considers only inventory system cost without addressing the differential costs of implementing and managing alternative models.

The cost/benefit analysis yields an interesting result. Under the assumptions applied here, the inventory system cost advantage (holding cost + order processing cost + stockout cost) of the more calculation-intensive replenishment methods is *fully offset* by the lower implementation cost of the more frugal Silver-Meal Heuristic. This result may not be generalizable to *all* multiple-item inventory replenishment situations, but it does confirm the

potential usefulness of the fast and frugal heuristics paradigm for inventory management replenishment decisions.

So, under the assumptions applied here, the incremental benefits of managing alternative replenishment rules are not cost-justified. And in this example the more frugal heuristic outperforms the more data-intensive  $(R, s, S)$  EOQ Model.

### 7.3.2 Another Use for the Wagner-Whitin Algorithm

Another useful observation that emerges from the cost/benefit analysis involves the comparison of all-inclusive inventory system and implementation costs under stochastic demand to the optimal inventory system costs that could be achieved under deterministic demand via the Wagner-Whitin model. The difference between these two annual cost totals could be used to measure the potential benefits of implementing process changes that would enable a manufacturing company to move from a make-to-stock (MTS) inventory flow to a make-to-order (MTO) process.

This cost difference represents the amount of annual cost that could be incurred to (a) compensate vendors for shorter lead times, and (b) implement manufacturing cycle time reductions that, taken together, would make it possible to respond only to firm customer orders in making inventory replenishment decisions. Shortening the enterprise response time in this way would enable management to respond only to known demand for inventory replenishment. This would essentially turn *stochastic* demand into *deterministic* demand, making it possible to follow the Wagner-Whitin algorithm for inventory replenishment decisions.

## CHAPTER 8

### CONCLUSIONS, CONTRIBUTIONS, AND FUTURE RESEARCH

#### 8.1 Conclusions

The analysis presented above indicates that this paper answers the key research questions—in some cases confirming the *a priori* expectations, and in other cases refuting them. It is useful here to summarize conclusions that flow from this research. This summary begins with general conclusions, and moves on to the central research questions.

##### *8.1.1 What General Conclusions Emerge from This Research?*

This research demonstrates the feasibility of using simulation techniques to understand the effect of alternative replenishment rules in a multi-item inventory environment for purchased independent demand items. The research involves the application of various techniques to verify the model, and includes the validation of the simulation model with empirical data.

The empirical validation study illustrates a situation where the demand patterns actually observed in a single operating environment are not consistent with the demand patterns that are presumed to exist, or with the patterns that are most frequently researched in peer-reviewed literature. The company that provided the empirical data had traditionally based its replenishment rules on the assumption that demand is normally distributed—but the validation study showed that only 3 of the 278 independent demand items studied had demand that fit the normal distribution. Many of the frequently-researched demand patterns were not represented at all in actual data over the three years studied.

This research included the development of a method for applying the Wagner-Whitin Algorithm to a large number of independent demand items. The Wagner-Whitin Algorithm is not widely used in practice because it is limited to deterministic demand situations. But direct engagement with the Wagner-Whitin Algorithm led to the identification of a potential new use for

the calculation of optimal inventory system costs with this method. The difference between actual inventory system cost under stochastic demand and the optimal Wagner-Whitin inventory system cost could be used to measure the potential benefits of process changes that would enable a manufacturing company to move from a make-to-stock inventory flow to a make-to-order model. Shortened cycle times would essentially turn stochastic demand into deterministic demand, making it possible to apply the Wagner-Whitin Algorithm to inventory replenishment decisions.

#### *8.1.2 Do Replenishment Models Matter?*

Horizontal analysis of results from the simulation study indicate that replenishment models matter in terms of yielding different inventory system costs for a given demand pattern. The identified differences are statistically significant at the  $\alpha = .05$  level, but in practical terms may lack managerial importance. In other words, these differences may be too small to alter management decisions or practices in some cases.

#### *8.1.3 Do Demand Patterns Matter?*

Vertical analysis of results from the simulation study indicate that the cost performance of any of the replenishment models considered will be affected significantly if the demand pattern that is actually encountered is different from the demand pattern that is expected. One limitation of the current study, which is also discussed below, is related to the fact that all of the stochastic-demand replenishment models studied assume that demand is normally distributed.

#### *8.1.4 What Process Impediments Are Involved in Item-Demand Pattern Matching?*

Fitting demand patterns to individual items was time-consuming but showed limited potential to affect total inventory system cost because the optimal replenishment model considered in this study—the  $(R, s, S)$  EOQ Model—tended to yield the lowest inventory system cost for all of the demand patterns studied. Process impediments identified included limited resources, limited expertise, and inertia. The development and presentation of a 5-step process for matching inventory items to demand patterns is offered to address these impediments.



### *8.1.5 Do the Advantages of Managing Multiple Replenishment Rules Outweigh the Costs?*

The cost/benefit analysis became a *total cost analysis* with consideration of differential staff, administrative, and consulting expenses associated with using the different models or matching of models to demand pattern groups. For the one year studied, matching models to demand patterns or using the  $(R, s, S)$  EOQ model would be optimal if *only* inventory system costs (benefits) are considered. But after recognizing implementation costs, the lower cost of the Silver-Meal Heuristic could make this the optimal model choice. So, under the assumptions used in the cost/benefit analysis, the differential costs of managing multiple replenishment rules would not be justified.

### *8.1.6 Can Efficient Heuristics Outperform More Data-Intensive Models in OM Decisions?*

Returning to the fast and frugal heuristics paradigm as an overarching framework for this research, the cost/benefit analysis identifies a situation where the use of a fast and frugal heuristic (the Silver-Meal Heuristic) offers better overall results than matching items to replenishment rules, or to relying on the more complete but more calculation-intensive  $(R, s, S)$  EOQ Model. This provides evidence that efficient heuristics can outperform more data-intensive models for operations management decisions.

## 8.2 Contributions

### *8.2.1 Contributions to Operations Management Research*

The proposed study extends existing OM research, and also offers potential contributions to management practice. Contributions to OM research are discussed below, while contributions to management practice are discussed in the next subsection.

This study offers an early extension of the fast and frugal heuristics research paradigm to OM. The finding that a simple heuristic can outperform more calculation-intensive decision models for multi-item inventory replenishment suggests that the fast and frugal research paradigm can be useful elsewhere in the field.

Use of the Wagner-Whitin algorithm with *actual demand* to quantify the optimal system cost result for multiple items is a novel approach. This study demonstrates a practical approach to quantification of the optimal Wagner-Whitin inventory system cost for multiple items. The study also offers the difference between the inventory system costs under existing replenishment rules and the Wagner-Whitin system cost as a measure of the potential benefit of implementing process changes to move from a make-to-stock inventory flow to a make-to-order inventory flow.

Use of *demand patterns* rather than other characteristics to group items for replenishment planning purposes is a novel approach. The simulation study presented in this paper indicates that matching inventory replenishment rules to items with different demand patterns may offer benefits that are statistically significant but not large enough to justify the use of different replenishment models for items with different demand patterns. But this technique could be useful in some situations.

Applying differential staff, administrative, and consulting costs to the inventory system costs resulting from the implementation and management of different replenishment models for *cost/benefit analysis* is a novel approach. The cost/benefit analysis presented in this study indicates that the less calculation-intensive and therefore more frugal Silver-Meal Heuristic may not outperform the  $(R, s, S)$  EOQ model when only inventory system costs (holding cost + order processing cost + stockout cost) are considered. But when the lower implementation costs of the Silver-Meal model are recognized, the more frugal heuristic wins.

#### *8.2.2 Contributions to Management Practice*

Potential contributions of this research to management practice are discussed below.

This research reflects the replenishment management challenges faced by practicing managers in that it considers multiple replenishment models, and both stationary-mean and time-varying demand patterns, in a single study. Study results reinforce the perception that EOQ-based lot sizing rules are robust and effective even when demand variability is great, and

when demand patterns do not even remotely resemble the normal distribution in a multi-item environment.

The definition and demonstration of an implementation process for identifying the best-fit demand patterns for individual inventory items in a multi-item environment represents a useful extension of the OM body of knowledge. This process addresses some of the impediments that prevent the widespread adoption of item-demand pattern fitting, and can be used for decisions regarding the management of individual items even when matching different replenishment rules to demand patterns is not appropriate.

The finding, under the assumptions used in this study, that greater implementation costs offset the benefits of managing multiple replenishment rules for independent demand items with long lead times and highly variable demand is significant. This encourages the use of frugal heuristics in lieu of more data-intensive methods by practicing managers.

### 8.3 Limitations and Future Research

#### *8.3.1 Limitations of This Research*

This research is subject to some limitations that are useful to recognize. Some limitations pertain to the assumptions applied here, which may limit the generalizability of the conclusions. Another limitation pertains to the choice of replenishment models for inclusion in the study.

The assumptions used in the simulation study and in the validation study are valid for a manufacturing or distribution company that manages a large number of independent demand items. The assumptions applied here include specified values and limits for the variability of periodic demand, and levels of item cost, periodic demand, and lead time. As the results of the empirical validation study indicate, the simulation results are valid for a multi-item inventory with similar parameter values. While the relationships and inferences developed here are intended to be broadly applicable, it would be useful to replicate this study with different values assigned

to these assumptions rather than extrapolating outside the range of the assumption values used in this research to specific inventory management environments.

Another limitation pertaining to the simulation assumptions deals with the values assigned to inventory ordering cost, holding cost, and stockout cost. The values used in the simulation are consistent with the ordering cost and holding cost values actually used by the company that provided the actual demand data, but these values have not been consistently reviewed and updated by the company. This situation is not unusual, but it could limit the generalizability of the findings. Again the best way to apply the results of this study to enterprises that use different values for ordering cost and holding cost would be to replicate the study with company-specific values.

The limitation dealing with the choice of replenishment models is relevant with regard to the results of the vertical analysis of inventory system cost results for a given replenishment model under different demand patterns. The vertical analysis indicated that different demand patterns could yield inventory system costs that are both statistically significant and managerially important. But all three of the stochastic-demand replenishment models considered in this research are based on the EOQ model. Therefore no combination of non-EOQ models and demand patterns was tested to compete against an EOQ-based model. This occurred because the focus of the research was replenishment rules *known to be widely-used* in practice, but it leaves the possibility of matching a demand pattern-specific lot sizing rule for, say, trend demand against an EOQ rule untested.

The limitations discussed above are recognized below in the discussion of potential extensions of this research.

### *8.3.2 Future Research Directions*

This research could be extended to situations involving different demand patterns and levels of demand variability. Different factor levels of item cost, periodic demand, and lead time

could also be studied. Studies of this type would need to be relevant to a specific industrial setting, and would need to be validated with actual demand data.

This research could also be extended by comparing the performance of demand pattern-specific replenishment models and lot sizing rules against the EOQ-based models. These alternative replenishment models are presented from time to time in peer-reviewed journals, but are not widely used in practice. Replicating this research with pattern-specific replenishment rules could identify situations where matching replenishment rules to demand patterns would be cost-effective.

It would be helpful to address the uncertainty surrounding assumed values for order processing costs and inventory holding cost. These variables are treated in a cursory way in many accounting, finance, and operations management textbooks, but peer-reviewed research on how these variables are or should be quantified is rare. Research to solidify these underlying assumptions would enhance the validity of simulation studies that seek to identify the effect of replenishment models and demand patterns on inventory system costs. Multiple research approaches would be needed to address these variables. Case studies, action research, archival data studies, and survey research could all be useful.

The simulation approach used in this research could be applied to estimate the inventory system cost/benefit advantages of reducing vendor lead times. Cost differentials could include fees for more frequent deliveries, higher transportation costs for more rapid delivery, higher prices paid to domestic vs. overseas vendors, etc. A related extension of the techniques applied here would involve the extension of the simulation to multi-echelon inventory management processes, as advocated by Cattani et al. (2011).

In addition, simulation studies can be applied to other OM problems involving the possibility that heuristic decision rules could outperform more detailed and data-intensive quantitative models. As noted previously, (e.g., Gigerenzer et al. 1999) simulation has been identified and applied as a useful technique for evaluating heuristics.

### 8.3.3 A Parting Thought

Speaking generally of future directions, this research provides evidence that significant opportunities exist to use simulation and other quantitative tools to improve inventory management practice—not to push the limits of bounded rationality, but rather to identify *fast and frugal heuristics* that can be used to optimize business processes within the *manageable limits* of that rationality.

APPENDIX A  
HISTORICAL DEMAND DATA AND SUMMARY STATISTICS





Line	Item #	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27
		7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended
37	10207442	7,000.00	4,000.00	0.0000	0.0000	5,000.00	4,000.00	4,000.00	2,000.00	4,000.00	4,000.00	4,000.00	6,000.00	4,000.00	4,000.00	4,000.00
416	CRB3802040	9,612.00	13,095.80	0.0000	0.0000	0.0000	0.7250	0.0000	0.0000	12,600.00	0.0000	0.0000	0.7250	3,134.60	4,694.00	4,191.15
242	90240041	3,000.00	0.0000	0.0000	0.0000	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
69	10431903	3,000.00	0.0000	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
70	10432608	3,000.00	0.0000	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
169	80572116	6,000.00	0.0000	0.0000	8,000.00	2,000.00	2,000.00	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
11	10100162	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	0.0000
147	80100486	3,000.00	0.0000	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
223	90132008	6,000.00	0.0000	0.0000	8,000.00	2,000.00	2,000.00	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
446	CRG3848096	0.2605	8.0847	1.5000	0.0000	2.5623	4.9879	1.0500	2.0000	6.3428	0.0100	0.5464	1.6948	13.4208	6.1638	0.0952
265	90590428	3,000.00	2,000.00	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
285	90590428	3,000.00	2,000.00	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
436	CRG2007244	4,1793	20,0794	0.0000	0.0000	6,000.00	3,100.00	5,501.10	5,000.00	2,711.70	0.0000	3,5725	5,000.00	6,6023	1,732	0.2915
135	10130168	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	1,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
33	10130168	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	1,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
186	90010100	4,000.00	4,000.00	0.0000	4,000.00	4,000.00	4,000.00	2,000.00	0.0000	0.0000	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
12	10100163	3,000.00	0.0000	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	0.0000	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
215	90122002	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	1,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
8	10100147	4,000.00	4,000.00	0.0000	4,000.00	4,000.00	4,000.00	2,000.00	0.0000	0.0000	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
81	10811700	4,000.00	4,000.00	0.0000	4,000.00	4,000.00	4,000.00	2,000.00	0.0000	0.0000	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
214	90122001	3,000.00	2,000.00	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
222	90132001	4,000.00	4,000.00	0.0000	4,000.00	4,000.00	4,000.00	2,000.00	0.0000	0.0000	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
353	90810227	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	1,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
346	90810206	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	1,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
10	10100160	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	0.0000	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
83	10639643	3,000.00	0.0000	0.0000	3,000.00	3,000.00	3,000.00	2,000.00	0.0000	0.0000	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
110	10810424	4,000.00	4,000.00	0.0000	4,000.00	4,000.00	4,000.00	2,000.00	0.0000	0.0000	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
170	80572117	6,000.00	0.0000	0.0000	8,000.00	2,000.00	2,000.00	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
171	80572118	6,000.00	0.0000	0.0000	8,000.00	2,000.00	2,000.00	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
172	80572128	3,000.00	0.0000	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
172	80572128	3,000.00	0.0000	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
172	80572128	3,000.00	0.0000	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
442	CRG3448086	16,000.00	0.0000	0.0000	24,000.00	8,000.00	6,000.00	12,000.00	8,000.00	3,127.00	0.0000	0.0000	12,000.00	12,000.00	12,000.00	0.0000
111	10810425	10,000.00	10,000.00	0.0000	10,000.00	10,000.00	10,000.00	5,000.00	0.0000	0.0000	10,000.00	10,000.00	20,000.00	10,000.00	10,000.00	0.0000
411	10810425	10,000.00	10,000.00	0.0000	10,000.00	10,000.00	10,000.00	5,000.00	0.0000	0.0000	10,000.00	10,000.00	20,000.00	10,000.00	10,000.00	0.0000
269	90590205	3,000.00	2,000.00	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
287	90590205	3,000.00	2,000.00	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
243	10210719	3,000.00	0.0000	0.0000	3,000.00	3,000.00	3,000.00	2,000.00	0.0000	0.0000	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
259	90412500	3,000.00	0.0000	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
429	CRG1660144	4,500.00	5,250.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6,500.00	0.0000	0.0000	0.0000	0.0000	0.0000	1,750.00
139	50353100	6,000.00	0.0000	0.0000	8,000.00	2,000.00	2,000.00	4,000.00	4,000.00	4,000.00	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
451	CRG4260120	0.5319	5.1414	0.0000	0.0250	0.0750	0.1650	0.1500	0.0000	1.8615	0.0000	0.0550	0.0000	0.1466	0.3931	0.4445
41	10210300	3,000.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2,000.00	0.0000	0.0000	4,000.00	2,000.00	2,000.00	0.0000
352	90810226	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	1,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
140	50412100	3,000.00	0.0000	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	0.0000	0.0000	0.0000	4,000.00	1,000.00	2,000.00	0.0000
428	CRG1660120	2,3352	5.4532	1.6120	0.0666	0.1999	0.0816	0.0000	0.0000	4.2124	0.0000	0.0000	0.0000	1.9999	17.5991	0.0000
141	50412112	2,000.00	2,000.00	0.0000	2,000.00	2,000.00	2,000.00	1,000.00	0.0000	1,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
21	10102162	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	0.0000
108	10810115	4,000.00	4,000.00	0.0000	4,000.00	4,000.00	4,000.00	2,000.00	0.0000	0.0000	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
166	10430910	3,000.00	2,000.00	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
105	10810107	4,000.00	4,000.00	0.0000	4,000.00	4,000.00	4,000.00	2,000.00	0.0000	0.0000	4,000.00	4,000.00	8,000.00	4,000.00	4,000.00	0.0000
107	10810113	12,000.00	12,000.00	0.0000	12,000.00	12,000.00	12,000.00	6,000.00	0.0000	0.0000	12,000.00	12,000.00	24,000.00	12,000.00	12,000.00	0.0000
341	10340013	3,000.00	2,000.00	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
104	10340013	3,000.00	2,000.00	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00	4,000.00	2,000.00	2,000.00	0.0000
75	10530292	0.0000	0.0000	0.0000	0.0000	0.0000	11,000.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
427	CRG1660096	3,000.00	3,000.00	0.0000	3,000.00	3,000.00	3,000.00	1,000.00	0.0000	11,000.00	0.0000	0.0000	0.0000	1,000.00	1,000.00	0.0000
24	10100160	3,000.00	0.0000	0.0000	4,000.00	1,000.00	1,000.00	2,000.00	2,000.00	2,000.00</						

Line	Item #	Week 28 7 Days Ended	Week 29 7 Days Ended	Week 30 7 Days Ended	Week 31 7 Days Ended	Week 32 7 Days Ended	Week 33 7 Days Ended	Week 34 7 Days Ended	Week 35 7 Days Ended	Week 36 7 Days Ended	Week 37 7 Days Ended	Week 38 7 Days Ended	Week 39 7 Days Ended	Week 40 7 Days Ended	Week 41 7 Days Ended	Week 42 7 Days Ended
37	1037442	5172028	5172028	5172028	5172028	5172028	5172028	5172028	5172028	5172028	5172028	5172028	5172028	5172028	5172028	5172028
416	CR6380240	11,5602	0,8032	1,5000	7,6550	1,1752	2,1225	2,7575	2,8575	0,0000	3,3299	2,4650	0,7350	1,3916	4,9814	3,0532
242	90340041	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000
699	10431903	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	4,0000	3,0000	0,0000	1,0000	0,0000	2,0000	2,0000	0,0000	0,0000
70	10432608	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	4,0000	3,0000	0,0000	1,0000	0,0000	2,0000	2,0000	0,0000	0,0000
169	80572116	4,0000	4,0000	2,0000	2,0000	6,0000	0,0000	6,0000	6,0000	0,0000	2,0000	0,0000	4,0000	6,0000	0,0000	0,0000
11	10100162	2,0000	0,0000	0,0000	2,0000	0,0000	2,0000	5,0000	1,0000	4,0000	3,0000	3,0000	0,0000	2,0000	3,0000	2,0000
147	80100486	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	2,0000	0,0000	2,0000	4,0000	0,0000	1,0000
223	90132008	2,0000	4,0000	2,0000	2,0000	6,0000	0,0000	6,0000	6,0000	0,0000	2,0000	0,0000	4,0000	8,0000	0,0000	2,0000
446	CRG384806	8,8081	4,4465	0,0357	3,4294	0,0549	2,5307	0,0200	0,6600	0,0472	5,6079	1,3215	1,3215	2,5214	0,1218	0,3612
9	10100154	3,0000	2,0000	1,0000	1,0000	3,0000	4,0000	5,0000	3,0000	1,0000	3,0000	2,0000	14,0000	4,0000	0,0000	1,0000
285	90550428	9,9013	0,1000	3,1675	2,8968	2,9754	3,7749	4,5000	8,6025	0,0000	0,6000	12,0725	4,3000	6,9000	0,3748	14,1868
436	CRG2072144	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	1,0000	0,0000	2,0000	0,0000	1,0000	1,0000
158	80202901	2,0000	0,0000	0,0000	2,0000	0,0000	2,0000	4,0000	1,0000	4,0000	3,0000	3,0000	0,0000	2,0000	0,0000	0,0000
33	10130188	4,0000	0,0000	0,0000	4,0000	0,0000	4,0000	10,0000	4,0000	4,0000	4,0000	0,0000	0,0000	0,0000	0,0000	2,0000
78	10810122	3,0000	0,0000	0,0000	2,0000	0,0000	4,0000	4,0000	1,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	2,0000
186	90010100	4,0000	0,0000	0,0000	4,0000	0,0000	4,0000	8,0000	4,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	0,0000
195	90010100	4,0000	0,0000	0,0000	4,0000	0,0000	4,0000	8,0000	4,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	0,0000
215	90100163	10,0000	0,0000	0,0000	10,0000	0,0000	4,0000	10,0000	4,0000	4,0000	3,0000	2,0000	14,0000	4,0000	0,0000	2,0000
8	10100147	11,0000	0,0000	0,0000	11,0000	0,0000	7,0000	10,0000	4,0000	4,0000	3,0000	5,0000	12,0000	1,0000	0,0000	2,0000
8	10101700	4,0000	0,0000	0,0000	4,0000	0,0000	4,0000	12,0000	4,0000	6,0000	4,0000	6,0000	0,0000	0,0000	0,0000	2,0000
214	80123001	10,0000	2,0000	0,0000	4,0000	0,0000	4,0000	4,0000	2,0000	4,0000	6,0000	2,0000	15,0000	0,0000	0,0000	3,0000
222	80123001	4,0000	0,0000	0,0000	4,0000	0,0000	4,0000	8,0000	2,0000	4,0000	6,0000	0,0000	0,0000	4,0000	0,0000	4,0000
353	90810227	2,0000	0,0000	0,0000	2,0000	0,0000	0,0000	4,0000	1,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
346	90810206	2,0000	0,0000	0,0000	2,0000	0,0000	0,0000	4,0000	1,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
10	10100160	4,0000	0,0000	0,0000	4,0000	0,0000	4,0000	0,0000	2,0000	0,0000	3,0000	3,0000	0,0000	0,0000	0,0000	3,0000
83	10630643	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	1,0000	0,0000	2,0000	0,0000	0,0000	0,0000
110	10810424	6,0000	4,0000	2,0000	2,0000	4,0000	0,0000	8,0000	2,0000	12,0000	6,0000	6,0000	0,0000	0,0000	0,0000	2,0000
170	80572117	4,0000	4,0000	2,0000	2,0000	6,0000	0,0000	6,0000	0,0000	0,0000	2,0000	0,0000	4,0000	6,0000	0,0000	0,0000
171	80572118	4,0000	4,0000	2,0000	2,0000	6,0000	0,0000	6,0000	0,0000	0,0000	2,0000	0,0000	4,0000	6,0000	0,0000	0,0000
172	80572125	2,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	1,0000	0,0000	2,0000	3,0000	0,0000	0,0000
72	10500140	6,0000	12,0000	0,0000	4,8539	1,7116	2,4295	(12,0000)	0,0000	0,0000	0,0000	0,0000	6,0000	0,0000	0,0000	0,0000
442	CRG344806	10,0000	0,0000	0,0000	10,0000	0,0000	20,0000	20,0000	5,0000	20,0000	15,0000	15,0000	0,0000	0,0000	0,0000	0,0000
111	10810425	1,9999	1,2950	0,0000	0,0000	3,0950	0,8333	0,0000	1,1950	0,1633	0,0000	0,0000	1,4999	0,0000	0,0000	0,0000
269	90500261	2,0000	2,0000	1,0000	2,0000	3,0000	0,0000	4,0000	1,0000	1,0000	0,0000	0,0000	0,0000	0,0000	0,0000	1,0000
287	90500261	2,0000	2,0000	1,0000	2,0000	3,0000	0,0000	4,0000	1,0000	1,0000	0,0000	0,0000	0,0000	0,0000	0,0000	1,0000
3	10210119	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	1,0000	0,0000	2,0000	3,0000	0,0000	0,0000
25	90100152	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	1,0000	0,0000	2,0000	3,0000	0,0000	0,0000
429	CRG1660144	3,0000	0,0000	0,0000	4,5000	0,2500	0,7500	2,0000	1,7500	0,0000	0,0000	0,0000	0,0000	0,5200	2,2500	0,0000
139	50830100	0,0000	0,0000	0,0000	0,0000	0,0000	0,7500	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
451	CRG4260120	1,5596	0,0250	0,1133	1,7868	0,1726	1,1463	0,1000	0,8497	0,0000	0,1833	1,5014	1,3956	0,0600	0,2548	0,4465
41	10210300	1,0000	0,0000	1,0000	1,0000	3,0000	0,0000	4,0000	1,0000	1,0000	1,0000	3,0000	2,0000	3,0000	0,0000	0,0000
352	90810226	2,0000	0,0000	0,0000	2,0000	0,0000	0,0000	4,0000	1,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
140	50412100	1,0000	3,0000	1,0000	1,0000	3,0000	0,0000	4,0000	1,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	0,0000
428	CRG1660120	4,9331	0,7112	0,0000	0,4284	1,4166	1,1572	0,0000	0,2676	0,1784	0,2676	0,1784	0,7957	3,0500	1,3333	0,6666
141	50412112	2,0000	0,0000	0,0000	2,0000	0,0000	2,0000	4,0000	1,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
21	10102162	2,0000	0,0000	0,0000	2,0000	0,0000	2,0000	4,0000	1,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
108	10810115	4,0000	0,0000	0,0000	4,0000	0,0000	0,0000	8,0000	2,0000	8,0000	6,0000	6,0000	0,0000	0,0000	0,0000	2,0000
66	10430910	2,0000	2,0000	0,0000	2,0000	2,0000	0,0000	4,0000	2,0000	4,0000	6,0000	6,0000	0,0000	0,0000	0,0000	1,0000
105	10810107	4,0000	0,0000	0,0000	4,0000	0,0000	4,0000	6,0000	2,0000	6,0000	0,0000	0,0000	0,0000	0,0000	0,0000	2,0000
107	10810113	12,0000	0,0000	0,0000	12,0000	0,0000	0,0000	24,0000	6,0000	24,0000	18,0000	18,0000	0,0000	0,0000	0,0000	6,0000
241	90240013	0,0000	2,0000	0,0000	0,0000	0,0000	0,0000	4,0000	4,0000	4,0000	6,0000	6,0000	0,0000	0,0000	0,0000	1,0000
14	10100188	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	1,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
75	10550002	1,9999	0,0000	0,0000	2,0000	0,0000	4,0000	0,0000	6,0000	0,0000	0,0000	0,0000	30,0000	0,0000	0,0000	2,0000
24	10100080	3,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
427	CRG1660006	1,9999	0,0000	0,0000	2,0000	0,0000	4,0000	0,0000	6,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
49	10220030	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	0,0000	0,0000	2,0000	0,0000	0,0000	0,0000
52	10100166	1,0000	2,0000	1,0000	1,0000	3,0000	0,0000	3,0000	3,0000	0,0000	0,0000	0,0000	2,0000	0,0000	0,0000	0,0000
26	10118436	0,0000	0,0000	0,0000	4,0000	0,0000	12,0000	0,0000	0,0000	0,0000	0,0000	0,0000	4,0000	8,0000	0,0000	12,0000
371	90500263	2,0000	2,0000	0,0000	2,0000	0,0000	2,0000	4,0000	2,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
272	90500264	2,0000	2,0000	0,0000	2,0000	0,0000	2,0000	4,0000	2,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
273	90500267	2,0000	2,0000	0,0000	2,0000	0,0000	2,0000	4,0000	2,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
274	90500268	2,0000	2,0000	0,0000	2,0000	0,0000	2,0000	4,0000	2,0000	4,0000	3,0000	3,0000	0,0000	0,0000	0,0000	1,0000
275	90500269	2,00														





Line	Item #	Week 58 7 Days Ended	Week 59 7 Days Ended	Week 60 7 Days Ended	Week 61 7 Days Ended	Week 62 7 Days Ended	Week 63 7 Days Ended	Week 64 7 Days Ended	Week 65 7 Days Ended	Week 66 7 Days Ended	Week 67 7 Days Ended	Week 68 7 Days Ended	Week 69 7 Days Ended	Week 70 7 Days Ended	Week 71 7 Days Ended	Week 72 7 Days Ended
37	1031440	0.0000	1.0000	8.0000	1.0000	0.0000	1.0000	5.0000	3.0000	1.0000	1.0000	0.0000	2.0000	0.0000	0.0000	5.0000
41	CRB3800240	0.0000	5.7400	11.8074	0.0000	0.0000	4.8384	6.7500	0.0000	0.0000	0.0000	0.0000	2.8550	0.0000	7.3378	7.3378
242	9024041	0.0000	0.0000	2.0000	5.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
69	10451903	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
70	10432608	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
169	80572116	0.0000	0.0000	4.0000	4.0000	0.0000	0.0000	4.0000	4.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000
11	10100162	0.0000	1.0000	3.0000	5.0000	0.0000	0.0000	3.0000	3.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	3.0000
147	80100496	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
223	90132008	0.0000	0.0000	4.0000	4.0000	0.0000	0.0000	4.0000	4.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000
448	CR33348096	0.0000	0.7721	1.1795	1.4621	2.3032	0.3144	0.7439	1.1094	2.2057	1.0716	0.0000	1.1554	0.0000	1.4051	4.1051
9	10100154	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	2.0000	2.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	2.0000
285	90504208	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	3.0000	3.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	3.0000
436	CR32007144	0.0000	2.5640	0.5416	0.0000	0.0000	7.9962	2.2370	0.0000	0.0000	0.0000	0.0000	24.2096	2.0000	0.8547	1.8586
198	80202901	0.0000	0.0000	1.0000	6.0000	0.0000	1.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
33	10130188	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	4.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	3.0000
78	10610122	0.0000	2.0000	4.0000	12.0000	0.0000	0.0000	4.0000	2.0000	2.0000	2.0000	0.0000	2.0000	0.0000	0.0000	6.0000
186	90010100	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	2.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	3.0000
12	10100163	0.0000	1.0000	2.0000	2.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	3.0000
21	90100162	0.0000	0.0000	3.0000	3.0000	0.0000	0.0000	3.0000	1.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	3.0000
8	10100140	0.0000	2.0000	4.0000	8.0000	0.0000	0.0000	8.0000	2.0000	2.0000	2.0000	0.0000	2.0000	0.0000	0.0000	6.0000
81	10611700	0.0000	0.0000	4.0000	4.0000	0.0000	0.0000	4.0000	2.0000	2.0000	2.0000	0.0000	2.0000	0.0000	0.0000	6.0000
214	90132001	0.0000	2.0000	2.0000	4.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
222	90132001	0.0000	2.0000	2.0000	4.0000	0.0000	0.0000	2.0000	2.0000	2.0000	2.0000	0.0000	2.0000	0.0000	0.0000	6.0000
353	90810227	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	3.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	3.0000
348	90810206	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	3.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	3.0000
10	10100160	0.0000	2.0000	4.0000	8.0000	0.0000	0.0000	6.0000	2.0000	2.0000	2.0000	0.0000	2.0000	0.0000	0.0000	6.0000
83	10630643	0.0000	1.0000	1.0000	3.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
110	10810424	0.0000	4.0000	4.0000	12.0000	0.0000	0.0000	6.0000	2.0000	2.0000	2.0000	0.0000	2.0000	0.0000	0.0000	10.0000
170	80572117	0.0000	0.0000	4.0000	4.0000	0.0000	0.0000	4.0000	4.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000
171	80572118	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
172	80572128	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
72	10500140	0.0000	0.2778	12.0000	10.0000	0.0000	0.0000	12.0000	4.0000	6.0000	6.0000	0.0000	6.0000	0.0000	0.0000	0.0000
442	CR33448096	0.0000	3.3559	3.3554	1.0004	0.0546	1.3359	0.3336	0.2538	0.1537	0.0703	0.0000	0.1369	0.0000	1.0999	3.4373
111	10810425	0.0000	5.0000	10.0000	15.0000	0.0000	0.0000	15.0000	5.0000	5.0000	5.0000	0.0000	5.0000	0.0000	0.0000	15.0000
433	CR32006020	0.0000	4.6175	0.0000	0.0000	0.2986	3.1086	0.2986	0.8000	1.2421	1.0000	0.0000	1.0000	0.0000	1.3332	0.0000
289	90500261	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	2.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	3.0000
287	90500261	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
43	10100110	0.0000	0.0000	3.0000	3.0000	0.0000	0.0000	3.0000	2.0000	2.0000	2.0000	0.0000	1.0000	0.0000	0.0000	2.0000
23	10100110	0.0000	0.0000	4.0000	4.0000	0.0000	0.0000	4.0000	2.0000	2.0000	2.0000	0.0000	1.0000	0.0000	0.0000	2.0000
429	CR31660144	0.0000	3.5000	3.5000	1.0000	0.0000	0.0000	4.5000	0.0000	0.0000	0.0000	0.0000	1.2500	0.0000	3.7500	2.7500
139	50383100	0.0000	0.5965	0.5969	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000
451	CR32480120	0.0000	2.5788	0.0000	0.0000	0.0000	1.0322	0.5503	0.6554	0.0000	0.0000	0.0000	0.1117	0.0000	0.4907	0.7780
41	10210300	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	3.0000	2.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	2.0000
352	90810226	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	3.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	3.0000
140	50412100	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	2.0000
428	CR31660120	0.0000	1.2676	3.9999	0.0000	0.0000	1.3333	2.0150	1.9166	0.0000	0.0000	0.0000	0.7033	1.1110	2.0334	5.1060
141	50412112	0.0000	0.0000	2.0000	6.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	3.0000
21	10102162	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
108	10810115	0.0000	2.0000	4.0000	6.0000	0.0000	0.0000	6.0000	2.0000	2.0000	2.0000	0.0000	2.0000	0.0000	0.0000	6.0000
66	10430010	0.0000	1.0000	4.0000	4.0000	0.0000	0.0000	1.0000	4.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
105	10810107	0.0000	2.0000	4.0000	6.0000	0.0000	0.0000	6.0000	2.0000	2.0000	2.0000	0.0000	3.0000	0.0000	0.0000	6.0000
107	10810113	0.0000	6.0000	12.0000	18.0000	0.0000	0.0000	18.0000	6.0000	6.0000	6.0000	0.0000	6.0000	0.0000	0.0000	18.0000
241	90240013	0.0000	1.0000	2.0000	8.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
14	10100168	0.0000	0.0000	6.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
75	10500092	0.0000	3.9998	0.0000	0.0000	0.0000	0.9999	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000
427	CR31660096	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000
24	10100380	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
40	10220330	0.0000	0.0000	1.0000	2.0000	0.0000	0.0000	1.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
58	10148036	0.0000	0.0000	3.0000	3.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
270	90200285	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	3.0000
271	90200285	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000
272	90200284	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000
273	90200267	0.0000	1.0000	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000
274	90500268	0.0000	1.0000	2.0000	3.0											

Line	Item #	Week 73 7 Days Ended	Week 74 7 Days Ended	Week 75 7 Days Ended	Week 76 7 Days Ended	Week 77 7 Days Ended	Week 78 7 Days Ended	Week 79 7 Days Ended	Week 80 7 Days Ended	Week 81 7 Days Ended	Week 82 7 Days Ended	Week 83 7 Days Ended	Week 84 7 Days Ended	Week 85 7 Days Ended	Week 86 7 Days Ended	Week 87 7 Days Ended
37	10201442	2,000	9,000	0,000	0,000	7,000	18,000	0,000	8,000	5232010	5232010	5652010	6132010	6202010	14,000	18,000
416	CR38302340	4,100	15,484	4,500	0,7350	11,4385	5,3332	11,2500	8,832	3,7666	12,4042	1,3332	6,8062	7,1648	0,000	9,2700
242	90240041	5,000	0,000	0,000	0,000	2,000	10,000	0,000	4,000	1,000	11,000	0,000	1,000	9,000	4,000	0,000
69	10431903	4,000	8,000	0,000	0,000	4,000	11,000	0,000	4,000	1,000	12,000	0,000	1,000	10,000	5,000	10,000
70	10432698	2,000	5,000	0,000	0,000	2,000	8,000	0,000	4,000	1,000	9,000	0,000	1,000	8,000	5,000	11,000
169	80572118	5,000	10,000	0,000	0,000	4,000	16,000	0,000	4,000	2,000	22,000	0,000	4,000	16,000	10,000	18,000
11	10100182	0,000	4,000	0,000	0,000	5,000	8,000	0,000	4,000	1,000	8,000	0,000	4,000	8,000	8,000	9,000
147	80100486	4,000	10,000	0,000	0,000	2,000	13,000	0,000	4,000	1,000	12,000	0,000	2,000	8,000	4,000	9,000
223	90132008	8,000	11,000	0,000	0,000	26,000	26,000	0,000	8,000	2,000	24,000	0,000	4,000	16,000	10,000	18,000
446	CR33848096	1,6300	5,1100	0,8916	2,8677	4,4233	6,6187	6,5507	3,797	7,0188	13,5319	1,181	7,7769	10,2412	13,6884	9,000
9	10100154	0,000	4,000	0,000	0,000	5,000	7,000	0,000	4,000	1,000	12,000	0,000	2,000	8,000	5,000	9,000
285	90550428	0,000	4,000	0,000	0,000	5,000	8,000	0,000	4,000	1,000	10,000	0,000	4,000	8,000	5,000	9,000
436	CR3207144	4,3747	18,5524	7,7459	1,6500	6,4415	1,2325	6,5517	15,6594	8,000	17,3084	8,000	0,3845	1,0845	2,6654	12,9294
158	80202901	2,000	0,000	0,000	0,000	2,000	10,000	0,000	4,000	1,000	11,000	0,000	1,000	9,000	4,000	9,000
33	10100188	0,000	0,000	0,000	0,000	10,000	11,000	0,000	4,000	1,000	8,000	0,000	5,000	5,000	8,000	9,000
78	10510122	0,000	8,000	0,000	0,000	20,000	20,000	0,000	8,000	2,000	30,000	0,000	16,000	12,000	20,000	18,000
186	90010100	0,000	2,000	0,000	0,000	0,000	5,000	0,000	4,000	1,000	7,000	0,000	2,000	5,000	8,000	9,000
43	10210130	2,000	4,000	0,000	0,000	5,000	8,000	0,000	4,000	1,000	10,000	0,000	2,000	5,000	8,000	9,000
212	90120102	0,000	2,000	0,000	0,000	5,000	8,000	0,000	4,000	1,000	10,000	0,000	2,000	5,000	8,000	9,000
8	10100145	2,000	4,000	0,000	0,000	8,000	8,000	0,000	4,000	1,000	10,000	0,000	2,000	7,000	8,000	9,000
81	10611200	0,000	8,000	0,000	0,000	10,000	20,000	0,000	8,000	2,000	2,000	0,000	0,000	12,000	8,000	18,000
214	90122000	2,000	4,000	0,000	0,000	10,000	13,000	0,000	2,000	1,000	10,000	3,000	0,000	10,000	21,000	1,000
222	90132001	0,000	8,000	0,000	0,000	20,000	22,000	0,000	8,000	2,000	16,000	0,000	6,000	10,000	18,000	18,000
363	90810227	0,000	4,000	0,000	0,000	5,000	10,000	0,000	4,000	1,000	8,000	0,000	4,000	9,000	9,000	9,000
346	90810206	0,000	4,000	0,000	0,000	5,000	10,000	0,000	4,000	1,000	8,000	0,000	4,000	9,000	9,000	9,000
10	10100160	0,000	8,000	0,000	0,000	10,000	16,000	0,000	8,000	2,000	17,000	0,000	8,000	10,000	16,000	16,000
83	10630643	2,000	5,000	0,000	0,000	2,000	8,000	0,000	4,000	1,000	9,000	0,000	1,000	7,000	4,000	9,000
110	10810424	0,000	16,000	0,000	0,000	20,000	32,000	0,000	8,000	2,000	18,000	0,000	12,000	10,000	26,000	18,000
170	80572117	4,000	10,000	0,000	0,000	4,000	16,000	0,000	4,000	2,000	22,000	0,000	4,000	16,000	10,000	18,000
171	80572118	0,000	10,000	0,000	0,000	5,000	16,000	0,000	4,000	2,000	22,000	0,000	4,000	16,000	10,000	18,000
172	80572128	0,000	2,000	0,000	0,000	2,000	8,000	0,000	4,000	1,000	11,000	1,000	3,000	8,000	5,000	9,000
72	10500140	0,000	6,000	0,000	0,000	30,000	30,000	0,000	4,000	6,000	6,000	0,000	6,000	42,000	24,000	48,000
442	CR34448096	8,8208	7,5109	0,1423	0,0000	8,2773	1,7295	0,1536	2,2986	1,1753	5,6099	0,1346	2,3961	5,1333	0,0000	8,4718
111	10810425	0,9999	24,0000	0,9999	0,0000	35,0000	96,0000	0,0000	20,0000	2,0000	42,0000	0,0000	34,0000	0,0000	65,0000	45,0000
433	CR32060120	2,2559	1,9999	1,9999	1,9605	0,9999	1,4893	0,0000	2,0000	2,6890	3,9819	0,0000	0,0000	0,0000	0,0000	5,2233
289	90500261	2,000	4,000	0,000	0,000	2,000	8,000	0,000	4,000	1,000	11,000	0,000	4,000	6,000	6,000	10,000
287	90500109	2,000	5,000	0,000	0,000	2,000	8,000	0,000	4,000	1,000	11,000	0,000	4,000	6,000	6,000	10,000
43	10210170	2,000	5,000	0,000	0,000	2,000	8,000	0,000	4,000	1,000	11,000	0,000	4,000	6,000	6,000	10,000
164	90500100	2,000	5,000	0,000	0,000	2,000	8,000	0,000	4,000	1,000	11,000	0,000	4,000	6,000	6,000	10,000
26	10210170	2,000	5,000	0,000	0,000	2,000	8,000	0,000	4,000	1,000	11,000	0,000	4,000	6,000	6,000	10,000
430	CR31860144	2,7500	5,0000	1,4200	0,0000	3,2500	2,7500	7,0000	0,0000	1,0000	13,7500	1,0000	2,5000	2,5000	0,0000	2,7500
139	50363100	0,000	4,000	0,000	0,000	10,000	10,000	0,000	4,000	2,000	20,000	0,000	4,000	16,000	10,000	16,000
451	CR34260120	0,3247	1,8241	1,2881	0,7346	1,8326	0,8496	0,0000	0,0000	0,1964	2,8029	0,0000	0,3032	1,0191	0,2566	3,9970
41	10210300	0,000	2,000	0,000	0,000	5,000	4,000	0,000	2,000	0,000	4,000	0,000	4,000	4,000	4,000	8,000
352	90810228	0,000	4,000	0,000	0,000	5,000	10,000	0,000	4,000	1,000	8,000	0,000	4,000	6,000	13,000	9,000
140	50412100	(1,0000)	2,000	0,000	0,000	0,000	4,000	0,000	4,000	1,000	7,000	0,000	1,000	6,000	4,000	8,000
428	CR31860120	(1,0000)	2,2229	0,0000	0,0000	5,4712	4,1334	0,0000	4,0000	0,0000	5,9723	0,0000	2,3333	3,6871	0,0000	8,0032
141	50412112	(1,0000)	2,000	0,000	0,000	0,000	4,000	0,000	4,000	1,000	8,000	0,000	4,000	4,000	4,000	8,000
21	10102162	0,000	4,000	0,000	0,000	5,000	8,000	0,000	4,000	1,000	9,000	0,000	4,000	5,000	8,000	9,000
108	10810115	0,000	8,000	0,000	0,000	10,000	20,000	0,000	8,000	2,000	16,000	0,000	8,000	8,000	26,000	18,000
66	10430910	1,000	3,000	0,000	1,000	4,000	8,000	0,000	2,000	1,000	9,000	1,000	2,000	0,000	21,000	1,000
105	10810107	2,000	8,000	0,000	0,000	10,000	20,000	0,000	8,000	2,000	16,000	0,000	8,000	8,000	2,000	2,000
107	10810113	0,000	20,000	0,000	0,000	54,000	54,000	0,000	24,000	6,000	46,000	0,000	20,000	0,000	78,000	54,000
241	90240013	0,000	2,000	0,000	0,000	0,000	9,000	0,000	2,000	1,000	12,000	3,000	0,000	0,000	25,000	1,000
14	10100168	8,000	18,000	0,000	10,000	16,000	46,000	0,000	8,000	2,000	34,000	0,000	6,000	20,000	8,000	16,000
75	10530002	6,000	12,000	0,000	4,000	3,000	9,000	0,000	13,000	3,000	6,000	0,000	12,000	6,000	33,000	27,000
427	CR31860096	0,9999	2,0000	0,9999	4,0000	4,0000	10,0000	0,0000	4,0000	7,0000	10,0000	0,0000	0,0000	6,0000	7,0000	7,0000
34	10100080	2,000	5,000	0,000	0,000	2,000	7,000	0,000	4,000	1,000	11,000	0,000	2,000	8,000	4,000	9,000
49	10225030	2,000	5,000	0,000	0,000	2,000	7,000	0,000	4,000	1,000	11,000	0,000	2,000	8,000	4,000	9,000
52	10530036	2,000	5,000	0,000	0,000	2,000	7,000	0,000	4,000	1,000	11,000	0,000	2,000	8,000	4,000	9,000
26	10116258	4,000	6,000	4,000	14,000	4,000	8,000	0,000	24,000	16,000	39,000	0,000	0,000	16,000	2,000	38,000
270	90500262	1,000	3,000	0,000	4,000	4,000	8,000	0,000	2,000	1,000	6,000	1,000	2,000	0,000	22,000	1,000
100	10100100	0,000	1,000	0,000	1,000	2,000	4,000	0,000	0,000	0,000	6,000	0,000	0,000	0,000	1,000	1,000
272	90500264	1,000	3,000	0,000	4,000	4,000	8,000	0,000	2,000	1,000	6,000	1,000	2,000	0,000	22,000	1,000
273	90500267	1,000	3,000	0,000	4,000	4,000	8,000	0,000	2,000	1,000	6,000	1,000	2,000	0,000	22,000	1,000
274	90500268	1,000	3,000	0,000	4,000	4,000	8,000	0,000	2,000	1,000	6,000	1,000	2,000	0,000	22,000	1,000
275	90500269	1,000	3,000	0,000	4,000	4,000	8,000	0,000	2,000	1,000	6,000	1,000	2,000	0,000	22,000	

Line	Item #	Week 88 7 Days Ended	Week 89 7 Days Ended	Week 90 7 Days Ended	Week 91 7 Days Ended	Week 92 7 Days Ended	Week 93 7 Days Ended	Week 94 7 Days Ended	Week 95 7 Days Ended	Week 96 7 Days Ended	Week 97 7 Days Ended	Week 98 7 Days Ended	Week 99 7 Days Ended	Week 100 7 Days Ended	Week 101 7 Days Ended	Week 102 7 Days Ended
37	1020442	18,000.00	9,000.00	12,000.00	8,000.00	0.0000	0.0000	19,000.00	4,000.00	9,000.00	13,000.00	9,000.00	2,000.00	33,000.00	7,000.00	2,000.00
416	CR83800240	0.0000	1,9482	14,478	5,8475	0.0000	3,6750	6,3750	2,2500	21,5798	0.0000	15,1146	0.0000	25,3150	0.0000	1,6998
242	90240041	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	11,000.00	8,000.00	4,000.00	8,000.00	8,000.00	1,000.00	1,000.00	17,000.00	4,000.00	1,000.00
69	10431903	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	10,000.00	9,000.00	4,000.00	8,000.00	7,000.00	1,000.00	3,000.00	17,000.00	4,000.00	1,000.00
70	10432608	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	10,000.00	9,000.00	4,000.00	8,000.00	7,000.00	1,000.00	2,000.00	17,000.00	4,000.00	1,000.00
169	80572116	10,000.00	12,000.00	10,000.00	12,000.00	0.0000	20,000.00	16,000.00	8,000.00	14,000.00	16,000.00	1,000.00	2,000.00	34,000.00	8,000.00	4,000.00
11	10100162	13,000.00	3,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	1,000.00
147	80100496	5,000.00	7,000.00	5,000.00	6,000.00	0.0000	15,000.00	5,000.00	2,000.00	9,000.00	8,000.00	1,000.00	1,000.00	19,000.00	4,000.00	1,000.00
223	90132008	10,000.00	12,000.00	10,000.00	12,000.00	0.0000	30,000.00	10,000.00	4,000.00	18,000.00	16,000.00	2,000.00	2,000.00	38,000.00	8,000.00	2,000.00
446	CR33344806	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	10100154	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	15,000.00	5,000.00	2,000.00	9,000.00	8,000.00	1,000.00	1,000.00	27,000.00	4,000.00	12,000.00
285	90550428	13,000.00	3,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	2,000.00
436	CR32027144	4,5180	5,3712	15,0250	17,8244	0.0000	17,2030	11,7980	6,2498	22,3018	9,1367	5,1367	1,000.00	43,8959	0.0000	2,000.00
158	80202901	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	4,000.00	15,000.00	3,000.00	4,000.00	6,000.00	1,000.00	1,000.00	23,000.00	4,000.00	1,000.00
33	10130188	13,000.00	3,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	1,000.00
78	10610122	28,000.00	4,000.00	2,000.00	12,000.00	0.0000	10,000.00	12,000.00	2,000.00	32,000.00	12,000.00	16,000.00	2,000.00	22,000.00	6,000.00	1,000.00
186	90010100	13,000.00	3,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	2,000.00
192	10100163	13,000.00	3,000.00	1,000.00	6,000.00	0.0000	15,000.00	5,000.00	2,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	2,000.00
212	10100165	13,000.00	3,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	2,000.00
215	10100166	13,000.00	3,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	2,000.00
8	10100142	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	10,000.00	9,000.00	4,000.00	18,000.00	6,000.00	8,000.00	2,000.00	22,000.00	6,000.00	1,000.00
81	10611700	28,000.00	4,000.00	2,000.00	12,000.00	0.0000	10,000.00	12,000.00	2,000.00	36,000.00	12,000.00	16,000.00	2,000.00	22,000.00	6,000.00	1,000.00
214	90123001	4,000.00	8,000.00	5,000.00	13,000.00	0.0000	15,000.00	1,000.00	17,000.00	7,000.00	4,000.00	0.0000	20,000.00	13,000.00	1,000.00	16,000.00
222	90133001	26,000.00	8,000.00	5,000.00	12,000.00	0.0000	12,000.00	8,000.00	0.0000	34,000.00	12,000.00	16,000.00	0.0000	24,000.00	6,000.00	2,000.00
353	90810227	14,000.00	1,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	7,000.00	8,000.00	1,000.00	10,000.00	3,000.00	1,000.00
348	90810226	14,000.00	1,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	7,000.00	8,000.00	1,000.00	10,000.00	3,000.00	1,000.00
83	10636643	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	10,000.00	9,000.00	4,000.00	18,000.00	6,000.00	8,000.00	1,000.00	20,000.00	6,000.00	1,000.00
110	10810424	28,000.00	4,000.00	4,000.00	12,000.00	0.0000	10,000.00	8,000.00	4,000.00	40,000.00	12,000.00	16,000.00	4,000.00	20,000.00	6,000.00	2,000.00
170	80572117	10,000.00	12,000.00	10,000.00	12,000.00	0.0000	20,000.00	16,000.00	8,000.00	14,000.00	16,000.00	1,000.00	2,000.00	34,000.00	8,000.00	4,000.00
171	80572118	10,000.00	12,000.00	10,000.00	12,000.00	0.0000	20,000.00	16,000.00	8,000.00	14,000.00	16,000.00	1,000.00	2,000.00	34,000.00	8,000.00	4,000.00
172	80572128	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	10,000.00	9,000.00	4,000.00	18,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	1,000.00
72	10500140	30,000.00	42,000.00	30,000.00	38,000.00	0.0000	58,000.00	42,000.00	24,000.00	48,000.00	48,000.00	0.0000	0.0000	102,000.00	34,000.00	6,000.00
442	CR33448006	0.0000	0.2588	5.9591	8.3803	0.0000	1.7736	0.1520	1.0000	8.4687	0.1950	3.9881	0.2360	11.1117	0.0000	0.2369
111	10610425	70,000.00	10,000.00	10,000.00	30,000.00	0.0000	25,000.00	20,000.00	7,000.00	89,000.00	30,000.00	40,000.00	7,000.00	50,000.00	15,000.00	5,000.00
433	CR20200720	0.0000	1.3183	3.6666	1.4349	0.0000	2.2598	0.0000	1.9265	8.6664	0.0000	0.3333	0.0000	9.3949	0.0000	0.0000
287	90500261	14,000.00	2,000.00	1,000.00	6,000.00	0.0000	5,000.00	3,000.00	1,000.00	17,000.00	6,000.00	7,000.00	1,000.00	10,000.00	3,000.00	1,000.00
287	90500261	14,000.00	2,000.00	1,000.00	6,000.00	0.0000	5,000.00	3,000.00	1,000.00	17,000.00	6,000.00	7,000.00	1,000.00	10,000.00	3,000.00	1,000.00
243	10100170	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	4,000.00	3,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	4,000.00	2,000.00
243	10100170	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	4,000.00	3,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	4,000.00	2,000.00
243	10100170	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	4,000.00	3,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	4,000.00	2,000.00
429	CR31660144	0.0000	0.2500	6.0000	1.5000	0.0000	1.0000	4.7500	1.5000	7.0000	0.0000	6.0000	0.0000	14.7500	0.0000	0.0000
139	50383100	10,000.00	12,000.00	10,000.00	10,000.00	0.0000	18,000.00	16,000.00	8,000.00	14,000.00	16,000.00	2,000.00	2,000.00	34,000.00	8,000.00	4,000.00
451	CR34260120	0.0000	0.1099	2.4451	2.5581	0.0000	1.8303	0.6995	0.3988	4.8296	0.0000	0.6799	0.7123	8.6837	0.0000	0.1568
41	10210020	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	4,000.00	3,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	1,000.00
352	90810226	14,000.00	1,000.00	1,000.00	6,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	7,000.00	8,000.00	1,000.00	10,000.00	3,000.00	1,000.00
140	50412100	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	10,000.00	8,000.00	5,000.00	17,000.00	8,000.00	1,000.00	1,000.00	17,000.00	4,000.00	1,000.00
428	CR31660120	0.0000	2.0000	3.9222	1.4142	0.0000	7.8858	1.5554	0.0000	17.4856	0.0000	1.9999	0.0000	8.1424	0.0000	0.0000
141	50412112	5,000.00	6,000.00	5,000.00	7,000.00	0.0000	5,000.00	4,000.00	1,000.00	17,000.00	6,000.00	8,000.00	1,000.00	10,000.00	3,000.00	1,000.00
21	10102162	14,000.00	2,000.00	1,000.00	6,000.00	0.0000	10,000.00	8,000.00	5,000.00	21,000.00	12,000.00	16,000.00	2,000.00	20,000.00	6,000.00	2,000.00
108	10810115	28,000.00	4,000.00	2,000.00	12,000.00	0.0000	10,000.00	8,000.00	2,000.00	34,000.00	12,000.00	16,000.00	2,000.00	20,000.00	6,000.00	2,000.00
66	10430910	4,000.00	8,000.00	4,000.00	6,000.00	0.0000	2,000.00	1,000.00	17,000.00	4,000.00	5,000.00	2,000.00	2,000.00	4,000.00	2,000.00	



Line	Item #	Week 103 7 Days Ended	Week 104 7 Days Ended	Week 105 7 Days Ended	Week 106 7 Days Ended	Week 107 7 Days Ended	Week 108 7 Days Ended	Week 109 7 Days Ended	Week 110 7 Days Ended	Week 111 7 Days Ended	Week 112 7 Days Ended	Week 113 7 Days Ended	Week 114 7 Days Ended	Week 115 7 Days Ended	Week 116 7 Days Ended	Week 117 7 Days Ended
37	1031440	8,000	13,000	10,000	9,000	18,000	28,000	5,000	16,000	15,000	9,000	11,000	8,000	14,000	20,000	16,000
38	CR63800240	2,620	8,960	8,675	9,812	1,914	5,672	14,483	9,178	5,708	9,105	12,152	3,750	2,565	9,805	1,275
242	9024041	10,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
69	1043193	10,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
170	1043268	10,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
169	8057216	20,000	4,000	6,000	22,000	8,000	16,000	8,000	12,000	14,000	14,000	10,000	0,000	30,000	12,000	16,000
111	1010162	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	8,000	0,000	8,000	0,000	15,000	3,000
147	8010496	10,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
223	9013208	20,000	4,000	6,000	22,000	8,000	16,000	8,000	12,000	14,000	14,000	10,000	0,000	30,000	12,000	16,000
48	CR3384806	3,6247	15,2573	1,4054	17,2631	1,2147	3,2077	16,2606	6,3135	3,9734	3,9734	3,2136	0,4802	3,8153	8,0708	9,9870
9	1010154	7,000	10,000	7,000	11,000	3,000	4,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
285	9050428	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
436	CR3207144	4,1471	31,1218	2,8367	22,4421	2,0384	9,0000	17,1742	3,0337	8,4278	17,6172	7,0882	0,4166	8,4769	28,1389	8,3771
158	8020291	5,000	7,000	3,000	4,000	2,000	3,000	4,000	6,000	7,000	1,000	11,000	0,000	14,000	5,000	12,000
33	10130188	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
78	10610122	6,000	20,000	14,000	18,000	4,000	8,000	1,000	18,000	16,000	2,000	0,000	16,000	0,000	30,000	6,000
186	9010100	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
112	10101063	10,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
12	10101063	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
21	9010102	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
8	1010106	6,000	20,000	14,000	18,000	4,000	8,000	1,000	18,000	16,000	2,000	0,000	16,000	0,000	30,000	6,000
81	1061170	1,000	14,000	10,000	14,000	2,000	2,000	17,000	13,000	13,000	10,000	6,000	0,000	30,000	24,000	15,000
214	9013200	6,000	20,000	14,000	18,000	4,000	8,000	1,000	20,000	16,000	2,000	0,000	16,000	0,000	30,000	6,000
222	9013201	6,000	20,000	14,000	18,000	4,000	8,000	1,000	20,000	16,000	2,000	0,000	16,000	0,000	30,000	6,000
353	9081027	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
348	9081026	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
83	10630643	5,000	20,000	14,000	18,000	4,000	8,000	1,000	20,000	16,000	2,000	0,000	16,000	0,000	30,000	6,000
110	10810424	6,000	20,000	14,000	18,000	4,000	8,000	1,000	28,000	16,000	26,000	2,000	16,000	0,000	30,000	6,000
170	80572117	20,000	4,000	6,000	22,000	8,000	16,000	8,000	12,000	14,000	14,000	10,000	0,000	30,000	12,000	16,000
171	80572118	20,000	4,000	6,000	22,000	8,000	16,000	8,000	12,000	14,000	14,000	10,000	0,000	30,000	12,000	16,000
172	80572128	10,000	2,000	3,000	11,000	4,000	8,000	1,000	6,000	7,000	9,000	5,000	0,000	15,000	6,000	8,000
72	1050140	40,000	12,000	12,000	44,000	24,000	50,000	24,000	28,000	28,000	30,000	20,000	0,000	60,000	26,000	32,000
442	CR3344806	1,000	6,2315	0,0855	7,5871	1,0445	5,6245	5,4220	4,1032	4,8913	2,2878	4,7421	0,0000	4,5599	9,0223	3,6159
111	10810425	15,000	50,000	35,000	45,000	20,000	25,000	5,000	50,000	40,000	35,000	5,000	40,000	0,000	75,000	15,000
433	CR2060120	0,000	8,6254	0,6438	3,7716	0,3266	4,1686	2,3477	1,8696	2,0252	8,497	0,1988	0,6666	0,4999	3,6594	0,8333
289	9050261	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
287	9050261	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
43	1021019	5,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
23	1061016	6,000	20,000	14,000	18,000	4,000	8,000	1,000	20,000	16,000	2,000	0,000	16,000	0,000	30,000	6,000
429	CR31660144	1,7500	1,2500	5,0000	4,0000	0,2500	2,0000	4,7500	3,0000	1,7500	2,7500	5,0000	2,5000	0,7500	4,2500	0,2500
139	50383100	20,000	4,000	6,000	22,000	8,000	16,000	8,000	12,000	14,000	14,000	10,000	0,000	30,000	12,000	16,000
451	CR24960120	0,1981	2,8644	0,7507	2,4946	0,0283	0,0000	1,6883	1,5741	0,0704	0,8988	1,1978	0,2832	1,2956	2,6747	0,3338
41	1021030	10,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
352	9081026	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
140	50412100	0,000	2,000	0,000	0,000	4,000	7,000	5,000	0,000	0,000	13,000	0,000	0,000	0,000	15,000	0,000
428	CR31660120	0,000	17,5000	0,5000	3,1866	1,7772	2,5664	6,7746	3,7016	4,6944	1,0127	5,2062	0,0000	2,3784	3,9096	0,4096
141	50412112	3,000	10,000	7,000	9,000	4,000	8,000	1,000	10,000	8,000	7,000	5,000	0,000	15,000	21,000	12,000
108	10810115	6,000	20,000	14,000	18,000	4,000	8,000	1,000	20,000	16,000	14,000	10,000	0,000	30,000	12,000	16,000
66	10430910	1,000	4,000	0,000	0,000	0,000	0,000	0,000	4,000	4,000	3,000	2,000	0,000	0,000	0,000	0,000
105	10810107	6,000	20,000	14,000	18,000	4,000	8,000	1,000	6,000	7,000	9,000	5,000	0,000	15,000	6,000	8,000
107	10810113	18,000	60,000	42,000	54,000	24,000	54,000	24,000	28,000	28,000	30,000	20,000	0,000	60,000	26,000	32,000
241	90240013	0,000	14,000	0,000	2,000	6,000	3,000	16,000	4,000	11,000	3,000	7,000	2,000	0,000	15,000	0,000
14	10101068	20,000	4,000	6,000	22,000	8,000	16,000	8,000	12,000	14,000	14,000	10,000	0,000	30,000	12,000	16,000
75	10500092	2,000	7,000	3,000	4,000	2,000	4,000	4,000	6,000	7,000	6,000	4,000	0,000	15,000	15,000	32,000
427	CR31660006	0,000	36,000	0,000	4,000	12,000	4,000	47,000	6,000	32,000	6,250	13,000	9,000	3,000	3,750	6,000
24	10101080	10,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
40	10220330	5,000	2,000	3,000	11,000	4,000	7,000	5,000	6,000	7,000	7,000	4,000	0,000	15,000	7,000	13,000
48	1043036	2,000	7,000	3,000	4,000	2,000	4,000	4,000	6,000	7,000	6,000	4,000	0,000	15,000	15,000	32,000
58	1043036	2,000	7,000	3,000	4,000	2,000	4,000	4,000	6,000	7,000	6,000	4,000	0,000	15,000	15,000	32,000
270	9050265	0,000	14,000	0,000	2,000	6,000	3,000	16,000	4,000	11,000	3,000	7,000	2,000	0,000	15,000	0,000
271	9050265	0,000	14,000	0,000	2,000	6,000	3,000	16,000	4,000	11,000	3,000	7,000	2,000	0,000	15,000	0,000
272	9050264	0,000	14,000	0,000	2,000	6,000	3,000	16,000	4,000	11,000	3,000	7,000	2,000	0,000	15,000	0,000
273	9050267	0,000	14,000	0,000	2,000	6,000	3,000	16,000	4,000	11,000	3,000	7,000	2,000	0,000	15,000	0,000
274	9050268	0,000	14,000	0,000	2,000	6,000	3,000	16,000	4,000	11,000	3,000	7,000	2,000	0,000	15,000	0,000
275	9050269	0,000	14,000	0,000	2,000	6,000	3,000	16,000	4,000	11,000	3,000	7,000	2,000	0,000	15,000	0,000
276	9050291	0,000	14,000	0,000	2,000	6,000	3,000	16,000	4,000	11,000	3,000	7,000	2,000	0,000	15,000	0,000
277	9050282	0,000	14,000	0,000	2,000	6										

Line	Item #	Week 118 7 Days Ended	Week 119 7 Days Ended	Week 120 7 Days Ended	Week 121 7 Days Ended	Week 122 7 Days Ended	Week 123 7 Days Ended	Week 124 7 Days Ended	Week 125 7 Days Ended	Week 126 7 Days Ended	Week 127 7 Days Ended	Week 128 7 Days Ended	Week 129 7 Days Ended	Week 130 7 Days Ended	Week 131 7 Days Ended	Week 132 7 Days Ended	Week 133 7 Days Ended
37	10371442	15,000	23,000	18,000	19,000	8,000	24,000	17,000	5,000	15,000	10,000	10,000	15,000	10,000	13,000	7,000	7,000
41	CRB3800240	11,7248	9,9212	4,8550	7,2100	3,7882	18,3852	1,6084	1,9866	8,3023	1,6084	9,5630	10,0559	2,3748	9,1337	12,1076	7,000
242	90430041	7,000	10,000	5,000	8,000	5,000	9,000	8,000	8,000	8,000	8,000	8,000	5,000	8,000	8,000	8,000	7,000
69	10431903	7,000	2,000	8,000	8,000	7,000	6,000	9,000	11,000	12,000	8,000	5,000	5,000	8,000	8,000	8,000	8,000
70	10432698	7,000	5,000	4,000	3,000	8,000	4,000	3,000	8,000	8,000	8,000	8,000	5,000	8,000	8,000	8,000	8,000
169	80572119	16,000	10,000	20,000	16,000	8,000	18,000	12,000	6,000	20,000	16,000	10,000	10,000	10,000	16,000	14,000	14,000
11	10101162	10,000	15,000	1,000	9,000	1,000	9,000	13,000	7,000	16,000	9,000	9,000	10,000	4,000	5,000	0,000	0,000
147	80100486	8,000	9,000	4,000	8,000	4,000	8,000	8,000	8,000	8,000	8,000	5,000	4,000	4,000	4,000	4,000	4,000
228	90130098	8,000	16,000	12,000	18,000	12,000	18,000	20,000	14,000	20,000	16,000	10,000	10,000	8,000	16,000	8,000	8,000
448	CR035848096	4,3999	3,4448	6,9130	3,3874	6,9130	3,1412	5,7798	0,0000	16,1412	0,0000	8,0083	3,7529	1,1745	6,3788	7,3151	7,3151
9	10101154	14,000	9,000	8,000	8,000	4,000	9,000	8,000	7,000	8,000	8,000	5,000	10,000	4,000	4,000	4,000	4,000
286	90594298	10,000	15,000	1,000	10,000	1,000	9,000	13,000	0,000	17,000	10,000	10,000	10,000	4,000	4,000	4,000	4,000
486	CR03007144	15,8724	18,0859	6,8384	30,8746	21,5955	6,8384	21,5955	8,0000	17,6335	37,7448	28,4467	4,0833	0,0000	12,3761	9,6921	9,6921
198	90101151	10,000	5,000	18,000	15,000	2,000	18,000	18,000	8,000	16,000	18,000	8,000	10,000	8,000	8,000	8,000	8,000
198	90101152	20,000	18,000	2,000	18,000	2,000	18,000	20,000	8,000	32,000	18,000	8,000	20,000	8,000	10,000	10,000	10,000
18	10431902	10,000	15,000	1,000	15,000	1,000	13,000	13,000	0,000	16,000	18,000	8,000	10,000	4,000	4,000	4,000	4,000
18	90101100	14,000	9,000	8,000	8,000	4,000	9,000	8,000	7,000	8,000	8,000	5,000	10,000	4,000	4,000	4,000	4,000
215	90120002	16,000	8,000	5,000	15,000	0,000	15,000	15,000	0,000	16,000	9,000	9,000	10,000	5,000	5,000	5,000	5,000
8	10101147	16,000	9,000	5,000	15,000	0,000	10,000	10,000	0,000	15,000	9,000	9,000	10,000	4,000	4,000	4,000	4,000
81	10611700	20,000	14,000	10,000	30,000	2,000	18,000	26,000	0,000	32,000	18,000	0,000	20,000	8,000	10,000	10,000	10,000
214	90120001	12,000	7,000	2,000	11,000	9,000	6,000	14,000	0,000	18,000	0,000	0,000	20,000	8,000	10,000	1,000	1,000
222	90130001	12,000	0,000	2,000	30,000	4,000	16,000	30,000	0,000	30,000	18,000	0,000	20,000	20,000	10,000	10,000	10,000
353	90810227	10,000	9,000	5,000	17,000	1,000	9,000	10,000	0,000	18,000	9,000	0,000	10,000	4,000	5,000	5,000	5,000
346	90810206	10,000	9,000	5,000	0,000	10,000	0,000	4,000	0,000	0,000	7,000	0,000	10,000	10,000	4,000	5,000	5,000
10	10101160	20,000	18,000	8,000	30,000	0,000	17,000	25,000	0,000	31,000	18,000	0,000	15,000	7,000	6,000	6,000	6,000
83	10630643	5,000	4,000	8,000	7,000	4,000	8,000	8,000	8,000	8,000	8,000	4,000	5,000	5,000	5,000	7,000	7,000
110	10610424	20,000	18,000	18,000	34,000	2,000	8,000	22,000	0,000	48,000	18,000	0,000	30,000	8,000	14,000	14,000	14,000
170	80572117	16,000	10,000	20,000	16,000	8,000	20,000	12,000	6,000	20,000	16,000	10,000	10,000	10,000	16,000	14,000	14,000
171	80572118	16,000	10,000	20,000	16,000	8,000	18,000	12,000	6,000	20,000	16,000	10,000	10,000	10,000	16,000	14,000	14,000
172	80572128	7,000	5,000	8,000	8,000	3,000	8,000	8,000	2,000	8,000	8,000	5,000	5,000	3,000	8,000	8,000	8,000
42	10601140	52,000	38,000	32,000	36,000	14,000	36,000	24,000	22,000	32,000	32,000	16,000	16,000	12,000	12,000	10,000	10,000
442	CR03448096	5,0959	4,7958	6,8946	3,5457	6,8946	1,6252	14,2629	0,0000	86,0000	45,0000	16,8247	5,6267	4,0019	8,1412	5,9637	5,9637
111	10610425	50,000	45,000	33,000	85,000	5,000	47,000	50,000	0,000	86,000	45,000	16,8247	50,000	20,000	25,000	25,000	25,000
433	CR02060720	6,1152	2,3135	2,0715	1,1686	2,9451	1,5104	5,8595	0,0000	52,397	0,1254	6,3068	4,5500	0,0000	4,2073	5,7777	5,7777
269	90500261	7,000	8,000	9,000	16,000	1,000	9,000	11,000	0,000	13,000	9,000	0,000	10,000	1,000	5,000	5,000	5,000
267	90500262	8,000	6,000	9,000	8,000	4,000	8,000	6,000	4,000	8,000	8,000	5,000	8,000	6,000	8,000	7,000	7,000
10	10431901	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
260	90412500	7,000	3,000	1,000	1,000	1,000	0,000	0,000	7,000	0,000	0,000	1,000	5,000	6,000	8,000	8,000	8,000
420	CR01660144	3,7500	1,5000	1,7500	2,9451	1,7500	1,7500	3,5000	0,0000	2,7500	0,0000	3,2000	2,2500	0,0000	3,0000	4,0000	4,0000
139	50835100	14,000	10,000	16,000	16,000	8,000	18,000	12,000	4,000	16,000	16,000	10,000	10,000	6,000	16,000	12,000	12,000
451	CR04260120	1,8712	2,0699	1,0653	1,718	1,718	0,4749	2,2725	0,0000	2,2160	0,0000	2,2750	4,4323	0,1224	0,6339	1,2751	1,2751
41	10210300	6,000	5,000	8,000	8,000	3,000	9,000	6,000	2,000	8,000	8,000	5,000	5,000	3,000	5,000	5,000	5,000
352	90810226	10,000	1,000	2,000	17,000	0,000	9,000	11,000	0,000	18,000	9,000	0,000	10,000	4,000	4,000	4,000	4,000
140	50412100	7,000	2,000	0,000	0,000	0,000	0,000	2,000	4,000	0,000	0,000	0,000	10,000	3,000	3,000	2,000	2,000
428	CR01660120	8,7785	2,6007	3,2302	2,2230	3,4190	12,8142	4,2346	0,0000	33,333	11,0009	1,6665	4,2778	3,0000	3,4210	5,0237	5,0237
141	50412112	7,000	3,000	3,000	0,000	1,000	0,000	0,000	0,000	4,000	0,000	0,000	5,000	3,000	3,000	3,000	3,000
21	10102162	10,000	10,000	3,000	15,000	2,000	8,000	12,000	0,000	15,000	7,000	0,000	20,000	3,000	1,000	0,000	0,000
108	10810115	20,000	18,000	10,000	34,000	2,000	18,000	22,000	0,000	32,000	18,000	0,000	20,000	8,000	10,000	0,000	0,000
66	10430910	6,000	2,000	2,000	11,000	10,000	6,000	10,000	0,000	19,000	0,000	8,000	0,000	11,000	0,000	0,000	0,000
105	10810107	22,000	18,000	6,000	30,000	2,000	18,000	28,000	0,000	34,000	18,000	0,000	18,000	8,000	8,000	8,000	8,000
107	10810113	60,000	54,000	22,000	102,000	6,000	52,000	66,000	0,000	90,000	64,000	0,000	60,000	24,000	30,000	0,000	0,000
241	90400113	6,000	8,000	2,000	11,000	6,000	6,000	10,000	0,000	19,000	0,000	0,000	0,000	12,000	0,000	2,000	2,000
14	10101168	24,000	10,000	20,000	18,000	12,000	16,000	18,000	0,000	36,000	18,000	12,000	20,000	22,000	30,000	26,000	26,000
75	10530002	11,000	4,000	24,000	22,000	33,000	20,000	20,000	0,000	16,000	0,000	16,000	0,000	21,000	0,000	0,000	0,000
427	CR01660096	8,2500	5,0000	1,7500	0,0000	6,5000	4,7500	0,0000	0,0000	10,0000	5,0000	6,5000	3,7750	0,0000	6,5250	7,5000	7,5000
24	10100380	8,000	6,000	8,000	9,000	8,000	9,000	10,000	8,000	8,000	8,000	5,000	8,000	8,000	8,000	8,000	8,000
34	10100380	5,000	8,000	3,000	8,000	3,000	8,000	6,000	2,000	8,000	8,000	4,000	5,000	5,000	5,000	5,000	5,000
45	10630636	12,000	8,000	4,000	14,000	4,000	14,000	14,000	4,000	18,000	8,000	20,000	21,000	9,000	10,000	7,000	7,000
28	10118826	6,000	7,000	2,000	11,000	9,000	6,000	10,000	0,000	16,000	9,000	8,000	9,000	9,000	21,000	16,000	16,000
270	90500263	6,000	7,000	2,000	11,000	9,000	6,000	10,000	0,000	16,000	9,000	8,000	9,000	9,000	21,000	16,000	16,000
271	90500263	6,000	7,000	2,000	11,000	9,000	6,000	10,000	0,000	16,000	9,000	8,000	9,000	9,000	21,000	16,000	16,000
272	90500264	6,000	7,000	2,000	11,000	9,000	6,000	10,000	0,000	16,000	9,000	8,000	9,000	9,000	21,000	16,000	16,000
273	90500267	6															



Line	Item #	Week 133	Week 134	Week 135	Week 136	Week 137	Week 138	Week 139	Week 140	Week 141	Week 142	Week 143	Week 144	Week 145	Week 146	Week 147
		7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended
37	10207440	6,000	10,000	32,000	16,000	3,000	3,000	28,000	28,000	25,000	28,000	30,000	12,000	13,000	17,000	20,000
416	CR3800240	5,1141	6,2303	12,8526	23,5414	9,1850	10,4432	28,1560	3,4780	3,4780	28,1560	4,6500	7,0160	2,1950	15,1182	16,9108
242	90240041	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
69	10431003	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
70	10432898	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
169	80572116	8,000	14,000	16,000	16,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
11	10100162	2,000	14,000	15,000	15,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
147	80100486	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
223	90132008	8,000	16,000	16,000	16,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
446	CR33848006	6,694	6,2566	7,6425	2,7059	2,1335	11,4207	5,4690	5,0161	5,0161	13,0000	11,0000	12,7914	5,4418	5,3553	19,7165
9	10100154	5,000	7,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
285	90550438	2,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
436	CR02307144	9,897	6,6569	20,0689	6,2569	19,1327	20,2038	24,2245	13,3846	13,3846	53,3152	7,0187	4,3077	27,9160	20,8178	4,5273
198	80230361	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
38	10130186	2,000	14,000	15,000	15,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
188	90010102	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
12	10100163	5,000	7,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
215	90122002	3,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
8	10100147	3,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
81	10611700	4,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
214	90122001	4,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000
222	90132001	3,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
353	90810227	2,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
346	90810226	2,000	14,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
83	10639843	1,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
110	10810424	4,000	46,000	46,000	46,000	12,000	12,000	36,000	36,000	32,000	36,000	18,000	12,000	8,000	20,000	22,000
170	80572117	8,000	14,000	16,000	16,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
171	80572118	8,000	14,000	16,000	16,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
172	80572119	8,000	14,000	16,000	16,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
42	CR03448006	2,695	1,8485	8,1055	7,2064	5,9198	7,1249	7,8696	4,7669	4,7669	12,3817	5,5709	6,6304	4,8281	4,6619	20,4145
442	CR03448006	10,000	74,000	75,000	30,000	50,000	30,000	50,000	70,000	70,000	128,000	85,000	40,000	35,000	70,000	50,000
433	CR02306020	2,008	0,3333	10,1158	4,4851	1,9998	2,8608	8,0999	3,3857	3,3857	5,0337	1,9999	3,9700	0,6666	0,2340	4,4412
269	90500261	4,000	14,000	15,000	15,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
48	10130187	5,000	7,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
269	90412500	7,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
429	CR01660144	2,250	1,750	3,500	11,250	1,750	1,750	4,000	4,000	4,000	8,750	1,250	2,000	3,500	5,250	5,250
139	50353100	8,000	14,000	16,000	16,000	8,000	8,000	20,000	20,000	20,000	22,000	6,000	22,000	0,000	34,000	14,000
41	10210300	3,000	5,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
352	90810226	2,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
140	50412100	4,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
428	CR01660120	0,3333	1,8333	6,0656	8,3835	5,5572	2,9159	5,6494	2,4605	2,4605	4,9239	0,1338	3,7793	5,7940	8,6579	9,5419
141	50412112	2,000	5,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
21	10102162	0,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
108	10810115	4,000	14,000	15,000	15,000	4,000	4,000	18,000	18,000	18,000	20,000	10,000	6,000	5,000	10,000	9,000
66	10430910	2,000	15,000	13,000	13,000	4,000	4,000	11,000	11,000	11,000	11,000	3,000	11,000	11,000	11,000	17,000
105	10810107	4,000	28,000	28,000	28,000	4,000	4,000	34,000	34,000	30,000	34,000	20,000	12,000	10,000	20,000	16,000
107	10810113	12,000	38,000	38,000	38,000	8,000	8,000	90,000	88,000	88,000	90,000	72,000	40,000	40,000	40,000	40,000
241	90240013	2,000	14,000	14,000	14,000	2,000	2,000	21,000	21,000	11,000	11,000	3,000	11,000	12,000	5,000	6,000
14	10100168	14,000	28,000	28,000	28,000	4,000	4,000	18,000	18,000	22,000	22,000	48,000	20,000	20,000	40,000	16,000
73	CR02306020	10,000	30,000	28,000	28,000	2,000	2,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
424	10100168	3,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
24	10100180	3,000	5,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
82	10639838	1,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
28	10118626	14,000	18,000	18,000	18,000	6,000	6,000	28,000	28,000	16,000	16,000	4,000	10,000	10,000	42,000	54,000
270	90500262	2,000	17,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	4,000	11,000	12,000	6,000	8,000
271	90500263	2,000	17,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	4,000	11,000	12,000	6,000	8,000
272	90500264	2,000	17,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	4,000	11,000	12,000	6,000	8,000
273	90500267	2,000	17,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	4,000	11,000	12,000	6,000	8,000
274	90500268	2,000	17,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	4,000	11,000	12,000	6,000	8,000
275	90500269	2,000	17,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	4,000	11,000	12,000	6,000	8,000
276	90500281	2,000	17,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	4,000	11,000	12,000	6,000	8,000
277	90500282	2,000	17,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	4,000	11,000	12,000	6,000	8,000
280	90412502	4,000	7,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
292	90600105	4,000	44,000	46,000	72,000	58,000	58,000	36,000	36,000	44,000	44,000	14,000	44,000	44,000	26,000	42,000

Line	Item #	Week 148 7 Days Ended 9/4/2011	Week 149 7 Days Ended 9/11/2011	Week 150 7 Days Ended 9/18/2011	Week 151 7 Days Ended 9/25/2011	Week 152 7 Days Ended 10/2/2011	Week 153 7 Days Ended 10/9/2011	Week 154 7 Days Ended 10/16/2011	Week 155 7 Days Ended 10/23/2011	Week 156 7 Days Ended 10/30/2011	Mean Weekly Demand (μ)	3-Yr Std Dev/Std of Weekly Cmd (σ)	Coefficient of Variation $\frac{\sigma}{\mu}$	Coefficient of Variation $\frac{\sigma}{\mu}$	Sequence #
37	10207442	6,000	1,000	20,000	19,000	25,000	6,000	7,000	2,000	8,2021	7,5250	0.02	0.02	1	
416	CR63800240	7,830	13,7198	25,2264	2,6100	5,2166	9,8716	13,3639	7,0790	14,9547	5,8840	0.98	0.98	2	
242	90240041	7,000	0,000	0,000	7,000	0,000	5,000	0,000	0,000	4,0600	4,0600	1.05	1.05	3	
69	10431903	1,000	1,000	11,000	9,000	12,000	5,000	4,000	3,000	7,0000	4,3300	1.08	1.08	4	
70	10432698	5,000	1,000	9,000	9,000	10,000	3,000	5,000	2,000	6,8846	4,1840	1.08	1.08	5	
169	80572116	4,000	0,000	18,000	18,000	26,000	12,000	10,000	10,000	7,1220	6,5962	1.08	1.08	6	
117	10100162	0,000	3,000	4,000	14,000	12,000	2,000	0,000	7,000	4,3530	3,9808	1.09	1.09	7	
141	80100466	4,000	0,000	5,000	10,000	10,000	3,000	0,000	0,000	3,8718	4,2330	1.09	1.09	8	
223	90132008	8,000	0,000	20,000	20,000	20,000	10,000	6,000	12,000	7,8141	8,6040	1.10	1.10	9	
446	CR63848096	7,0993	1,0595	13,6158	5,0788	3,9562	1,9286	3,6859	0,8176	4,1114	4,5330	1.10	1.10	10	
9	10100154	4,000	4,000	4,000	11,000	10,000	3,000	5,000	7,000	4,9615	5,5600	1.12	1.12	11	
285	90595428	0,000	3,000	4,000	13,000	10,000	1,000	0,000	5,000	3,0231	4,4020	1.12	1.12	12	
89	CR63007144	8,9250	5,8651	11,8847	17,2811	9,4028	11,8107	7,2448	6,6665	7,8902	8,9120	1.12	1.12	13	
158	80202901	6,000	0,000	9,000	9,000	12,000	4,000	4,000	2,000	3,9467	4,4630	1.13	1.13	14	
33	10130186	0,000	3,000	4,000	14,000	12,000	3,000	0,000	4,000	3,9872	4,5640	1.14	1.14	15	
18	10610122	0,000	0,000	8,000	26,000	24,000	4,000	0,000	12,000	7,8077	8,0230	1.14	1.14	16	
186	80100160	4,000	3,000	5,000	10,000	10,000	5,000	3,000	3,000	4,6785	5,0000	1.16	1.16	17	
212	90122002	0,000	3,000	5,000	11,000	11,000	2,000	0,000	6,000	5,6960	6,0000	1.16	1.16	18	
8	10100147	4,000	0,000	0,000	15,000	11,000	2,000	0,000	7,000	5,1218	5,6870	1.17	1.17	19	
81	10611700	0,000	0,000	8,000	26,000	26,000	4,000	0,000	10,000	7,6266	8,7990	1.17	1.17	20	
214	90123001	5,000	2,000	0,000	14,000	11,000	4,000	0,000	8,000	5,1346	6,0240	1.17	1.17	21	
222	90132001	0,000	6,000	8,000	26,000	20,000	4,000	0,000	10,000	7,5513	8,1500	1.17	1.17	22	
353	90810227	0,000	3,000	4,000	14,000	14,000	2,000	0,000	7,000	3,9744	4,6630	1.17	1.17	23	
346	90810206	0,000	3,000	4,000	14,000	12,000	2,000	0,000	6,000	3,7244	4,3780	1.18	1.18	24	
10	10100160	0,000	3,000	4,000	14,000	12,000	2,000	0,000	12,000	7,4359	8,8720	1.19	1.19	25	
83	10630643	4,000	0,000	5,000	9,000	24,000	5,000	2,000	1,000	3,6218	4,2930	1.19	1.19	26	
110	10810424	0,000	8,000	8,000	26,000	0,000	4,000	0,000	14,000	8,8462	10,5200	1.19	1.19	27	
170	80572117	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,0000	0,0000	1.19	1.19	28	
172	80572118	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	5,7821	6,8630	1.19	1.19	29	
171	80572128	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	5,8333	6,8630	1.19	1.19	30	
442	CR63448096	16,000	0,000	22,000	36,000	40,000	26,000	12,000	18,000	15,6667	18,7930	1.20	1.20	31	
111	10810425	0,000	15,000	20,000	86,000	82,000	10,000	0,000	29,000	20,6538	24,9930	1.21	1.21	32	
433	CR62060120	0,2340	1,1686	1,9969	6,8106	0,9160	1,6750	0,000	3,3950	1,7332	2,1030	1.21	1.21	33	
269	90502651	3,000	4,000	4,000	13,000	10,000	0,000	0,000	7,000	3,9833	4,3670	1.22	1.22	34	
287	90570019	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	2,8718	3,4910	1.22	1.22	35	
13	10100160	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,0164	1,0164	1.24	1.24	36	
265	90412020	2,000	0,000	3,000	0,000	0,000	1,000	0,000	1,000	2,9927	2,9880	1.24	1.24	37	
420	CR61660144	1,5000	8,2500	11,5000	1,2500	4,8523	13,8144	13,3464	5,7276	13,7430	6,4661	1.24	1.24	38	
139	50363100	18,000	2,000	18,000	18,000	20,000	26,000	0,000	8,000	6,2692	7,8080	1.25	1.25	39	
451	CR64260120	1,6605	1,4626	3,2747	1,7816	1,1631	3,4236	2,2840	3,2682	2,0506	1,3170	1.25	1.25	40	
41	10210300	4,000	0,000	10,000	14,000	12,000	3,000	1,000	3,000	3,1218	3,9360	1.26	1.26	41	
352	90810226	0,000	3,000	4,000	14,000	14,000	2,000	0,000	7,000	3,9423	4,6660	1.26	1.26	42	
140	50412100	0,000	0,000	4,000	10,000	0,000	2,000	0,000	2,000	2,0962	2,7090	1.29	1.29	43	
428	CR61660120	7,9533	4,0950	7,6097	0,3568	1,5122	0,9999	4,9666	1,9000	6,8000	3,1600	1.29	1.29	44	
141	50412112	0,000	0,000	0,000	0,000	1,000	2,000	0,000	2,000	2,1346	2,7780	1.30	1.30	45	
21	10102162	0,000	0,000	0,000	15,000	12,000	0,000	0,000	5,000	4,5321	4,6380	1.31	1.31	46	
108	10810115	0,000	0,000	0,000	0,000	2,000	0,000	0,000	0,000	6,1667	8,0610	1.31	1.31	47	
66	10430910	5,000	3,000	4,000	12,000	13,000	1,000	3,000	8,000	4,9370	4,9370	1.32	1.32	48	
105	10810107	0,000	6,000	8,000	26,000	24,000	4,000	0,000	12,000	6,4423	8,5040	1.32	1.32	49	
107	10810113	0,000	0,000	0,000	0,000	10,000	0,000	0,000	0,000	18,1538	23,8820	1.32	1.32	50	
241	90240013	5,000	3,000	17,000	14,000	13,000	1,000	2,000	6,000	3,9103	5,1460	1.32	1.32	51	
14	10100168	12,000	1,000	17,000	15,000	27,000	6,000	2,000	5,000	8,2628	11,7860	1.35	1.35	52	
75	10530002	10,000	6,000	9,000	16,000	29,000	3,000	10,000	21,000	8,7628	11,7860	1.35	1.35	53	
427	CR61660096	6,000	2,000	20,000	3,000	0,5000	0,000	0,000	2,000	12,6665	3,5220	1.36	1.36	54	
24	10100080	2,000	0,000	0,000	20,000	26,000	6,000	0,000	0,000	4,8141	6,5750	1.37	1.37	55	
60	10250330	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	3,0841	4,2090	1.37	1.37	56	
62	10100036	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,6855	1,6855	1.37	1.37	57	
270	90502625	86,0000	36,0000	12,0000	14,0000	8,0000	0,0000	70,0000	10,0000	16,2320	16,2320	1.38	1.38	58	
271	90502626	5,000	3,000	3,000	13,000	13,000	1,000	1,000	3,000	3,5277	4,5160	1.38	1.38	59	
272	90502627	5,000	2,000	4,000	12,000	13,000	1,000	0,000	7,000	3,5277	4,5160	1.38	1.38	60	
273	90502628	5,000	2,000	4,000	12,000	13,000	1,000	0,000	8,000	3,5277	4,5160	1.38	1.38	61	
274	90502629	5,000	2,000	3,000	13,000	13,000	1,000	1,000	7,000	3,5277	4,5160	1.38	1.38	62	
275	90502630	5,000	2,000	3,000	13,000	13,000	1,000	1,000	7,000	3,5277	4,5160	1.38	1.38	63	
276	90502631	5,000	2,000	4,000	12,000	13,000	1,000	1,000	7,000	3,5277	4,5160	1.38	1.38	64	
277	90502632	5,000	2,000	3,000	13,000	12,000	1,000	1,000	8,000	3,5277	4,5160	1.38	1.38	65	
260	90412502	2,000	0,000	4,000	2,000	0,000	2,000	0,000	0,000	1,9744	2,7500	1.39	1.39	66	
292	90600105	20,000	8,000	16,000	48,000	46,000	4,000	8,000	22,000	13,6923	19,0730	1.39	1.39	67	

Line	Item #	Item Description	Week 1 7 Days Ended 11/02/08	Week 2 7 Days Ended 11/09/08	Week 3 7 Days Ended 11/16/08	Week 4 7 Days Ended 11/23/08	Week 5 7 Days Ended 11/30/08	Week 6 7 Days Ended 12/07/08	Week 7 7 Days Ended 12/14/08	Week 8 7 Days Ended 12/21/08	Week 9 7 Days Ended 12/28/08	Week 10 7 Days Ended 01/04/09	Week 11 7 Days Ended 01/11/09	Week 12 7 Days Ended 01/18/09
112	10810026	LIGHT KIT-AMBER CLEARANCE-LED	8.0000	8.0000	8.0000	8.0000	8.0000	8.0000	8.0000	8.0000	8.0000	8.0000	8.0000	8.0000
212	90110315	BRACKET, WATER TANK - 5M 25"	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
213	90110316	STRAP, WATER TANK - 5M 25"	0.0000	4.0000	10.0000	10.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
200	90019102	PLATE, DATA - CBMW MIXERS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
425	CRG1648066	100A, 1/4"X 1/2" X 96	8.2759	17.1250	4.0000	4.0000	0.0000	0.0000	0.8750	0.0000	2.8758	0.0000	11.4200	1.0312
74	100501146	STRAP, RUBBER-CHUTE HOLD DOWN	22.0000	2.0000	4.0000	4.0000	0.0000	0.0000	16.0000	0.0000	12.0000	28.0000	0.0000	20.0000
189	90014004	BECK, 6 HOLE - TGL SWITCH MFG.	3.0000	2.0000	4.0000	4.0000	0.0000	0.0000	4.0000	0.0000	2.0000	1.0000	0.0000	5.0000
330	90648001	CRK, WAXING UNIV. FNDR LH 8T	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	2.0000	0.0000	3.0000	3.0000
444	CRG3460120	1/4, 25IX 60 X 120	3.5472	21.7250	12.1720	26.1000	0.0000	0.0000	1.8925	0.0000	0.6000	0.0000	28.0152	19.6750
387	CRF5470240	1/4, 25IX 2, 1/2 X 240	1.2250	0.0000	0.0000	0.0000	0.0000	0.0000	12.1041	0.0000	0.0000	0.0000	2.5959	10.4666
54	10400217	BALL JOINT, QUICK DISCONNECT	5.0000	1.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	1.0000	0.0000	2.0000	4.0000
80	10610701	HANGER, MILD FLAP	12.0000	28.0000	12.0000	8.0000	0.0000	0.0000	0.0000	0.0000	6.0000	0.0000	4.0000	8.0000
168	86570010	LOCK, PIVOT - CHUTE SUPPORT	0.0000	2.0000	5.0000	0.0000	0.0000	0.0000	7.0000	1.0000	1.0000	0.0000	3.0000	3.0000
286	86570116	COLLAR, IRM SUPPORT - PIVOT	0.0000	2.0000	5.0000	0.0000	0.0000	0.0000	7.0000	1.0000	1.0000	0.0000	3.0000	3.0000
434	90300044	COLLAR, IRM SUPPORT - PIVOT	1.0000	5.0000	1.3300	1.3300	0.0000	0.0000	2.5100	0.3120	3.0000	0.0000	1.0000	1.0000
456	90300054	FLANGE, CBMW - 3/4 BOLT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	16.0000	3.0000	3.0000	0.0000	8.0000	0.0000
246	90230214	CYLINDER-HYD - CHUTE LIFT OFF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	2.0000	2.0000	0.0000	5.0000	2.0000
46	10214861	PUMP ASSY, HYD - NEW EATON	5.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	5.0000	2.0000
286	10610701	HOUSING, CHUTE LOCK - CBMW NIS	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	7.0000	0.0000	1.0000	0.0000	2.0000	3.0000
76	10610100	PLATE, ADAPTOR - GRK MOUNTING	6.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	18.0000	0.0000
132	90600011	SPRING, LADDER LOCK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
385	CRF3460240	1/4, 25IX 1, 1/2 X 240	3.7016	2.1495	0.0000	0.0000	0.0000	0.0000	1.2000	0.0000	0.0125	0.0000	2.5000	5.4083
237	90230200	VALVE, CHUTE MANIFOLD - DOUBLE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	2.0000	1.0000	0.0000	5.0000	2.0000
438	CRG3248066	3/16, 1/875IX 48 X 96	2.2000	2.5398	0.0000	0.1781	0.0000	0.1944	3.6460	0.8874	0.0000	0.4454	1.7674	0.1242
142	50412280	KIT, IN-CAB CONTROL - 4"STROKE	3.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
257	90401322	STRAIN RELIEF, REAR CONTROL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
408	CPA0240252	1/1 X 40 X 262	0.3500	0.0000	0.0000	0.0000	0.0000	0.0000	1.2978	0.0000	0.0000	0.0000	0.5100	0.0000
417	CRF4200540	1/2, 50IX 240	0.3500	6.4044	0.2596	0.7500	0.0000	0.0000	11.4104	1.0386	1.2596	0.3750	0.6624	0.0000
441	CRG3260120	3/16, 1/875IX 60 X 120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.2958	14.7500
253	90400321	HANDLE, ELECTRONIC CONTROL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
254	90400323	COVER, REAR ELEC. CONTROL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
256	90400326	COVER, REAR ELEC. CONTROL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
384	CRM4260066	1/2, 50 X 4 X 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
173	90110166	BALL VALVE - 3/4" NPT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
225	90110168	BALL VALVE - 3/4" NPT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
220	90110126	GAUGE, CALIB. - GALLON/HR-150/567	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	CDM4460100	1/4, 25 X 60 X 100, 100XF	19.0000	12.0000	0.0000	0.0000	0.0000	0.0000	17.0000	0.0000	2.0000	0.0000	0.0000	0.0000
230	902304003	BUSHING, AIR CHUTE LOCK NIS	3.0000	1.0000	0.0000	0.0000	0.0000	0.0000	5.0000	0.0000	1.0000	0.0000	5.0000	4.0000
332	90654480	BUMPER, REAR - CBMW, LP BRNT	10.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	1.0000	0.0000	0.0000	2.0000
375	CA4266240	1/2, 50IX 2 X 3 X 240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
90	10757100	GEARBOX ASSY-ZF - P7300 NEW	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
351	90810225	HARNES, WRM/CLRNCE - 9F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8.0000	0.0000	0.0000	0.0000	0.0000	0.0000
386	CRF3460240	1/4, 25IX 2 X 240	0.0000	0.0415	0.0000	0.0000	0.0000	0.0000	3.1666	0.0000	0.0000	0.0000	0.0000	3.8331
156	80200624	GAUGE, HYD-SLUMP METER	3.0000	1.0000	0.0000	0.0000	0.0000	0.0000	4.833	0.0000	0.0000	0.0000	0.0000	0.0000
406	CPA440252	3/4, 75 X 40 X 252	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
173	80610031	TUBE, PIVOT FEDESTAL - BRG.	7.0000	5.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
99	10600626	SWITCH, TOGGLE-AMCM SWITCH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
155	80151592	CYLINDER-HOPPER AIR CYL - NIS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000
297	90602407	COVER, REAR CONTROL SWITCHES	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	7.0000	1.0000	0.0000	0.0000	0.0000	0.0000
100	10800610	SWITCH, TOGGLE BUS. SWITCH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
183	90010006	DECAL, CONTINENTAL MIXERS LOGO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
238	90150103	BALL JOINT, HOPPER LIFT CYL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000
349	90810223	BALL JOINT, HOPPER LIFT CYL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
435	CRG007120	PIGTAL, "Y" ADAPTER	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
446	CRG3472144	120A, 1046IX072 X 120	7.0000	5.0000	2.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
218	90131226	GAUGE, CALIB-GALLON/HR-125/473	4.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000
245	80250514	CYLINDER-HYD - CHUTE LIFT/FF	3.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	10610126	CYLINDER-HYD - CHUTE LIFT/FF	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
164	10610126	CABLE, FRONT CONTROL, CABLE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	73.0000	0.0000	0.0000	0.0000	0.0000	0.0000
880	CDM4460100	1/4, 25 X 60 X 120, 100XF	96.0000	9.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
48	10212509	MOTOR, HYD - EATON	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000
182	90010004	DECAL, CONTINENTAL MIXERS LOGO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	30.0000
300	90610003	DEBUNCER, CBMW 2004	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000
296	90602404	PLATFORM, LOWER - CBMW 97	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000
396	CRH3260120	3/16, 1/875IX 60 X 120	10.0000	10.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	14.0000	0.0000	21.5000	0.0000
461	CRT3066240	1/8 OD X 2 W X 2 H X 240 L	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5000	0.0000	0.0000	0.0000	0.0000	0.0000
369	CA1326240	3/16, 1/875IX 1/4 X 1/4 X 240 L	0.1750	2.8000	0.0000	0.0000	0.0000	0.0000	1.2250	0.7000	0.1750	0.0000	0.8750	0.0000
390	CRF3866240	3/8, 375IX 2 X 240	0.0000	1.8000	0.0000	0.1125	0.0000	0.0000	0.1875	0.0000	0.1125	0.0000	0.5625	0.0000
370	CA1346240	1/4,												



Line	Item #	Week 13 7 Days Ended 2/1/2020	Week 14 7 Days Ended 2/8/2020	Week 15 7 Days Ended 2/15/2020	Week 16 7 Days Ended 2/22/2020	Week 17 7 Days Ended 3/1/2020	Week 18 7 Days Ended 3/8/2020	Week 19 7 Days Ended 3/15/2020	Week 20 7 Days Ended 3/22/2020	Week 21 7 Days Ended 3/29/2020	Week 22 7 Days Ended 4/5/2020	Week 23 7 Days Ended 4/12/2020	Week 24 7 Days Ended 4/19/2020	Week 25 7 Days Ended 4/26/2020	Week 26 7 Days Ended 5/3/2020	Week 27 7 Days Ended 5/10/2020
112	10810426	4,000	4,000	0,000	0,000	4,000	4,000	2,000	4,000	2,000	4,000	4,000	4,000	4,000	4,000	0,000
212	90110315	6,000	4,000	0,000	6,000	4,000	12,000	2,000	4,000	9,000	0,000	0,000	9,000	6,000	0,000	0,000
213	90110316	6,000	4,000	0,000	6,000	2,000	12,000	2,000	4,000	9,000	0,000	0,000	9,000	6,000	0,000	0,000
200	90019102	0,000	0,000	0,000	0,000	0,000	20,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
425	CPG1648096	0,000	5,9792	0,250	0,000	0,000	0,000	2,750	0,000	2,750	0,000	0,000	0,000	0,000	0,250	0,8384
74	10500146	16,000	0,000	0,000	24,000	6,000	6,000	12,000	8,000	8,000	0,000	0,000	12,000	12,000	12,000	0,000
180	90044004	2,000	2,000	0,000	2,000	2,000	2,000	1,000	2,000	1,000	1,000	3,000	2,000	2,000	0,000	0,000
330	90046001	0,000	0,000	0,000	0,000	0,000	6,000	2,000	4,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
444	CPG3460120	1,000	2,6590	0,000	0,000	10,3000	3,500	2,897	6,3132	0,000	0,000	27,1040	3,9795	30,0000	0,0000	0,0000
387	CPB3470240	0,000	0,000	0,000	0,000	7,8754	7,8754	7,7020	8,7959	0,0000	0,0000	8,7959	3,6666	0,0000	0,0000	0,0000
54	10420217	3,000	3,000	0,000	3,000	1,000	2,000	2,000	2,000	2,000	0,000	0,000	2,000	4,000	4,000	0,000
180	10810701	6,000	4,000	0,000	4,000	4,000	14,000	2,000	10,000	10,000	4,000	4,000	4,000	4,000	4,000	0,000
188	80510010	3,000	2,000	0,000	4,000	1,000	8,000	2,000	2,000	7,000	0,000	0,000	3,000	2,000	0,000	0,000
288	80510016	3,000	4,000	0,000	4,000	1,000	8,000	2,000	2,000	7,000	0,000	0,000	3,000	2,000	0,000	0,000
159	80302044	7,000	5,000	0,000	8,000	0,000	8,000	0,000	8,000	8,000	8,3332	0,000	8,000	0,000	1,000	1,000
160	80302045	7,000	5,000	0,000	8,000	0,000	8,000	0,000	8,000	8,000	8,3332	0,000	8,000	0,000	1,000	1,000
161	80302046	10,000	10,000	3,000	10,000	2,000	7,000	4,000	4,000	4,000	0,000	0,000	2,000	1,000	4,000	0,000
248	9023214	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
45	10214681	3,000	0,000	0,000	0,000	0,000	2,000	0,000	0,000	2,000	0,000	2,000	0,000	2,000	0,000	0,000
286	90670111	3,000	2,000	0,000	3,000	1,000	6,000	1,000	2,000	3,000	0,000	0,000	3,000	2,000	0,000	0,000
76	10801000	4,000	6,000	0,000	0,000	0,000	0,000	2,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
132	30600011	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
385	CPB3462040	1,000	0,9200	0,000	2,4852	0,2516	0,000	0,4620	0,000	4,000	0,000	0,000	0,000	0,000	0,0125	0,000
237	90232300	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
438	CPG3248096	0,000	3,5937	0,000	0,000	0,1100	0,6340	0,1407	0,250	0,000	0,000	0,000	0,000	0,000	0,000	1,6664
142	50412280	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
257	90401322	0,000	0,000	0,000	0,000	0,000	4,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
408	CPA5240252	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
417	CPB4200240	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
411	CPG3260120	4,500	7,8466	2,160	2,9596	0,7759	23,2596	0,000	1,5575	0,000	0,000	0,6524	0,000	0,2760	0,000	0,000
253	90400321	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	28,6769	0,000	0,000	0,000	1,0000	3,0386	1,7500
254	90400323	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
256	90400326	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
384	CEM423096	0,000	2,0220	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
113	10100196	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,7142	0,000	0,000	0,000	0,000	0,000	0,000
200	90110156	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
250	90110158	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
581	CD34460100	0,000	18,5000	9,000	0,000	0,000	12,000	3,000	4,000	6,000	1,000	0,000	2,000	2,000	1,500	0,000
230	90240003	3,000	0,000	0,000	4,000	1,000	0,000	2,000	0,000	0,000	0,000	0,000	4,000	2,000	2,000	0,000
330	90624880	3,000	0,000	0,000	0,000	0,000	4,000	1,000	2,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
375	CA14265240	0,000	0,000	0,000	0,000	0,000	0,000	1,4851	0,000	3,000	0,000	(2,0000)	(1,0000)	0,6666	0,347	0,000
90	10757100	2,000	0,000	1,000	0,000	0,000	0,000	1,000	2,000	2,000	0,000	0,000	4,000	0,000	0,000	0,000
351	90810225	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
386	CPB3462040	0,000	0,000	1,9999	0,000	1,9999	0,3333	1,9999	0,250	0,250	0,000	0,000	0,000	0,000	2,4003	0,4999
156	80200624	0,000	1,3155	0,000	0,000	0,000	0,000	0,000	2,000	2,000	0,000	0,000	4,000	0,000	0,000	0,000
408	CPA4840252	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
173	80610031	0,000	1,000	0,000	0,000	0,000	0,000	1,000	0,000	8,000	0,000	0,000	0,000	0,000	0,000	0,000
99	10800808	0,000	0,000	0,000	0,000	12,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
155	80151692	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
297	90602407	3,000	2,000	0,000	4,000	1,000	6,000	2,000	0,000	3,000	0,000	0,000	3,000	2,000	0,000	0,000
100	10800810	0,000	0,000	0,000	0,000	16,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
183	90010006	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
228	90150103	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
340	90810223	2,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
435	CPG3072120	0,000	0,000	12,000	0,000	0,000	0,000	10,000	0,000	0,000	0,000	0,000	0,4150	0,000	0,1248	2,000
445	CPG3472144	0,000	6,000	0,000	0,000	0,000	0,000	0,000	0,000	8,000	0,000	0,000	0,000	0,000	0,000	0,000
218	90151226	2,000	2,000	0,000	4,000	2,000	2,000	1,000	2,000	6,000	0,000	0,000	4,000	2,000	2,000	0,000
245	90250114	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	6,000	0,000	0,000	4,000	0,000	0,000	0,000
340	90151228	2,000	2,000	0,000	4,000	2,000	2,000	1,000	2,000	6,000	0,000	0,000	4,000	2,000	2,000	0,000
45	10621024	3,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
55	10621026	3,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
63	CPA3450120	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	6,000	0,000
48	10225020	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
182	90010004	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	8,000	0,000	0,000	0,000	0,000	0,000	0,000
300	90610003	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	3,000	2,000	0,000	0,000
296	90602404	3,000	2,000	0,000	2,000	1,000	7,000	2,000	4,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
396	CH83260120	0,000	9,000	0,000	0,000	0,000	12,000	0,000	0,000	0,000	0,000	0,000	0,000	3,000	0,000	0,000
461	CS73066240	0,000	0,000	0												

Line	Item #	Week 28 7 Days Ended 5/17/2020	Week 29 7 Days Ended 5/24/2020	Week 30 7 Days Ended 5/31/2020	Week 31 7 Days Ended 6/7/2020	Week 32 7 Days Ended 6/14/2020	Week 33 7 Days Ended 6/21/2020	Week 34 7 Days Ended 6/28/2020	Week 35 7 Days Ended 7/5/2020	Week 36 7 Days Ended 7/12/2020	Week 37 7 Days Ended 7/19/2020	Week 38 7 Days Ended 7/26/2020	Week 39 7 Days Ended 8/2/2020	Week 40 7 Days Ended 8/9/2020	Week 41 7 Days Ended 8/16/2020	Week 42 7 Days Ended 8/23/2020
112	10810428	0.0000	0.0000	4.0000	0.0000	0.0000	8.0000	2.0000	8.0000	6.0000	6.0000	6.0000	6.0000	0.0000	0.0000	0.0000
212	90110315	6.0000	4.0000	0.0000	0.0000	6.0000	0.0000	4.0000	4.0000	4.0000	12.0000	0.0000	6.0000	0.0000	0.0000	0.0000
213	90110316	6.0000	4.0000	0.0000	0.0000	6.0000	0.0000	4.0000	4.0000	4.0000	12.0000	0.0000	6.0000	0.0000	0.0000	0.0000
200	90010102	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
425	CF31648096	0.3750	0.0000	2.0000	4.0398	4.0398	0.3000	3.2315	0.0000	0.0000	1.2576	6.0000	3.4376	5.0000	3.0000	0.0000
74	10500146	6.0000	12.0000	0.0000	0.0000	6.0000	0.0000	18.0000	0.0000	0.0000	6.0000	6.0000	12.0000	0.0000	0.0000	0.0000
189	90014004	2.0000	0.0000	2.0000	0.0000	2.0000	4.0000	1.0000	4.0000	4.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000
330	90648001	4.0000	4.0000	0.0000	0.0000	4.0000	0.0000	4.0000	0.0000	0.0000	12.0000	0.0000	6.0000	0.0000	0.0000	0.0000
444	CF3460120	0.5030	1.2500	0.0000	1.9322	1.9322	0.2250	3.0750	19.0000	15.0000	0.6575	1.9250	2.6810	4.5000	3.2000	0.0000
587	CF34710240	1.2250	0.0000	1.6666	4.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3750	3.6666	3.2000	4.7333	0.0000
54	10420217	1.0000	2.0000	1.0000	3.0000	3.0000	0.0000	11.0000	0.0000	0.0000	5.0000	0.0000	10.0000	0.0000	0.0000	1.0000
80	10610701	0.0000	4.0000	2.0000	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	20.0000
168	80503010	2.0000	3.0000	0.0000	2.0000	2.0000	0.0000	2.0000	0.0000	4.0000	6.0000	0.0000	3.0000	0.0000	0.0000	1.0000
388	90503116	2.0000	3.0000	0.0000	0.0000	0.0000	0.0000	2.0000	4.0000	4.0000	6.0000	0.0000	3.0000	0.0000	0.0000	1.0000
394	CF3460044	6.0000	6.0000	0.0000	0.0000	6.0000	0.0000	4.0000	4.0000	4.0000	6.0000	0.0000	6.0000	0.0000	0.0000	0.0000
169	80300204	5.0000	3.0000	0.0000	0.0000	5.0000	0.0000	5.0000	0.0000	0.0000	5.0000	9.0000	2.0000	0.0000	0.0000	0.0000
248	90230214	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
246	10214561	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
266	90570111	2.0000	2.0000	0.0000	0.0000	2.0000	0.0000	2.0000	0.0000	4.0000	6.0000	0.0000	2.0000	0.0000	0.0000	1.0000
76	10601000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8.0000	20.0000	0.0000	0.0000
132	30600011	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
385	CF3460240	0.0000	0.0000	0.0000	1.7500	0.4373	1.0966	6.2562	0.2000	0.0000	0.0000	0.0000	3.9416	1.6875	0.0000	0.1187
237	90330300	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
438	CF33248096	2.4999	0.0000	0.0000	0.5000	5.0000	0.1863	1.5000	0.0000	0.0000	0.9999	0.6360	0.6360	0.4054	0.0000	0.5787
142	50412260	1.0000	2.0000	1.0000	1.0000	1.0000	3.0000	3.0000	0.0000	0.0000	1.0000	0.0000	2.0000	3.0000	0.0000	0.0000
257	90401322	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
408	CF4240252	0.3500	0.4832	0.0000	0.6031	0.6570	1.0000	1.4444	4.2832	0.0000	0.0000	0.6966	0.2222	0.7304	0.3333	1.1666
417	CF34200240	0.0000	0.0000	0.0000	0.0000	0.5728	0.0000	0.0000	0.4832	0.0000	0.0000	0.0000	0.0000	0.0000	0.4416	0.3312
441	CF33260120	5.1600	3.7500	1.0000	4.7886	0.2500	4.2516	2.5779	11.0000	12.5779	2.5885	2.5885	0.0000	1.7000	2.2500	19.0000
253	90400321	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
254	90400323	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
256	90400326	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
384	CF3420096	0.8580	0.0000	0.2860	0.0000	2.8600	0.0000	0.0000	0.0000	0.0000	0.2854	0.0000	0.0000	0.0000	0.0000	0.0000
113	10101096	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
103	90110225	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
255	90110225	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
381	CD3460100	17.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
258	90240003	1.0000	2.0000	1.0000	1.0000	3.0000	0.0000	3.0000	0.0000	0.0000	1.0000	0.0000	2.0000	3.0000	0.0000	0.0000
332	90624880	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	13.0000	0.0000	0.0000	0.0000
375	CA4286240	0.0000	0.6666	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1666
90	10751100	1.0000	2.0000	0.0000	0.0000	1.0000	0.0000	3.0000	0.0000	0.0000	1.0000	0.0000	2.0000	0.0000	0.0000	0.0000
351	90810225	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
368	CF3486240	0.0000	0.0000	0.0000	0.0000	0.0000	0.8333	0.5999	0.2000	0.0000	0.0000	0.4999	0.4999	0.0000	0.0000	0.0000
156	80200624	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000
406	CP44840252	0.0000	0.0000	1.7291	3.4056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8187
173	80610031	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	8.0000	0.0000	0.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000
99	10808008	0.0000	0.0000	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	12.0000	0.0000	0.0000	0.0000	0.0000	0.0000
155	80154992	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000
207	90602407	2.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.0000	0.0000	3.0000	0.0000	0.0000	1.0000
100	10800810	0.0000	24.0000	0.0000	0.0000	0.0000	8.0000	0.0000	4.0000	0.0000	16.0000	0.0000	0.0000	0.0000	0.0000	0.0000
183	90010009	0.0000	0.0000	0.0000	0.0000	0.0000	10.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
228	90150103	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
349	90810223	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
435	CF32072120	10.0000	0.0000	0.0000	0.0000	8.2080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
218	90151226	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
345	90250514	2.0000	2.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	2.0000	0.0000	0.0000	0.0000
350	90250514	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
55	10230294	1.0000	1.0000	1.0000	1.0000	3.0000	0.0000	9.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
56	10230294	1.0000	1.0000	1.0000	1.0000	3.0000	0.0000	9.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
80	CD3460120	18.0000	6.0000	0.0000	0.0000	36.0000	27.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
48	10220209	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
182	90010004	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
300	90610003	0.0000	2.0000	0.0000	0.0000</											



Line	Item #	Week 58 7 Days Ended 12/13/2020	Week 59 7 Days Ended 12/20/2020	Week 60 7 Days Ended 12/27/2020	Week 61 7 Days Ended 1/3/2021	Week 62 7 Days Ended 1/10/2021	Week 63 7 Days Ended 1/17/2021	Week 64 7 Days Ended 1/24/2021	Week 65 7 Days Ended 1/31/2021	Week 66 7 Days Ended 2/7/2021	Week 67 7 Days Ended 2/14/2021	Week 68 7 Days Ended 2/21/2021	Week 69 7 Days Ended 2/28/2021	Week 70 7 Days Ended 3/7/2021	Week 71 7 Days Ended 3/14/2021	Week 72 7 Days Ended 3/21/2021
112	108101028	0.0000	2.0000	4.0000	6.0000	0.0000	0.0000	6.0000	2.0000	2.0000	2.0000	0.0000	0.0000	0.0000	0.0000	6.0000
212	90110315	0.0000	0.0000	0.0000	9.0000	0.0000	0.0000	6.0000	9.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	6.0000
213	90110316	0.0000	0.0000	0.0000	9.0000	0.0000	0.0000	6.0000	9.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	6.0000
200	90019102	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
425	CR61648096	0.0000	0.0000	8.8365	10.0000	0.0000	0.0000	0.0000	0.1522	0.8666	0.0000	0.0000	7.9500	0.0000	0.0000	0.0000
74	10500148	0.0000	0.0000	8.0000	10.0000	0.0000	0.0000	12.0000	4.0000	6.0000	6.0000	0.0000	0.0000	0.0000	0.0000	18.0000
189	90014004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	2.0000
330	90648001	0.0000	0.0000	0.0000	8.0000	0.0000	0.0000	4.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000
444	CR63460120	1.8750	0.3250	0.5000	8.5000	0.5000	15.0000	10.0000	20.1832	10.0000	0.0000	0.0000	0.9000	0.1000	0.0000	0.0588
387	CF6347040	4.8666	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.9568	0.0000	0.0000	0.0000	0.0000	0.0000	5.8666	0.0000
54	10420217	0.0000	0.0000	1.0000	6.0000	0.0000	0.0000	1.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
80	10810701	0.0000	0.0000	0.0000	12.0000	0.0000	0.0000	8.0000	10.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	4.0000
188	80570010	0.0000	1.0000	2.0000	4.0000	0.0000	0.0000	1.0000	4.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
288	90170116	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000
3	1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
150	80330244	0.0000	0.0000	2.0000	9.0000	0.0000	0.0000	2.0000	2.0000	4.0000	2.0000	0.0000	4.0000	0.0000	2.0000	3.0000
246	80283214	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
46	10214861	0.0000	0.0000	1.0000	4.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
266	80570011	0.0000	1.0000	2.0000	4.0000	0.0000	2.0000	0.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000
76	10601000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
132	30600011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
385	CF63460240	0.6874	0.0000	0.2500	0.0000	0.0000	0.0729	0.2916	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
237	90232300	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
438	CR63248096	2.9998	0.0000	0.7500	0.0000	0.0000	0.9999	0.1787	0.0040	0.0000	0.0000	0.0000	0.0000	0.1000	0.5000	4.5000
142	60412280	0.0000	0.0000	2.0000	1.0000	0.0000	0.0000	1.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
257	90401322	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
468	CPA6240262	1.8526	0.0000	0.0000	0.1111	0.0000	0.9999	0.0000	0.1666	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1504
417	CR64200240	0.1250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1418	0.0000	0.0000	0.0000	0.0000	0.4418	0.0000
441	CR63260120	3.4079	3.6666	3.7000	3.0000	1.0000	4.6666	0.0000	1.6666	0.0000	0.0000	0.0000	1.2500	0.0000	4.5289	3.7886
253	90400321	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
254	90400323	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
256	90400326	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
384	CEM4282096	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2857	0.0000	0.0000	0.0000	0.0000	0.0000	0.2860	4.0225
13	10100196	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
165	80413126	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
201	80413128	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
381	CD13460100	10.0000	2.0000	5.0000	3.0000	7.5000	0.0000	0.0000	0.0000	4.5000	0.0000	0.0000	7.5000	0.0000	6.0000	0.0000
239	80240100	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
332	80654480	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
375	CA4266240	0.0000	0.0000	0.1800	0.0000	0.0000	0.6666	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
90	10757100	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
351	90810225	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
366	CF63466240	0.0000	0.0000	0.0000	2.0000	0.0000	1.1577	0.0000	0.5000	0.0000	0.0000	0.0000	0.0810	0.0000	1.3332	0.0000
156	80200624	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
406	CPA6420262	4.2088	0.0000	0.0000	0.0000	0.0000	1.2000	3.4263	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
173	80610031	2.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
99	10800698	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
155	80151692	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	2.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
297	90602407	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000
100	10800610	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
183	90010009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
228	90150103	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
349	90810223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
435	CR63472120	2.0000	0.0000	12.0000	0.0000	0.0000	0.8832	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
445	CR63472144	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
218	90131226	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
345	80252914	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
108	10810104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
55	80413124	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
380	CD13460120	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	27.0000	0.0000	18.0000	0.0000	36.0000	0.0000	18.0000	27.0000
48	10225209	0.0000	0.0000	0.0000	3.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
182	90010004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
300	90610003	0.0000	1.0000	0.0000	0.0000											



Line	Item #	Week 73	Week 74	Week 75	Week 76	Week 77	Week 78	Week 79	Week 80	Week 81	Week 82	Week 83	Week 84	Week 85	Week 86	Week 87
		7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended
112	10510248	3/28/2010	4/4/2010	4/11/2010	4/18/2010	4/25/2010	5/2/2010	5/9/2010	5/16/2010	5/23/2010	5/30/2010	5/27/2010	6/3/2010	6/10/2010	6/17/2010	6/24/2010
212	90110315	0.0000	8.0000	0.0000	0.0000	10.0000	20.0000	0.0000	4.0000	2.0000	16.0000	0.0000	8.0000	0.0000	26.0000	16.0000
213	90110316	0.0000	6.0000	0.0000	0.0000	0.0000	16.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	41.0000	2.0000
200	90019102	0.0000	6.0000	0.0000	0.0000	0.0000	16.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	41.0000	2.0000
425	CR01648096	2.0000	5.3563	2.8666	3.3828	3.0000	2.1539	2.0000	11.0000	2.3332	14.0277	0.0000	2.0000	5.0000	9.0000	19.7398
74	10500146	0.0000	12.0000	0.0000	0.0000	0.0000	30.0000	0.0000	4.0000	6.0000	46.0000	0.0000	6.0000	0.0000	24.0000	54.0000
189	90014004	0.0000	2.0000	0.0000	0.0000	0.0000	4.0000	0.0000	10.0000	1.0000	5.0000	0.0000	2.0000	0.0000	0.0000	7.0000
330	90648001	3.0000	7.0000	0.0000	3.0000	12.0000	19.0000	0.0000	4.0000	0.0000	8.0000	4.0000	2.0000	0.0000	42.0000	2.0000
444	CR03460120	0.0000	3.0500	0.3750	0.3750	0.3220	19.0250	0.0000	0.0000	4.2550	29.2960	0.2960	10.1250	18.3150	0.6300	15.1250
387	CF8470240	7.3333	1.8000	7.9999	0.0000	7.3333	0.0000	7.3333	0.0000	7.3333	0.0000	10.4582	0.0000	20.8581	0.0000	20.8581
54	10420217	(1.0000)	2.0000	0.0000	0.0000	20.0000	4.0000	0.0000	2.0000	4.0000	8.0000	0.0000	0.0000	7.0000	4.0000	9.0000
80	10510701	1.0000	3.0000	0.0000	1.0000	4.0000	8.0000	0.0000	2.0000	1.0000	9.0000	1.0000	0.0000	0.0000	22.0000	1.0000
188	90070109	1.0000	3.0000	0.0000	1.0000	4.0000	8.0000	0.0000	2.0000	1.0000	9.0000	1.0000	0.0000	0.0000	22.0000	1.0000
288	90070118	1.0000	3.0000	0.0000	1.0000	4.0000	8.0000	0.0000	2.0000	1.0000	9.0000	1.0000	0.0000	0.0000	22.0000	1.0000
125	CR03260144	0.0000	3.6500	0.0000	1.7500	3.7200	0.9900	2.0000	0.0000	2.0000	4.2700	0.0000	0.2500	4.5100	0.0000	15.5100
136	90010104	0.0000	5.0000	0.0000	10.0000	0.0000	6.0000	0.0000	11.0000	0.0000	11.0000	0.0000	11.0000	0.0000	19.0000	15.0000
246	90232124	2.0000	5.0000	0.0000	0.0000	2.0000	7.0000	0.0000	4.0000	0.0000	3.0000	0.0000	1.0000	2.0000	4.0000	1.0000
286	90270911	0.0000	2.0000	0.0000	0.0000	0.0000	4.0000	0.0000	2.0000	0.0000	4.0000	0.0000	0.0000	7.0000	0.0000	8.0000
76	10601000	0.0000	12.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	1.0000	9.0000	0.0000	0.0000	0.0000	21.0000	1.0000
132	30600011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	22.0000	0.0000	0.0000	34.0000	0.0000	32.0000
385	CF83460240	0.8673	4.3706	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	5.0000	8.0000	9.0000
237	90232300	0.0000	2.0000	0.0000	0.6666	0.2516	0.1624	0.0000	4.0000	0.0000	9.4122	0.0000	0.0000	2.0641	0.0000	9.5248
438	CR03248096	0.1187	11.8332	0.9999	0.0000	0.2159	0.1944	0.0000	1.0546	0.0000	0.0000	0.0000	0.0000	0.0000	3.5122	3.5122
142	50412260	0.0000	9.0000	0.0000	0.0000	0.0000	4.0000	0.0000	10.0000	1.0000	8.0000	0.0000	0.0000	8.0000	4.0000	9.0000
257	90401322	3.0000	9.0000	6.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	3.0557	0.0000	0.0000	3.0000	0.0000	0.0000
408	CPA5240252	0.3333	1.4830	0.2333	0.7777	3.6999	4.8621	0.0000	1.3332	0.8943	3.0557	0.0000	0.0000	0.0000	0.1111	4.1464
417	CR84200240	0.5520	1.2513	0.6524	0.0000	0.5520	4.8621	0.0000	0.0000	0.0000	16.7702	2.0000	2.5000	2.3750	0.0000	0.0000
441	CR03260120	2.5000	25.3818	1.5000	0.0451	6.2771	11.1431	9.2200	11.5000	11.5000	16.7702	2.0000	2.5000	7.8176	0.0000	16.2271
253	90400321	3.0000	8.0000	6.0000	0.0000	2.0000	0.0000	0.0000	10.0000	0.0000	1.0000	0.0000	0.0000	3.0000	0.0000	2.0000
254	90400323	3.0000	8.0000	6.0000	0.0000	2.0000	0.0000	0.0000	10.0000	0.0000	1.0000	0.0000	0.0000	3.0000	0.0000	2.0000
256	90400325	3.0000	8.0000	6.0000	0.0000	2.0000	0.0000	0.0000	10.0000	0.0000	1.0000	0.0000	0.0000	3.0000	0.0000	2.0000
384	CPA4820096	0.0000	1.4300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1596	0.0000	0.0000	0.0000	0.0000	4.0010
12	10100196	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000
130	90010105	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000
220	90131526	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000
381	CD03460100	6.0000	5.0000	0.0000	27.5000	6.0000	18.0000	0.0000	14.0000	6.0000	22.5000	3.0000	38.0000	6.0000	49.0000	17.5000
239	90240003	2.0000	4.0000	0.0000	0.0000	2.0000	8.0000	0.0000	4.0000	1.0000	11.0000	0.0000	1.0000	8.0000	4.0000	10.0000
332	90654480	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	1.0000	5.0000	0.0000	0.0000	1.9999	0.0000	2.1982
375	CA44860240	1.9999	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1749	0.0000	0.0000	5.0000	5.0000	0.0000
90	10757100	2.0000	5.0000	0.0000	0.0000	0.0000	5.0000	0.0000	0.0000	0.0000	3.0000	0.0000	1.0000	5.0000	0.0000	0.0000
351	90810225	1.1619	0.8742	0.0000	0.0000	1.1998	2.3765	0.0000	0.0000	0.0000	1.9999	0.0000	0.0000	0.8333	0.0000	4.1797
366	CF83460240	3.0000	5.0000	0.0000	0.0000	2.0000	8.0000	0.0000	2.0000	1.0000	4.0000	0.0000	0.0000	2.0000	0.0000	0.0000
156	80200624	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.2000	0.0000	0.0000	0.0000	0.0000	6.3499
406	CPA4840252	1.6374	0.0000	0.0000	0.0000	3.4583	4.7440	0.0000	0.0000	0.0000	10.0000	0.0000	0.0000	2.0000	0.0000	15.0000
173	80510031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
99	10800608	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
155	80151692	3.0000	5.0000	0.0000	0.0000	2.0000	8.0000	0.0000	2.0000	1.0000	4.0000	0.0000	1.0000	1.0000	0.0000	2.0000
297	90602407	(1.0000)	2.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	8.0000	1.0000	0.0000	0.0000	18.0000	1.0000
100	10800610	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
183	90010009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
228	90150103	3.0000	5.0000	0.0000	0.0000	2.0000	8.0000	0.0000	2.0000	1.0000	3.0000	0.0000	1.0000	1.0000	0.0000	2.0000
349	90810225	4.1664	6.8500	0.0000	0.0000	0.1664	0.0300	0.0000	0.0000	0.0000	0.3203	0.0000	0.0000	0.0058	0.0000	0.1705
435	CR03070120	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10.0000	0.0000	0.0000	0.0000	0.0000	18.0000
746	CR03470144	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8.0000	0.0000	0.0000	0.0000	2.0000	15.0000
216	90232125	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	8.0000	0.0000	0.0000	2.0000	5.0000	8.0000
360	90410224	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	7.0000	0.0000	0.0000
55	10424260	0.0000	2.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	7.0000	4.0000	9.0000
360	CD03460120	18.0000	27.0000	0.0000	81.0000	18.0000	54.0000	0.0000	36.0000	18.0000	27.0000	0.0000	0.0000	0.0000	0.0000	0.0000
48	10225020	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	2.0000	1.0000	5.0000	0.0000	1.0000	3.0000	0.0000	0.0000
182	90010004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
300	90810003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
296	90602404	1.0000	3.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	1.0000	1.0000	2.0000	2.0000	0.0000
366	CR03260120	0.0000	0.0000													



Line	Item #	Week 88 7 Days Ended 7/11/2010	Week 89 7 Days Ended 7/18/2010	Week 90 7 Days Ended 7/25/2010	Week 91 7 Days Ended 8/01/2010	Week 92 7 Days Ended 8/08/2010	Week 93 7 Days Ended 8/15/2010	Week 94 7 Days Ended 8/22/2010	Week 95 7 Days Ended 8/29/2010	Week 96 7 Days Ended 9/05/2010	Week 97 7 Days Ended 9/12/2010	Week 98 7 Days Ended 9/19/2010	Week 99 7 Days Ended 9/26/2010	Week 100 7 Days Ended 10/03/2010	Week 101 7 Days Ended 10/10/2010	Week 102 7 Days Ended 10/17/2010
112	10810126	28,000	4,000	2,000	12,000	0,000	10,000	8,000	2,000	34,000	12,000	16,000	20,000	20,000	6,000	2,000
212	90110315	8,000	16,000	0,000	26,000	0,000	0,000	0,000	36,000	12,000	8,000	0,000	4,000	6,000	5,000	10,000
213	90110316	8,000	16,000	0,000	26,000	0,000	0,000	0,000	36,000	12,000	8,000	0,000	4,000	6,000	5,000	10,000
200	90019102	13,000	3,000	0,000	6,000	0,000	5,000	4,000	0,000	17,000	6,000	8,000	0,000	11,000	3,000	2,000
425	CR51648096	4,980	4,980	15,837	7,733	0,000	17,865	8,000	35,513	36,513	0,000	4,000	5,000	19,281	0,000	9,998
74	10500146	30,000	42,000	30,000	36,000	0,000	58,000	42,000	24,000	0,000	48,000	4,000	6,000	102,000	24,000	6,000
189	90014004	2,000	2,000	0,000	3,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
330	90648001	8,000	16,000	0,000	28,000	0,000	0,000	1,000	32,000	15,000	8,000	0,000	40,000	8,000	2,000	10,000
444	CR33460120	4,000	4,000	32,1250	11,8600	0,0000	25,9625	0,5500	0,3000	40,0886	0,4725	1,7870	0,0000	15,8300	0,0000	0,1296
387	CF53470140	4,000	3,3333	0,0000	10,8666	0,0000	5,5551	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	17,5665	0,0000	0,0000
54	10420217	5,000	6,000	5,000	6,000	0,000	4,000	15,000	3,000	3,000	6,000	0,000	1,000	23,000	4,000	1,000
80	10610701	16,000	24,000	4,000	64,000	0,000	4,000	4,000	167,000	4,000	24,000	0,000	44,000	48,000	4,000	4,000
168	80570010	4,000	8,000	0,000	12,000	0,000	0,000	1,000	17,000	4,000	5,000	0,000	20,000	4,000	2,000	4,000
288	90570118	4,000	8,000	0,000	12,000	0,000	0,000	0,000	17,000	4,000	5,000	0,000	19,000	4,000	2,000	4,000
434	CR23060144	0,000	0,000	4,230	21,160	0,000	5,540	0,000	0,000	15,430	0,000	3,500	0,000	24,120	0,000	1,500
159	80300024	0,000	11,000	3,000	14,000	0,000	8,000	0,000	15,000	11,000	0,000	0,000	14,000	10,000	0,000	3,000
248	90232714	0,000	0,000	0,000	3,000	0,000	2,000	0,000	0,000	1,000	0,000	0,000	1,000	2,000	0,000	1,000
46	10414681	5,000	6,000	5,000	6,000	0,000	11,000	0,000	3,000	2,000	6,000	0,000	1,000	2,000	4,000	0,000
266	10514001	0,000	0,000	0,000	13,000	0,000	6,000	0,000	16,000	6,000	0,000	0,000	20,000	4,000	2,000	4,000
76	10610100	26,000	26,000	26,000	26,000	0,000	26,000	0,000	26,000	26,000	26,000	0,000	26,000	26,000	26,000	0,000
132	36800011	13,000	3,000	0,000	28,000	0,000	8,000	0,000	2,000	0,000	0,000	0,000	0,000	44,000	0,000	0,000
385	CF53470140	0,000	0,2516	4,0541	6,1456	0,0000	2,1100	0,0000	0,3000	6,8414	0,0000	0,0000	1,0000	14,5290	0,0000	0,0000
237	90232300	0,000	0,000	0,000	2,000	0,000	1,000	0,000	4,000	6,5455	0,000	1,000	0,000	2,000	4,000	1,000
438	CR33248096	0,000	0,7182	4,3407	0,0000	0,0000	0,1874	0,0000	0,0000	0,0000	0,0000	0,1966	0,0000	0,4165	0,0000	0,0000
142	50412260	5,000	6,000	5,000	7,000	0,000	11,000	8,000	5,000	7,000	8,000	0,000	2,000	19,000	4,000	1,000
257	90401322	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
408	CP45240252	0,6666	0,2222	4,4817	2,6902	0,0000	1,7832	1,1277	0,5255	16,6347	0,0000	0,4666	0,6815	5,3663	0,0000	0,0000
417	CR54200240	0,5520	0,0000	0,0000	2,4183	0,0000	5,0018	0,0000	3,1468	0,0000	0,0541	0,6227	0,2166	4,9653	0,0000	0,0000
441	CR33260120	1,2000	3,3402	24,9766	23,1342	0,0000	14,9347	4,2500	10,5000	21,3854	0,0000	4,0000	4,75081	75,0081	0,0000	0,0000
253	90400321	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000
254	90400323	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000
256	90400326	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000
384	CEM4282096	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
384	CEM4282096	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
13	10100166	0,000	0,000	2,000	3,000	0,000	8,000	3,000	0,000	6,000	8,000	1,000	1,000	12,000	4,000	1,000
165	80412105	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
220	90110326	0,000	2,000	0,000	3,000	0,000	3,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
220	90110326	0,000	2,000	0,000	3,000	0,000	3,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
220	90110326	0,000	2,000	0,000	3,000	0,000	3,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
322	90648001	4,000	8,000	8,000	10,000	0,000	11,000	8,000	16,000	16,000	28,000	1,000	30,000	17,500	24,000	1,000
375	CA4266240	0,000	0,000	2,8815	2,8815	0,0000	2,2498	0,0000	0,0000	4,1988	0,0000	0,0000	20,0000	4,3248	1,0000	4,0000
90	10757100	0,000	0,000	0,000	6,000	0,000	1,000	1,000	1,000	1,000	0,000	0,000	1,000	3,000	6,000	0,000
351	90810225	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	14,000	2,000	19,000	6,000	2,000
386	CF53466240	0,000	0,000	0,000	7,9159	1,9332	0,9999	0,000	0,000	8,7784	0,000	0,000	0,000	18,000	6,000	2,000
156	80200624	0,000	0,000	0,000	1,9332	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	0,000
406	CP4A40252	2,1428	3,6263	2,4000	2,1000	0,0000	2,0000	1,0000	0,0000	0,0000	0,0000	0,0000	0,0000	1,0000	0,0000	0,0000
173	80510031	0,000	0,000	12,000	16,000	0,000	7,000	0,000	11,000	2,900	1,000	0,000	0,000	35,000	0,000	0,000
99	10800638	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	18,000
155	80151692	0,000	0,000	0,000	3,000	0,000	2,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	2,000	1,000
297	90602407	4,000	8,000	0,000	12,000	0,000	0,000	0,000	16,000	6,000	4,000	0,000	20,000	3,000	2,000	4,000
100	10800610	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	23,000
183	90010009	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	2,000
349	90810223	0,000	0,000	0,000	3,000	0,000	2,000	0,000	1,000	1,000	0,000	0,000	0,000	6,000	4,000	2,000
228	90150103	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	14,000	2,000	19,000	6,000	2,000
435	CR20072120	0,000	1,000	1,000	3,1882	0,000	10,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
445	CR34727144	5,000	7,000	4,000	16,000	0,000	7,000	0,000	11,000	0,000	0,000	0,000	0,000	35,000	0,000	0,000
218	90131226	0,000	0,000	0,000	5,000	0,000	2,000	0,000	4,000	0,000	0,000	0,000	0,000	11,000	3,000	1,000
245	90232514	0,000	0,000	0,000	4,000	0,000	8,000	0,000	4,000	7,000	8,000	0,000	0,000	15,000	0,000	2,000
380	10610100	0,000	0,000	0,000	0,000	0,000	4,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
380	10610100	0,000	0,000	0,000	0,000	0,000	4,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
48	10225020	0,000	0,000	0,000	3,000	0,000	18,000	0,000	18,000	0,000	0,000	0,000	18,000	15,000	6,000	0,000
48	10225020	0,000	0,000	0,000	3,000	0,000	18,000	0,000	18,000	0,000	0,000	0,000	18,000	15,000	6,000	0,000
182	90010004	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
300	90610003	4,000	8,000	0,000	8,000	0,000	0,000	0,000	16,000	4,000	5,000	0,000	19,000	10,000	2,000	2,000
296	90602404	0,000	0,000	0,000	4,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
396	CH3250120	0,000	0,000	0,000	42,000	0,000	15,000	0,000	0,000	0,000	0,000	0,000	42,000	21,000	6,000	5,832
461	CB73															

Line	Item #	Week 103	Week 104	Week 105	Week 106	Week 107	Week 108	Week 109	Week 110	Week 111	Week 112	Week 113	Week 114	Week 115	Week 116	Week 117
		7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended
		10/24/2010	10/31/2010	11/07/2010	11/14/2010	11/21/2010	11/28/2010	12/05/2010	12/12/2010	12/19/2010	12/26/2010	1/02/2011	1/09/2011	1/16/2011	1/23/2011	1/30/2011
112	10810128	0.0000	20.0000	14.0000	18.0000	18.0000	18.0000	0.0000	20.0000	16.0000	14.0000	2.0000	16.0000	0.0000	30.0000	6.0000
212	90110315	0.0000	0.0000	0.0000	4.0000	4.0000	4.0000	44.0000	6.0000	14.0000	6.0000	22.0000	0.0000	0.0000	30.0000	32.0000
213	90110316	0.0000	28.0000	0.0000	4.0000	4.0000	4.0000	4.0000	6.0000	14.0000	6.0000	22.0000	0.0000	0.0000	30.0000	32.0000
200	90019102	4.0000	10.0000	7.0000	9.0000	4.0000	8.0000	1.0000	10.0000	8.0000	8.0000	0.0000	8.0000	0.0000	15.0000	0.0000
425	CRG1648096	0.0000	32.1331	0.0000	16.0932	0.8665	0.0000	0.7168	3.0933	15.4381	2.4096	4.9477	0.0000	4.6678	9.3962	2.5165
74	10500148	0.0000	0.0000	0.0000	0.0000	0.0000	46.0000	24.0000	0.0000	0.0000	6.0000	12.0000	0.0000	0.0000	6.0000	32.0000
189	90014304	3.0000	0.0000	2.0000	0.0000	0.0000	5.0000	0.0000	4.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	3.0000
330	90648001	0.0000	40.0000	0.0000	6.0000	18.0000	6.0000	37.0000	10.0000	24.0000	9.0000	23.0000	2.0000	0.0000	46.0000	39.0000
444	CRG3460120	0.0000	21.1250	0.1000	6.4500	0.1000	4.5000	6.7942	36.8027	16.6380	5.8380	8.2500	21.9500	8.2500	21.9500	2.3000
387	CFB5470240	6.6333	8.8749	1.8375	11.0298	0.0000	0.0000	10.0998	4.1865	8.7883	0.6666	3.0624	3.3333	4.9458	10.7154	2.0000
54	10402017	0.0000	20.0000	0.0000	4.0000	4.0000	8.0000	0.0000	0.0000	16.0000	24.0000	2.0000	0.0000	0.0000	0.0000	12.0000
80	10610701	0.0000	60.0000	0.0000	12.0000	0.0000	36.0000	69.0000	0.0000	16.0000	24.0000	64.0000	0.0000	0.0000	20.0000	44.0000
188	86570193	1.0000	14.0000	0.0000	2.0000	2.0000	2.0000	17.0000	4.0000	11.0000	3.0000	7.0000	2.0000	0.0000	15.0000	10.0000
288	90570116	0.0000	14.0000	0.0000	6.0000	6.0000	6.0000	19.0000	4.0000	11.0000	3.0000	7.0000	2.0000	0.0000	15.0000	10.0000
289	90570117	0.0000	14.0000	0.0000	6.0000	6.0000	6.0000	19.0000	4.0000	11.0000	3.0000	7.0000	2.0000	0.0000	15.0000	10.0000
156	90330244	7.0000	10.0000	0.0000	15.0000	0.0000	0.0000	21.0000	10.0000	11.0000	10.0000	28.0000	0.0000	2.8000	25.0000	13.0000
246	90330244	7.0000	10.0000	0.0000	15.0000	0.0000	0.0000	21.0000	10.0000	11.0000	10.0000	28.0000	0.0000	2.8000	25.0000	13.0000
45	10214861	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.0000	7.0000	4.0000	6.0000	0.0000	15.0000	0.0000	7.0000
266	90570111	0.0000	14.0000	0.0000	0.0000	0.0000	0.0000	19.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	13.0000
76	10601001	0.0000	36.0000	0.0000	20.0000	0.0000	0.0000	17.0000	4.0000	11.0000	3.0000	9.0000	0.0000	0.0000	15.0000	0.0000
132	90600011	3.0000	15.0000	7.0000	9.0000	0.0000	8.0000	24.0000	16.0000	10.0000	20.0000	0.0000	0.0000	16.0000	26.0000	8.0000
385	CFB3460240	0.0000	4.6790	0.0000	6.6333	0.5631	0.0000	7.5374	6.3249	1.5999	2.2332	1.5000	0.0000	4.7914	4.8208	2.1748
237	90232000	10.0000	0.0000	3.0000	11.0000	4.0000	8.0000	5.0000	6.0000	7.0000	4.0000	6.0000	0.0000	5.0000	2.0000	13.0000
438	CRG3248096	0.0000	2.3100	0.0000	2.4543	0.0000	0.0000	2.8959	0.8985	0.0000	0.0000	0.5937	0.0000	0.0000	0.5224	3.5621
142	50412260	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	5.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	12.0000
257	90401322	16.0000	0.0000	0.0000	11.0000	0.0000	1.0000	1.0000	6.0000	0.0000	0.0000	6.0000	0.0000	15.0000	7.0000	0.0000
408	CPA5240252	0.3015	6.9738	0.3333	4.5482	0.0000	0.4444	1.2452	0.8580	4.7775	0.9205	1.2854	0.3333	5.1742	2.5712	0.6666
417	CRB4300240	0.6824	4.4150	0.2250	2.2500	0.0000	0.0000	2.0360	0.3125	3.9715	1.3400	0.8750	0.0000	0.8000	4.6720	0.0000
441	CRG3260120	2.0928	8.0431	5.1354	10.9208	0.2500	1.7000	12.4883	10.0743	3.0283	9.5902	6.8941	2.5000	2.5831	9.8034	6.4888
253	90400321	16.0000	4.0000	5.0000	6.0000	0.0000	3.0000	0.0000	6.0000	0.0000	6.0000	9.0000	0.0000	15.0000	7.0000	0.0000
254	90400323	16.0000	4.0000	5.0000	6.0000	0.0000	3.0000	0.0000	6.0000	0.0000	6.0000	9.0000	0.0000	15.0000	7.0000	0.0000
256	90400326	16.0000	4.0000	5.0000	6.0000	0.0000	3.0000	0.0000	6.0000	0.0000	6.0000	9.0000	0.0000	15.0000	7.0000	0.0000
384	CEM4260096	0.0000	3.5712	0.0000	0.0000	0.0000	0.0000	1.9728	2.0958	1.4285	1.7180	0.2856	0.0000	1.1428	2.2956	0.2856
13	10100198	10.0000	2.0000	3.0000	11.0000	4.0000	7.0000	0.0000	6.0000	0.0000	2.0000	5.0000	0.0000	15.0000	7.0000	12.0000
165	90110195	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
201	90110126	0.0000	19.0000	0.0000	31.5000	0.0000	4.0000	0.0000	4.0000	0.0000	0.0000	1.0000	0.0000	9.0000	0.0000	0.0000
381	CDJ3460100	16.0000	0.0000	0.0000	0.0000	0.0000	0.0000	63.0000	0.0000	0.0000	0.0000	67.0000	0.0000	0.0000	36.5000	12.5000
239	90240003	60.0000	2.0000	3.0000	0.0000	0.0000	0.0000	5.0000	6.0000	7.0000	10.0000	4.0000	0.0000	15.0000	7.0000	0.0000
332	90654480	0.0000	14.0000	0.0000	2.0000	0.0000	0.0000	16.0000	0.0000	7.0000	3.0000	5.0000	0.0000	15.0000	10.0000	0.0000
90	10757100	0.0000	6.5115	0.0000	7.9940	0.0000	0.0000	2.0199	2.3468	1.0967	2.4705	1.2469	0.0000	1.4268	2.7123	0.0000
351	90810225	6.0000	20.0000	14.0000	18.0000	4.0000	4.0000	10.0000	6.0000	16.0000	16.0000	2.0000	0.0000	10.0000	30.0000	6.0000
386	CFB3460240	0.0000	6.4680	0.0000	0.3500	0.0000	0.0000	0.8165	3.9914	0.3333	5.3088	0.3250	0.6666	0.4269	4.7524	1.3166
156	80200624	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	1.0000	4.0000	0.0000	1.0000	3.0000	0.0000	2.0000	4.0000	0.0000
406	CPA4840252	0.0000	7.3499	0.0000	0.0000	3.4582	2.1428	0.0000	0.0000	0.0000	0.0000	0.3000	0.0000	2.6000	0.0000	2.0748
173	80610031	0.0000	12.0000	0.0000	14.0000	0.0000	0.0000	11.0000	9.0000	4.0000	3.0000	5.0000	0.0000	9.0000	15.0000	0.0000
99	10800608	30.0000	32.0000	27.0000	77.0000	12.0000	21.0000	12.0000	18.0000	0.0000	2.0000	77.0000	0.0000	70.0000	35.0000	46.0000
155	80151992	10.0000	0.0000	3.0000	11.0000	4.0000	4.0000	5.0000	1.0000	0.0000	0.0000	1.0000	0.0000	15.0000	7.0000	1.0000
297	90602407	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	14.0000	2.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	13.0000
100	10800610	38.0000	24.0000	8.0000	0.0000	0.0000	28.0000	16.0000	24.0000	0.0000	7.0000	29.0000	0.0000	0.0000	2.0000	59.0000
183	90010099	4.0000	20.0000	14.0000	18.0000	8.0000	16.0000	2.0000	20.0000	16.0000	16.0000	2.0000	16.0000	0.0000	30.0000	6.0000
228	90150108	13.0000	3.0000	3.0000	11.0000	4.0000	4.0000	6.0000	6.0000	0.0000	5.0000	1.0000	0.0000	15.0000	7.0000	1.0000
349	90810225	6.0000	20.0000	14.0000	18.0000	8.0000	16.0000	2.0000	20.0000	16.0000	16.0000	2.0000	16.0000	0.0000	30.0000	6.0000
436	CRG0070120	0.0000	12.0000	0.0000	14.0000	0.0000	0.0000	11.7491	0.0000	0.0000	10.0000	8.0000	4.0000	0.0000	0.0000	0.0000
445	CRG3472144	0.0000	0.0000	2.0000	0.0000	0.0000	3.0000	0.0000	0.0000	4.0000	3.0000	5.0000	0.0000	0.0000	15.0000	0.0000
218	90131226	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
345	90232014	6.0000	20.0000	14.0000	18.0000	8.0000	16.0000	2.0000	20.0000	16.0000	16.0000	2.0000	16.0000	0.0000	30.0000	6.0000
55	10610194	0.0000	14.0000	0.0000	0.0000	0.0000	0.0000	17.0000	4.0000	16.0000	4.0000	19.0000	0.0000	4.0000	38.0000	6.0000
380	CDJ3460120	18.0000	0.0000	0.0000	0.0000	0.0000	0.0000	90.0000	0.0000	0.0000	0.0000	36.0000	0.0000	0.0000	27.0000	7.0000
48	10225020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	5.0000
182	90010004	2.0000	0.0000	0.0000	0.0000	0.0000	10.0000	10.0000	20.0000	16.0000	16.0000	2.0000	16.0000	0.0000	30.0000	6.0000
300	90610003	1.0000	12.0000	0												

Line	Item #	Week 118 7 Days Ended	Week 119 7 Days Ended	Week 120 7 Days Ended	Week 121 7 Days Ended	Week 122 7 Days Ended	Week 123 7 Days Ended	Week 124 7 Days Ended	Week 125 7 Days Ended	Week 126 7 Days Ended	Week 127 7 Days Ended	Week 128 7 Days Ended	Week 129 7 Days Ended	Week 130 7 Days Ended	Week 131 7 Days Ended	Week 132 7 Days Ended
112	10810428	20,000	18,000	10,000	34,000	2,000	18,000	22,000	0,000	30,000	18,000	0,000	20,000	6,000	0,000	0,000
212	90110315	8,000	17,000	6,000	22,000	20,000	12,000	24,000	0,000	30,000	0,000	16,000	0,000	14,000	0,000	2,000
213	90110316	8,000	17,000	6,000	22,000	20,000	12,000	24,000	0,000	30,000	0,000	16,000	0,000	14,000	0,000	2,000
200	90019102	10,000	8,000	2,000	20,000	2,000	8,000	16,000	0,000	15,000	8,000	0,000	10,000	5,000	0,000	0,000
425	CR31648096	3,1484	10,1572	11,1166	12,7960	9,4798	8,3256	8,3256	2,750	18,8651	6,4784	17,0165	7,7500	6,5040	3,2298	0,0000
74	10500146	52,000	30,000	1,000	12,000	6,000	0,000	0,000	18,000	0,000	0,000	0,000	0,000	12,000	4,000	6,000
189	90014004	5,000	7,000	1,000	0,000	1,000	0,000	0,000	0,000	3,000	0,000	0,000	0,000	5,000	3,000	0,000
330	90648001	13,000	14,000	4,000	33,000	22,000	18,000	30,000	0,000	53,000	0,000	24,000	0,000	32,000	0,000	5,000
444	CR33460120	6,4645	4,2850	2,9850	27,5575	12,1575	2,7150	10,9471	0,3750	32,4349	0,1000	11,8550	0,0810	30,4208	3,0200	16,5985
387	CF83470240	12,8039	4,0668	12,6186	6,6333	10,1248	7,3957	7,3957	15,4289	0,0000	5,1020	0,0000	0,0000	7,0520	5,7868	0,0000
54	10420217	7,000	1,000	2,000	1,000	0,000	0,000	0,000	4,000	0,000	0,000	1,000	0,000	4,000	4,000	2,000
80	10610701	72,000	4,000	8,000	52,000	0,000	32,000	0,000	64,000	0,000	20,000	0,000	44,000	80,000	34,000	14,000
188	80670010	6,000	6,000	2,000	11,000	10,000	6,000	10,000	0,000	15,000	0,000	8,000	0,000	11,000	0,000	3,000
288	90670118	6,000	2,000	2,000	11,000	10,000	6,000	10,000	0,000	15,000	0,000	8,000	0,000	11,000	0,000	3,000
434	CR30607144	3,8195	2,7300	4,3800	3,6500	6,6500	11,0349	8,9725	0,7500	4,8800	3,9999	3,7700	8,8299	0,0000	11,0599	8,5700
159	90300024	7,000	0,000	0,000	29,000	2,000	0,000	0,000	46,000	0,000	0,000	0,000	0,000	42,000	0,000	0,000
400	90300024	4,000	4,000	4,000	8,000	4,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
245	10314364	4,000	4,000	4,000	8,000	4,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
266	90670091	6,000	3,000	3,000	11,000	9,000	6,000	10,000	0,000	15,000	0,000	8,000	0,000	11,000	4,000	2,000
76	10610100	22,000	12,000	6,000	10,000	22,000	4,000	26,000	0,000	36,000	0,000	26,000	12,000	40,000	14,000	12,000
132	30600011	10,000	8,000	5,000	15,000	1,000	9,000	13,000	0,000	30,000	0,000	0,000	10,000	4,000	5,000	0,000
385	CF83462040	5,3387	8,8642	1,5000	2,4000	3,8832	6,6791	3,8916	0,8375	11,4682	0,3333	4,3477	3,1037	6,0000	4,7303	8,8414
237	90232300	4,000	4,000	4,000	7,000	3,000	9,000	6,000	5,000	5,000	0,000	5,000	5,000	5,000	7,000	5,000
438	CR3248096	6,3716	1,2500	1,9750	4,000	2,5853	0,5486	0,1215	5,0666	0,0000	0,0000	0,3159	1,5000	3,5749	6,0603	1,8901
142	50412280	7,000	1,000	4,000	1,000	0,000	0,000	0,000	5,000	0,000	0,000	1,000	0,000	4,000	4,000	4,000
257	90401322	4,000	4,000	4,000	10,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
408	CP45240252	6,4233	3,1742	3,2805	1,1221	2,3152	6,7298	1,6029	0,2222	16,7339	0,6388	2,1147	1,3620	0,0000	6,3346	2,0170
417	CR64200240	1,5745	1,2975	1,4468	3,5437	3,1335	1,1135	2,0798	0,0000	3,7337	0,0000	1,5368	0,0000	1,4703	1,0509	0,0000
441	CR33260120	6,7359	10,8792	6,7893	8,8657	9,0342	3,1441	14,0054	0,0000	37,3988	0,0000	12,1970	8,6015	13,0000	11,7984	64,1821
253	90400321	4,000	4,000	4,000	16,000	0,000	7,000	4,000	4,000	10,000	8,000	4,000	0,000	8,000	2,000	10,000
254	90400323	0,000	0,000	18,000	20,000	4,000	9,000	5,000	0,000	3,000	8,000	4,000	0,000	10,000	4,000	10,000
256	90400326	0,000	4,000	18,000	10,000	4,000	9,000	5,000	0,000	3,000	8,000	4,000	0,000	10,000	4,000	10,000
384	CF84282096	2,8044	0,7150	2,0007	2,8578	0,3857	1,7142	0,0000	0,0000	0,0000	0,0000	2,427	0,8696	0,0000	2,5393	1,1294
13	10100186	8,000	6,000	9,000	10,000	4,000	9,000	8,000	8,000	8,000	10,000	5,000	5,000	8,000	8,000	7,000
165	80412105	3,000	3,000	3,000	10,000	4,000	9,000	5,000	4,000	4,000	8,000	4,000	0,000	4,000	4,000	4,000
220	90134265	0,000	0,000	0,000	2,000	1,000	2,000	0,000	0,000	2,000	0,000	0,000	0,000	0,000	0,000	0,000
550	90134265	15,000	6,000	9,000	9,000	1,000	6,000	7,000	0,000	7,000	0,000	0,000	0,000	6,000	3,000	3,000
250	90240003	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
332	90640488	4,000	4,000	4,000	11,000	5,000	6,000	10,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
375	CA4586240	2,4416	3,9747	1,9966	2,7547	0,5333	4,0000	6,0000	0,0000	18,0000	8,0000	2,9665	0,9999	0,1290	1,2469	3,4697
90	10757100	3,000	5,000	12,000	0,000	8,000	4,000	0,000	0,000	11,000	18,000	4,000	3,000	8,000	1,000	7,000
351	90810225	20,000	16,000	2,000	30,000	2,000	16,000	26,000	0,000	32,000	0,000	20,000	0,000	20,000	10,000	0,000
366	CF83462040	2,8411	1,0914	1,6665	2,7866	3,0951	1,2599	1,4248	0,0000	4,0258	0,0000	3,4248	0,1000	0,0000	2,0826	2,0617
156	80200624	4,000	1,000	2,000	3,000	1,000	0,000	0,000	3,000	0,000	0,000	1,000	10,000	5,000	11,000	8,000
406	CP48420252	5,0206	7,7886	5,0000	8,0000	0,4000	0,0000	6,1668	5,1000	0,0000	0,0000	0,0000	0,5167	0,0000	3,6312	0,0000
173	80510031	7,000	10,000	5,000	8,000	8,000	1,000	12,000	0,000	23,000	0,000	11,000	3,000	0,000	1,000	9,000
59	10800688	21,000	15,000	67,000	68,000	17,000	63,000	42,000	16,000	62,000	40,000	16,000	27,000	29,000	20,000	34,000
155	80151692	3,000	4,000	9,000	5,000	4,000	9,000	7,000	8,000	8,000	8,000	5,000	5,000	3,000	7,000	7,000
297	90602407	4,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
100	10800610	22,000	20,000	6,000	35,000	6,000	0,000	0,000	13,000	7,000	0,000	3,000	0,000	4,000	1,000	1,000
183	90010009	16,000	6,000	6,000	30,000	6,000	16,000	26,000	0,000	34,000	18,000	0,000	20,000	9,000	10,000	0,000
228	90150103	3,000	4,000	6,000	3,000	7,000	9,000	10,000	5,000	3,000	8,000	5,000	5,000	3,000	7,000	7,000
349	90810229	20,000	16,000	1,000	30,000	2,000	16,000	26,000	0,000	30,000	18,000	0,000	20,000	9,000	10,000	0,000
445	CR3007120	2,7500	0,0000	1,0000	8,0000	0,8500	0,0000	6,0000	0,0000	8,0500	5,0000	1,0200	10,0000	8,0000	1,4400	1,1900
445	CR33472144	7,000	10,000	2,000	8,000	8,000	1,000	12,000	0,000	8,000	0,000	11,000	3,000	0,000	1,000	5,000
218	90131226	4,000	3,000	2,000	2,000	0,000	0,000	0,000	1,000	1,000	0,000	0,000	0,000	4,000	1,000	0,000
245	90252614	3,000	1,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
352	90810224	20,000	2,000	2,000	30,000	2,000	16,000	26,000	0,000	32,000	0,000	20,000	0,000	20,000	10,000	0,000
380	CA3450120	13,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
48	10205200	4,000	0,000	0,000	1,000	1,000	0,000	0,000	6,000	2,000	0,000	0,000	0,000	3,000	0,000	2,000
182	90010004	20,000	6,000	6,000	30,000	6,000	16,000	30,000	0,000	34,000	18,000	0,000	20,000	9,000	10,000	0,000
300	90810003	5,000	0,000	0,000	11,000	4,000	6,000	10,000	0,000	13,000	0,000	8,000	0,000	4,000	0,000	0,000
296	90802404	1,000	6,000	2,000	0,000	0,000	0,000	0,000	3,000	0,000	0,000	0,000	0,000	4,000	0,000	3,000
396	CH3260120	0,000	0,000	0,000	6,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
461	CA3206240	0,8832	5,0656	11,3724	0,0000	0,0000	0,0000	9,9296	7,5948	0,0000	10,9892	8,4664	0,0000	137,5000	0,0000	6,6750
369	CA3205240	1,4000	0,8750	2,6250	1,0500	2,6250	0,3500	1,5750	0,0000	2,4500	0,0000	1,6875	0,0000	3,2500	1,7500	2,4500



Line	Item #	Week 133 7 Days Ended	Week 134 7 Days Ended	Week 135 7 Days Ended	Week 136 7 Days Ended	Week 137 7 Days Ended	Week 138 7 Days Ended	Week 139 7 Days Ended	Week 140 7 Days Ended	Week 141 7 Days Ended	Week 142 7 Days Ended	Week 143 7 Days Ended	Week 144 7 Days Ended	Week 145 7 Days Ended	Week 146 7 Days Ended	Week 147 7 Days Ended
112	10510246	4,000	28,000	0,000	12,000	30,000	50,000	4,000	0,000	18,000	82,000	62,000	24,000	20,000	40,000	26,000
212	90110315	0,000	4,000	25,000	0,000	0,000	51,000	14,000	18,000	22,000	22,000	6,000	24,000	24,000	10,000	18,000
213	90110316	0,000	4,000	25,000	0,000	0,000	51,000	14,000	18,000	22,000	22,000	6,000	24,000	24,000	10,000	18,000
200	90019102	0,000	0,000	0,000	0,000	15,000	0,000	0,000	0,000	14,000	18,000	9,000	6,000	5,000	10,000	7,000
425	CR01648096	4,2876	4,435	8,9131	1,5263	3,4134	13,4479	13,4966	8,5384	5,3742	22,5145	1,5270	3,3498	5,1130	9,0184	13,3774
174	10500146	6,000	36,000	44,000	24,000	10,000	0,000	0,000	0,000	0,000	6,000	0,000	0,000	0,000	12,000	0,000
180	90014004	2,000	3,000	0,000	2,000	10,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
330	90648001	10,000	45,000	18,000	0,000	27,000	0,000	29,000	0,000	32,000	33,000	12,000	36,000	36,000	15,000	31,000
487	CR03460120	0,000	78,2750	6,5790	7,9999	1,9999	8,3300	51,4770	8,6250	38,6119	15,1317	2,5715	50,1400	3,3200	15,4282	18,2841
387	CFB3470240	0,000	13,9560	13,9560	16,7916	4,5999	4,5999	12,9248	19,8415	0,0000	24,1475	0,0000	3,9000	3,9000	13,5479	13,7020
54	10402017	4,000	6,000	9,000	3,000	0,000	0,000	1,000	0,000	0,000	74,000	20,000	48,000	0,000	2,000	0,000
80	10510101	8,000	28,000	16,000	36,000	44,000	67,000	134,000	36,000	55,000	0,000	0,000	0,000	0,000	0,000	0,000
168	80201010	2,000	15,000	13,000	0,000	0,000	15,000	11,000	2,000	1,000	0,000	0,000	0,000	0,000	0,000	1,000
283	90201116	2,000	15,000	13,000	0,000	0,000	15,000	11,000	2,000	1,000	0,000	0,000	0,000	0,000	0,000	1,000
284	90201116	2,000	15,000	13,000	0,000	0,000	15,000	11,000	2,000	1,000	0,000	0,000	0,000	0,000	0,000	1,000
159	90300244	4,000	5,000	2,000	14,4209	0,000	4,000	16,209	1,000	1,000	16,000	4,000	30,000	6,000	10,000	10,000
160	90300244	4,000	5,000	2,000	14,4209	0,000	4,000	16,209	1,000	1,000	16,000	4,000	30,000	6,000	10,000	10,000
248	90202214	4,000	0,000	2,000	2,000	16,000	0,000	4,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
248	90202214	4,000	0,000	2,000	2,000	16,000	0,000	4,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
45	10214061	3,000	5,000	0,000	3,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
266	90570111	2,000	16,000	12,000	0,000	0,000	21,000	5,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
76	10501000	0,000	0,000	30,000	0,000	26,000	0,000	18,000	0,000	10,000	32,000	10,000	0,000	0,000	36,000	34,000
132	30600011	2,000	0,000	0,000	6,000	15,000	0,000	2,000	0,000	14,000	0,000	9,000	6,000	5,000	10,000	9,000
385	CFB3460240	0,000	0,000	10,8055	2,0749	3,7469	3,5331	3,2248	4,5000	2,1123	5,6998	2,7000	0,000	2,4125	0,000	14,4762
237	90230300	4,000	0,000	2,000	2,000	14,000	0,000	0,000	0,000	12,000	12,000	24,000	6,000	9,000	3,000	5,000
438	CR03248096	2,4836	1,4688	1,9862	4,1488	3,5396	1,0094	1,0094	0,000	0,000	2,1855	0,000	0,000	0,3159	0,5488	2,9181
142	50412360	0,000	7,000	8,000	0,000	0,000	0,000	1,000	0,000	0,000	2,000	0,000	0,000	0,000	2,000	0,000
257	90401322	0,000	0,000	0,000	0,000	23,000	0,000	0,000	0,000	4,000	0,000	20,000	0,000	0,000	0,000	6,000
408	CPA5240252	1,2276	0,9999	3,9521	1,7339	0,8888	4,6781	4,1146	2,0156	1,2101	7,5154	0,5079	11,298	1,9840	4,5246	11,7209
417	CFB4200040	0,000	0,000	1,6197	3,2760	0,000	1,9497	6,6949	4,0750	4,8872	4,8872	0,000	1,6912	0,5625	3,0488	3,2205
441	CR03260120	1,7500	2,6500	59,7859	15,0966	4,3902	11,2981	63,1018	13,9137	16,0753	16,9395	4,7400	14,5964	5,5147	62,5570	11,8252
253	90400321	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	4,000	0,000	19,000	0,000	0,000	0,000	0,000
254	90400323	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	4,000	0,000	12,000	4,000	0,000	0,000	0,000
256	90400326	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	4,000	0,000	12,000	4,000	0,000	0,000	0,000
384	CFB4200096	0,150	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
13	10101196	4,000	7,000	2,985	0,7145	0,8076	0,7145	2,985	0,7145	0,8076	0,714	0,000	4,000	3,5713	0,4289	4,5727
105	90201106	0,000	0,000	0,000	0,000	17,000	0,000	0,000	0,000	11,000	14,000	24,000	0,000	0,000	0,000	19,000
205	90131526	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
384	CFB3460240	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
384	CFB3460240	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
250	90240003	4,000	7,000	8,000	0,000	0,000	0,000	0,000	0,000	16,000	0,000	20,000	60,000	12,000	34,500	28,500
332	90624980	0,000	12,000	16,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
375	CA4286240	0,000	0,000	2,9968	2,4699	0,000	0,000	0,000	0,000	11,000	5,000	3,000	20,000	10,000	0,000	14,000
30	10757100	1,000	0,000	7,000	0,000	16,000	0,000	1,000	0,000	0,000	10,000	1,3124	0,000	2,4698	1,2489	3,8330
351	90810225	4,000	0,000	0,000	12,000	30,000	30,000	4,000	0,000	28,000	38,000	18,000	12,000	10,000	20,000	18,000
386	CFB3460240	0,000	0,000	7,4684	1,1666	0,000	3,6526	4,1895	1,549	2,2476	3,5331	0,300	2,6666	0,500	0,0332	3,9332
156	80200624	3,000	4,000	4,000	2,000	2,000	0,000	1,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000
406	CPA4840252	1,6071	0,000	6,5707	0,000	4,1499	3,1154	1,5000	0,000	4,0034	4,1749	1,0000	0,000	0,000	1,3000	4,4000
173	80510031	1,000	0,000	14,000	2,000	3,000	8,000	9,000	15,000	5,000	16,000	9,000	0,000	8,000	0,000	40,000
99	10808098	8,000	12,000	33,000	9,000	123,000	18,000	2,000	0,000	7,000	43,000	51,000	14,000	77,000	26,000	31,000
155	80151692	4,000	3,000	2,000	0,000	15,000	0,000	7,000	0,000	1,000	5,000	0,000	0,000	8,000	8,000	13,000
297	90602407	2,000	4,000	11,000	0,000	0,000	0,000	0,000	0,000	1,000	0,000	1,000	0,000	0,000	0,000	0,000
100	10808010	4,000	15,000	40,000	12,000	0,000	0,000	0,000	0,000	3,000	34,000	39,000	0,000	0,000	0,000	4,000
183	90010039	4,000	24,000	2,000	0,000	30,000	30,000	30,000	0,000	28,000	36,000	15,000	12,000	10,000	20,000	14,000
228	90150109	4,000	3,000	2,000	0,000	15,000	0,000	7,000	0,000	1,000	5,000	0,000	0,000	8,000	8,000	15,000
349	90810225	4,000	0,000	0,000	12,000	30,000	30,000	8,000	0,000	32,000	36,000	15,000	12,000	10,000	20,000	22,000
436	CR03007120	0,7500	5,000	0,000	9,4500	2,000	0,000	0,000	0,000	3,000	4,4850	2,000	6,000	0,000	0,000	0,000
445	CR03472144	1,000	0,000	14,000	2,000	3,000	8,000	9,000	15,000	5,000	16,000	9,000	0,000	8,000	0,000	40,000
218	90131226	0,000	2,000	0,000	1,000	0,000	0,000	0,000	0,000	2,000	0,000	0,000	0,000	0,000	0,000	3,000
345	90252514	0,000	7,000	2,000	2,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
345	90252514	0,000	7,000	2,000	2,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
345	90252514	0,000	7,000	2,000	2,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
365	10402017	5,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
380	CFB3460240	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
48	10202020	1,000	1,000	3,000	0,000	0,000	0,000	1,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
182	90010004	4,000	0,000	4,000	12,000	30,000	30,000	0,000	0,000	28,000	36,000	18,000	12,000	10,000	20,000	14,000
300	90610003	0,000	4,000	0,000	0,000	0,000										

Line	Item #	Week 148 7 Days Ended 9/4/2011	Week 149 7 Days Ended 9/11/2011	Week 150 7 Days Ended 9/18/2011	Week 151 7 Days Ended 9/25/2011	Week 152 7 Days Ended 10/2/2011	Week 153 7 Days Ended 10/9/2011	Week 154 7 Days Ended 10/16/2011	Week 155 7 Days Ended 10/23/2011	Week 156 7 Days Ended 10/30/2011	Mean Weekly Demand (μ)	3-Yr Std Dev/Std of Weekly Dmd (σ)	Coefficient of Variation $\frac{\sigma}{\mu}$	Coefficient of Variation $\frac{\sigma}{\mu}$	Sequence #
112	10810428	0.0000	6.0000	8.0000	46.0000	46.0000	4.0000	4.0000	12.0000	10.0000	9.0064	12.6340	1.40	71	
212	90110315	10.0000	4.0000	2.0000	24.0000	23.0000	0.0000	4.0000	18.0000	8.0000	7.3718	10.2840	1.40	72	
213	90110316	10.0000	4.0000	0.0000	26.0000	23.0000	0.0000	4.0000	20.0000	6.0000	7.3718	10.3300	1.40	73	
200	90019102	2.0000	3.0000	4.0000	10.0000	10.0000	2.0000	0.0000	5.0000	3.0000	3.4038	4.8300	1.42	74	
425	CR01648096	33.1173	12.0000	4.7067	5.0364	5.0768	0.0000	1.4385	3.8118	27.4537	10.8718	6.7240	1.42	75	
74	10500146	0.0000	0.0000	16.0000	0.0000	0.0000	26.0000	0.0000	6.0000	12.0000	10.8718	15.6650	1.43	76	
189	90014004	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	4.0000	3.0000	1.2438	1.7760	1.43	77	
330	90648001	15.0000	8.0000	8.0000	33.0000	38.0000	2.0000	7.0000	14.0000	6.0000	8.9679	12.9060	1.44	78	
444	CR03460120	18.4571	10.8653	7.7500	6.1345	5.5638	20.2131	17.6883	8.5002	17.6883	8.5002	12.2700	1.44	79	
387	CFB470240	0.0000	0.0000	2.1666	10.7873	1.3353	4.2375	14.4644	0.0000	26.1332	3.8572	5.9380	1.45	80	
54	10420277	0.0000	12.0000	12.0000	56.0000	48.0000	4.0000	3.0000	2.0000	12.0000	16.9038	25.0840	1.47	81	
80	10610701	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1731	4.7030	1.48	82	
168	90570010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0512	4.7030	1.48	83	
438	CR02360144	1.8000	1.8000	9.4700	5.3500	4.2000	49.2584	7.6652	7.4900	4.0775	5.3770	6.3700	1.48	84	
159	90300204	15.0000	14.0000	13.0000	15.0000	15.0000	5.0000	0.0000	10.0000	12.0000	5.7244	8.6500	1.51	85	
246	90263214	7.0000	1.0000	9.0000	6.0000	12.0000	2.0000	1.0000	3.0000	3.0000	2.1170	3.5470	1.51	87	
45	10214061	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	3.2800	3.2800	1.53	88	
286	90570011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1090	4.7690	1.53	88	
76	10601000	16.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1090	4.7690	1.53	88	
132	30600011	0.0000	3.0000	4.0000	14.0000	13.0000	2.0000	0.0000	6.0000	6.0000	3.7372	5.8470	1.54	90	
385	CFB460240	10.1998	2.6520	5.3916	2.6666	5.2956	16.4416	1.2541	12.6334	12.6334	2.1042	3.2770	1.56	92	
237	90232300	6.0000	0.0000	9.0000	9.0000	11.0000	2.0000	0.0000	2.0000	3.0000	2.3333	3.6940	1.58	93	
438	CR03248096	0.0833	0.2116	0.3638	0.2430	1.1429	0.0486	1.4626	0.3839	1.2500	1.0905	1.7310	1.59	94	
142	50412260	0.0000	0.0000	4.0000	0.0000	0.0000	1.0000	1.0000	2.0000	6.0000	1.8141	2.8680	1.60	95	
257	90401322	6.0000	0.0000	5.0000	1.0000	1.0000	0.0000	0.0000	10.0000	0.0000	2.7051	4.3270	1.60	96	
408	CPA5240252	3.9680	3.9680	3.4284	1.6775	2.2401	0.8489	2.7574	6.0339	6.0339	1.6796	2.5250	1.60	97	
417	CRB4200240	1.3320	1.1875	1.3125	3.3705	0.0000	0.8562	1.7623	1.7854	1.7854	0.8028	1.2820	1.60	98	
441	CR03260120	6.0802	12.2885	18.6758	13.1007	90.6425	5.6129	7.5000	55.1834	13.6683	14.7780	1.7780	1.60	99	
253	90400321	6.0000	0.0000	5.0000	1.0000	1.0000	0.0000	0.0000	10.0000	0.0000	2.6282	4.2230	1.61	100	
254	90400323	4.0000	0.0000	5.0000	1.0000	1.0000	0.0000	0.0000	10.0000	0.0000	2.6282	4.2230	1.61	100	
256	90400326	6.0000	0.0000	5.0000	1.0000	1.0000	0.0000	0.0000	10.0000	0.0000	2.6282	4.2230	1.61	100	
384	CEM4620096	2.7141	2.5713	0.9969	0.0000	1.8570	2.8570	3.5712	2.0000	2.8569	4.3430	1.3860	1.62	102	
113	10101016	6.0000	1.0000	5.0000	0.0000	13.0000	2.0000	2.0000	10.0000	5.0000	2.6921	4.3500	1.63	104	
220	90131526	0.0000	3.0000	4.0000	2.0000	2.0000	1.0000	0.0000	4.0000	5.0000	1.0705	1.7420	1.63	106	
381	CDAA60100	20.0000	24.0000	24.5000	15.0000	21.0000	6.0000	0.0000	12.0000	28.0000	9.5180	15.9040	1.67	107	
239	90240003	5.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.8718	6.5390	1.69	108	
332	90554480	0.0000	3.0000	3.0000	10.0000	10.0000	1.0000	0.0000	4.0000	0.0000	3.4295	5.7820	1.69	109	
375	CA4266240	4.0068	2.2496	7.0000	2.0000	1.4969	0.0000	0.0000	0.6666	0.0000	0.7383	1.2580	1.70	111	
90	10757100	0.0000	6.0000	8.0000	26.0000	16.0000	0.0000	0.0000	12.0000	1.0000	2.4231	4.2030	1.73	113	
351	90810225	0.0000	0.0000	0.0000	0.0000	0.2748	14.0006	0.0000	0.238	0.0000	5.1410	8.8930	1.73	115	
386	CFB466240	4.0000	0.0000	2.1566	0.8583	0.2748	0.0000	0.0000	0.0000	0.1238	1.1862	2.0400	1.73	114	
156	80200624	0.0000	0.0000	13.0000	0.0000	3.0000	2.0000	0.0000	3.0000	3.0000	1.2179	2.1470	1.76	114	
406	CPA4840252	4.8665	1.9020	0.7000	1.4000	3.3361	0.0000	0.0000	2.0000	14.0659	1.0859	1.9060	1.76	115	
173	80510031	15.0000	4.0000	10.0000	6.0000	6.0000	7.0000	0.0000	32.0000	8.0000	3.5897	6.3480	1.77	116	
99	10800808	15.0000	7.0000	31.0000	11.0000	6.0000	1.0000	9.0000	8.0000	11.5000	20.4410	2.0440	1.78	117	
155	80151692	15.0000	0.0000	5.0000	9.0000	13.0000	1.0000	1.0000	1.0000	1.0000	2.3333	4.1510	1.78	118	
297	90602407	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	4.0000	3.0000	1.9487	3.4710	1.78	119	
100	10800810	16.0000	0.0000	4.0000	12.0000	6.0000	5.0000	0.0000	43.0000	14.0000	7.1603	12.8000	1.79	120	
183	90010009	8.0000	6.0000	8.0000	25.0000	20.0000	1.0000	1.0000	10.0000	6.0000	4.8752	8.7460	1.79	121	
228	90150103	15.0000	0.0000	5.0000	9.0000	12.0000	1.0000	1.0000	2.0000	2.0000	4.2270	4.2270	1.79	122	
349	90810223	0.0000	6.0000	8.0000	28.0000	28.0000	4.0000	0.0000	14.0000	14.0000	5.1262	9.2180	1.80	123	
435	CR0207120	0.0000	4.0000	0.0000	0.1700	0.5100	0.0000	1.0000	0.0000	0.0000	1.7202	3.1140	1.81	124	
446	CR0344244	0.0000	0.0000	0.0000	6.0000	1.0000	0.0000	8.0000	0.0000	0.0000	3.2236	5.9300	1.81	125	
512	90252514	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.2885	2.3800	1.84	127	
350	90810224	0.0000	6.0000	8.0000	28.0000	28.0000	1.0000	0.0000	14.0000	14.0000	4.2885	8.8770	1.85	128	
55	10424260	0.0000	0.0000	4.0000	0.0000	0.0000	4.0000	0.0000	5.0000	5.0000	1.6570	2.7480	1.87	129	
380	CDAA60120	18.0000	0.0000	64.0000	45.0000	72.0000	27.0000	0.0000	36.0000	27.0000	13.2564	24.9820	1.88	130	
48	10225029	0.0000	0.0000	0.0000	0.0000	5.0000	0.0000	2.0000	0.0000	1.0000	0.6967	1.3220	1.89	131	
182	90010004	8.0000	6.0000	8.0000	26.0000	20.0000	4.0000	0.0000	10.0000	6.0000	4.6603	8.8400	1.90	132	
300	90610003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.9359	3.6750	1.90	133	
296	90602404	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.1090	2.1180	1.91	134	
396	CH3250120	36.0000	39.0000	45.0000	15.0000	24.0000	9.0000	0.0000	21.0000	84.0000	13.8365	26.6000	1.92	135	
461	EST3066240	0.4125	0.7000	5.8320	1.1664	0.0000	4.6656	0.0000	0.3375	0.0000	1.5922	3.0930	1.94	136	
369	CA3256240	0.7000	0.0000	1.5750	1.4000	1.5750	0.0000	0.0000	0.3500	0.0000	0.8242	1.6100	1.95	137	
390	CFB3866240	0.4500	0.0000	1.0125	0.9000	0.9541	8.4375	0.0000	1.4968	0.0000	0.5241	1.0360	1.98	138	
370	CA3456240	0.5000	1.1666	0.4500	0.8333	0.0000	14.0000	0.0000	1.4968	0.0000	0.8752	1.7520	2.00	139	
374	CA3874240	1.8875	0.9437	16.9873	1.9998	0.0000	0.0000	0.0000	0.0000	0.0000	1.4168	2.8310	2.00	140	

Line	Item #	Item Description	Week 1 7 Days Ended 11/02/2008	Week 2 7 Days Ended 11/16/2008	Week 3 7 Days Ended 11/23/2008	Week 4 7 Days Ended 11/30/2008	Week 5 7 Days Ended 12/07/2008	Week 6 7 Days Ended 12/14/2008	Week 7 7 Days Ended 12/21/2008	Week 8 7 Days Ended 12/28/2008	Week 9 7 Days Ended 1/4/2009	Week 10 7 Days Ended 1/11/2009	Week 11 7 Days Ended 1/18/2009	Week 12 7 Days Ended 1/25/2009
236	30232100	VALVE, CHUTE MANIFOLD BLOCK	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
415	CRB500240	519, 3125X 240	0.3333	0.1999	0.3333	0.3333	0.1999	0.3333	1.3332	0.3333	0.0000	1.6665	0.1999	0.0333
259	90603911	GUARD, OSHA MACH - NS CBMW PVR.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	1.0000
250	90400304	HANGER, REAR HAND HELD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
251	90400305	CLIP, HANGER - REAR HAND HELD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
382	CD43460120	14L 251 X 60 X 120 100WF	9.5000	8.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
58	10424278	CABLE, REAR CONTROL CABLE	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000
372	CA3466240	14L 251X2 X 2 X 240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
418	CRB4600240	59, 625X 240	0.0000	0.0000	0.0000	2.3000	0.0000	0.0000	1.9000	0.0000	0.0000	0.0000	0.0000	2.3000
391	CPB5874240	38, 395 X 3 X 240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
208	90100080	FILTER, AIR - 25RFS1	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
420	CRB630040	718, 875X 240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
187	90910107	PLATE, WORK LIGHTS	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.5351
32	10130004	VALVE, DRAIN LOCK	15.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	3.0000
145	80100021	BRACKET, MOUNTING - AIR FILTER	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	10210020	PUMP, PONY - HYD. CHUTE PUMP	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
265	90601196	BRACKET, CHUTE CARRIER - CBMW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	4.0000
96	10777700	GEARBOX ASSY, PML90 - 90 DEG.L	0.0000	0.0000	0.0000	0.0000	0.0000	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000
252	90400307	BRACKET, HANGER-REAR HAND HELD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
364	ARG3260096	319, 191X 60 X 96	2.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
163	80238600	DRUM TRACK - EXPRESS LIGHT WT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
470	INTERNATIONAL	International truck chassis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	10200265	GALVE, VACUUM-COLOR GRAPUATED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
230	90200110	VALVE, GATE - 1" HYD. SHUT OFF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
71	10500135	BRACKET, CHUTE CARRIER	4.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
361	ARG1636144	100A, 13461 X 96 X 144	10.5000	0.0000	0.0000	0.0000	0.0000	5.5499	0.0000	0.0000	0.0000	0.0000	7.9998	0.0000
31	10119628	HEAD, WATER TANK - 28" ALLUM.	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
73	10500141	STRAP, RUBBER-CHUTE HOLD DOWN	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
56	10424267	CABLE, FRONT CONTROL CABLE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	4.0000
202	90100040	VALVE, AIR - RELAY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
354	90501026	SHAFT, DRIVE ASSY - 28" 5T	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
317	90501026	SHAFT, DRIVE ASSY - 28" 5T	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
422	10107333	MUFFLER, CHUTE LOCK VALVE	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000
47	10214064	PUMP ASSY, HYDRAULIC BAYON	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
181	90010003	DECAL CONTINENTAL WYERS LOGO	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
201	90100030	VALVE, QUICK RELEASE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	10210734	VALVE, SOLENOID - ELEC/AIR	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	10201042	KIT MOUNTING-OIL COOLER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42	10210600	PUMP, PONY - 9 SPLINE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
176	80520021	CARING GLAND NUT-TRLR LCK CYL	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
177	80520022	CARING ROD SEAL-TRLR LCK CYL	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
178	80520023	BACKLIP RING, ROD SEAL	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
229	90200050	FILTER, HYD - HIGH PRESSURE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
233	90200020	VALVE, ROD END BLOCK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
244	90251200	CYLINDER, HYD - BRIDGE SAVER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
293	90600110	MOUNT, RUBBER - BRDGSVR MFLD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
308	90620106	PIN, CYLINDER - BRIDGE SAVER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
309	90620107	SPACER, CYL PIN - BRIDGE SAVER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
311	90620130	PIN, BRDGSVR ARM - FOUR BOLT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
314	90626806	BLOCK SET, ROD CAP-BRDGSVR NS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
306	90620105	BEARING, ARM - BRIDGE SAVER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
307	90620106	SHOCK, INSULATED PIN - CBMW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
181	90410017	DECAL, MOUNTING LOGO SWANTH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
261	90410012	PANEL, LOCAL CONSOLE WYERS LOGO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
266	90500204	SHOCK, E MCHOR - 38"	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
262	90412504	SOCKET, LIGHT-CONSOLE WYO BULB	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
263	90412505	LIGHT, CONSOLE - BULB ONLY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
56	10201061	COOLER, HYD OIL - UNIV. 6 TUBE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
443	CRG3448120	14L 251X 48 X 120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
146	80100333	ADAPTOR, WASH DOWN HOSE	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
439	CRG3248120	319, 1875X 48 X 120	0.9999	0.0000	0.0000	0.0000	0.0000	0.0000	0.7000	0.0000	0.0000	0.0000	0.0000	0.0000
402	CHT520240	111 X 120 X 240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
77	10610121	BAR, ANTI-DRIFT - MLD FLAP	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	12.0000	0.0000	0.0000	0.0000	0.0000	0.0000
367	925735	16-14 Gauge Female Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
116	200A	WATER SYSTEM, CHUTE ASSEMBLY,	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
160	80200100	TRACK, DRUM RING - MTM	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
324	90632148	SHAFT, DRIVE ASSY - 48" 50"	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000





Line	Item #	Week 28 7 Days Ended	Week 29 7 Days Ended	Week 30 7 Days Ended	Week 31 7 Days Ended	Week 32 7 Days Ended	Week 33 7 Days Ended	Week 34 7 Days Ended	Week 35 7 Days Ended	Week 36 7 Days Ended	Week 37 7 Days Ended	Week 38 7 Days Ended	Week 39 7 Days Ended	Week 40 7 Days Ended	Week 41 7 Days Ended	Week 42 7 Days Ended
236	90232100	1.0000	0.0000	0.0000	0.0000	3.0000	0.0000	3.0000	3.0000	0.0000	1.0000	0.0000	2.0000	3.0000	0.0000	0.0000
415	CRB3600240	0.0000	0.3333	0.0000	1.3332	0.0000	3.6663	0.0000	1.9998	0.0000	1.9998	1.3332	1.0998	0.9660	0.0000	0.0000
299	90603911	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
250	90400394	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
251	90400395	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
382	CD34860120	21.0000	15.0000	19.0000	0.0000	18.5000	1.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
58	10424278	0.0000	0.0000	0.0000	0.0000	0.0000	0.1500	0.4708	1.0500	0.0000	0.0000	0.0000	0.0000	0.3000	0.0000	0.0000
372	CA13486240	0.0000	0.0000	0.0000	0.0000	1.3000	0.5000	0.0000	0.0000	0.0000	0.0000	0.3000	0.3000	0.0000	0.0000	0.0000
418	CRB4500240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1168	0.0000	0.0000
391	CFB5874240	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
208	90100060	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
247	90200100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
420	CRB5000240	0.0000	0.0000	0.0000	0.0000	0.8664	0.3333	0.0000	0.0000	0.0000	0.0000	0.1999	0.1999	0.0000	0.0000	0.0000
187	90010107	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
142	90130034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
185	90130035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	10210201	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	12.0000	0.0000	6.0000	0.0000	0.0000	0.0000
265	90601196	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
56	10777700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
252	90400307	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
364	AR03260096	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
163	80326600	5.0000	3.0000	3.0000	0.0000	3.0000	0.0000	4.0000	4.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000
470	INTERNATIONAL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	10200565	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
230	90200110	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
71	10500135	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.9999	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000
361	AR01636144	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5000
31	10119626	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
73	10500141	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
56	10424267	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
202	90100040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
354	90510236	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
317	90630126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
472	MA03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
47	10210203	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
181	90010035	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
201	90100030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	10100734	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	10201042	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42	10210600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
176	80620021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
177	80620022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
178	80620023	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
229	90200050	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
233	90230020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
244	90251200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
293	90600110	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
308	90620106	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
309	90620107	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
311	90620130	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
314	90626936	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
308	90620101	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
307	90620105	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
67	10430947	0.0000	0.0000	0.0000	0.0000	0.0000	14.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
184	90412042	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
284	90412025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
266	90600035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
262	90412504	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
263	90412505	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	10201061	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
443	CR03446120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6668
146	80100333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
439	CR03546120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
402	CHT520240	0.0000	0.0000	0.0000	0.0000											







Line	Item #	Week 73	Week 74	Week 75	Week 76	Week 77	Week 78	Week 79	Week 80	Week 81	Week 82	Week 83	Week 84	Week 85	Week 86	Week 87
		7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended	7 Days Ended
236	90232100	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	8.0000	0.0000	0.0000	7.0000	4.0000	8.0000
415	CRB3500240	0.0000	1.6665	0.0000	0.0000	2.9997	1.2665	0.0000	0.0000	0.0000	6.7326	0.0000	0.0000	2.3997	0.0000	7.7992
259	90603911	1.0000	3.0000	0.0000	1.0000	4.0000	8.0000	2.0000	0.0000	0.0000	6.0000	0.0000	1.0000	0.0000	2.0000	0.0000
250	90400384	0.0000	0.0000	0.0000	0.0000	2.0000	4.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
251	90400395	3.0000	3.0000	0.0000	0.0000	2.0000	4.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000
382	CD43460120	0.0000	0.0000	0.0000	7.0000	0.0000	0.0000	0.0000	7.0000	0.0000	42.0000	0.0000	80.0000	34.0000	141.0000	56.0000
58	10424278	(1.0000)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8.0000
372	CA3466240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0312	0.0000	0.0000	0.2998	0.0000	1.0812
418	CRB4600240	0.0000	0.0000	0.0000	0.0000	0.6000	0.8000	0.0000	0.0000	0.0000	3.2000	0.0000	0.0000	0.2000	0.0000	1.4000
391	CRB574240	0.0000	2.7328	0.0000	0.0000	3.6409	8.4161	0.0000	0.0000	0.0000	29.7650	0.2333	1.7496	0.0000	0.0000	8.6320
208	90100360	2.0000	5.0000	0.0000	0.0000	2.0000	7.0000	0.0000	2.0000	0.0000	4.0000	0.0000	1.0000	1.0000	0.0000	2.0000
189	90100370	0.0000	0.0000	0.0000	0.0000	2.0000	5.0000	0.0000	1.0000	0.0000	3.0000	0.0000	2.0000	0.0000	0.0000	3.0000
420	CRB560240	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
182	90101107	0.0000	2.0000	0.0000	0.0000	5.0000	3.0000	0.0000	0.0000	0.0000	4.0000	0.0000	2.0000	0.0000	0.0000	0.0000
145	80100024	0.0000	5.0000	0.0000	0.0000	2.0000	7.0000	0.0000	2.0000	0.0000	4.0000	0.0000	1.0000	1.0000	0.0000	2.0000
36	10210200	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
265	90601196	0.0000	4.0000	0.0000	0.0000	0.0000	10.0000	0.0000	0.0000	0.0000	8.0000	2.0000	0.0000	0.0000	42.0000	2.0000
96	10777700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	1.0000	7.0000	0.0000	1.0000	3.0000	0.0000	6.0000
252	90400307	2.0000	1.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000
364	AR3260096	0.0000	2.0000	0.0000	0.0000	5.9143	8.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000
163	80328600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	2.0000	8.0000	0.0000	11.0000	2.0000	15.0000	8.0000
470	INTERNATIONAL	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000	16.0000
34	10200565	4.0000	4.0000	0.0000	0.0000	3.0000	6.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000
230	90200110	4.0000	6.0000	0.0000	0.0000	4.0000	6.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000	0.0000	0.0000
71	10500135	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
361	AR51636144	0.0000	2.8000	0.0000	0.0000	7.4500	9.8500	0.3333	0.0000	0.0000	4.5000	0.0000	0.0000	0.0000	0.0000	0.0000
31	10119626	0.0000	4.0000	0.0000	0.0000	0.0000	16.0000	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000
73	10500141	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
56	10424267	(1.0000)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
202	90100040	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	2.0000	1.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000
354	90510296	0.0000	8.0000	0.0000	0.0000	4.0000	10.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
317	90502126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
472	10127338	1.0000	3.0000	0.0000	1.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000
162	10127338	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000
47	10214264	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
181	90100303	0.0000	4.0000	0.0000	0.0000	10.0000	6.0000	0.0000	0.0000	0.0000	2.0000	0.0000	4.0000	0.0000	0.0000	0.0000
201	90100330	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	10107134	0.0000	3.0000	0.0000	0.0000	0.0000	8.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	10201142	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	12.0000	0.0000	2.0000	2.0000	0.0000	2.0000
42	10210600	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
176	80520021	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000
178	80520022	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000
229	90200050	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000
233	90230020	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000
244	90251200	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000
293	90600110	2.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000
308	90620106	4.0000	6.0000	0.0000	0.0000	4.0000	6.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000	0.0000	0.0000
309	90620107	8.0000	12.0000	0.0000	0.0000	8.0000	12.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	8.0000	0.0000	0.0000
311	90620130	4.0000	6.0000	0.0000	0.0000	4.0000	6.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000	0.0000	0.0000
314	90626698	4.0000	6.0000	0.0000	0.0000	4.0000	6.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000	0.0000	0.0000
368	90620101	4.0000	6.0000	0.0000	0.0000	4.0000	6.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000	0.0000	0.0000
307	90620105	8.0000	12.0000	0.0000	0.0000	8.0000	12.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	8.0000	0.0000	0.0000
67	10430047	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
184	90010012	0.0000	3.0000	0.0000	0.0000	2.0000	3.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000
261	90412003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
262	90412004	2.0000	6.0000	0.0000	0.0000	4.0000	6.0000	0.0000	2.0000	0.0000	4.0000	0.0000	0.0000	4.0000	0.0000	0.0000
263	90412005	4.0000	6.0000	0.0000	0.0000	4.0000	6.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000	0.0000	0.0000
36	10201061	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000
443	CR33446120	0.0000	3.3332	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5696	0.0000	0.0000	0.0000	0.0000	1.6668
146	80100333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
439	CR33546120	0.0000	0.1437	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.3332	0.0000	0.0000	0.0000	0.0000
402	CHT5200240	1.0000	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1770
77	10510121	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	2.0000	0.0000	10.0000	0.0000	0.0000	0.0000</		



Line	Item #	Week 88 7 Days Ended	Week 89 7 Days Ended	Week 90 7 Days Ended	Week 91 7 Days Ended	Week 92 7 Days Ended	Week 93 7 Days Ended	Week 94 7 Days Ended	Week 95 7 Days Ended	Week 96 7 Days Ended	Week 97 7 Days Ended	Week 98 7 Days Ended	Week 99 7 Days Ended	Week 100 7 Days Ended	Week 101 7 Days Ended	Week 102 7 Days Ended
236	90232100	5.0000	6.0000	4.0000	4.0000	0.0000	0.0000	8.0000	4.0000	1.0000	8.0000	0.0000	0.0000	15.0000	0.0000	0.0000
415	CRB3600240	0.0000	0.0000	2.7331	8.6666	0.0000	4.5328	0.0000	0.0000	8.3971	0.0000	0.0000	0.0000	22.9311	0.0000	0.0000
299	90603911	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	2.0000
250	90400384	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
251	90400305	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
382	CD34801120	0.0000	0.0000	77.5000	99.0000	0.0000	21.0000	0.0000	86.0000	56.0000	0.0000	0.0000	84.0000	35.0000	0.0000	15.0000
58	10424278	5.0000	6.0000	5.0000	6.0000	0.0000	10.0000	8.0000	5.0000	6.0000	8.0000	0.0000	0.0000	17.0000	2.0000	0.0000
372	CA13466240	0.0000	0.0000	0.2812	0.2696	0.0000	0.6000	0.0000	0.0000	4.2000	0.0000	0.0000	0.0000	1.4262	0.0000	0.0000
418	CRB4600240	0.0000	0.0000	2.2000	0.0000	0.0000	6.6000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.8000	0.0000	0.0000
391	CFB167240	0.0000	0.0000	8.2500	8.2500	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	6.6666	0.0000	0.5832
208	90100060	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
247	90200100	0.0000	0.0000	0.0000	2.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000
420	CRB5000240	0.0000	0.0000	1.4666	0.0000	0.0000	0.3999	0.0000	0.0000	2.7998	0.0000	0.0000	0.0000	3.1999	0.0000	0.0000
187	90010107	0.0000	1.0000	1.0000	1.0000	0.0000	7.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
152	10130004	0.0000	0.0000	3.0000	4.0000	0.0000	0.0000	0.0000	4.0000	5.0000	8.0000	0.0000	2.0000	16.0000	4.0000	4.0000
136	90100021	0.0000	0.0000	1.0000	1.0000	0.0000	3.0000	0.0000	1.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
109	90400180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
206	90601196	8.0000	18.0000	0.0000	22.0000	0.0000	0.0000	0.0000	34.0000	10.0000	8.0000	0.0000	40.0000	10.0000	4.0000	8.0000
56	10777701	4.0000	6.0000	5.0000	0.0000	0.0000	0.0000	11.0000	5.0000	4.0000	9.0000	0.0000	10.0000	3.0000	0.0000	0.0000
262	90400307	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
364	AR03260096	0.0000	0.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000
163	80326600	0.0000	7.0000	3.0000	9.0000	0.0000	5.0000	0.0000	13.0000	18.0000	0.0000	0.0000	12.0000	8.0000	0.0000	2.0000
470	INTERNATIONAL	3.0000	6.0000	0.0000	15.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54	10200565	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
230	90200110	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
71	10500135	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
361	AR01636144	0.0000	0.0000	0.0000	6.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000
31	10119626	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
73	10500141	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
56	10424267	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	4.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000
202	90100040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
354	90810236	4.0000	6.0000	1.0000	5.0000	0.0000	0.0000	0.0000	1.0000	15.0000	6.0000	0.0000	10.0000	11.0000	0.0000	0.0000
317	90632126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
472	MACS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
47	10114733	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
181	10114824	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
201	90100030	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	10107734	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	10201142	0.0000	0.0000	0.0000	4.0000	0.0000	2.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	2.0000	0.0000	2.0000
42	10110600	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
176	80620021	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
177	80620022	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
178	80620023	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
229	90200050	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
233	90230020	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
244	90251200	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
293	90600110	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
308	90620106	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	2.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
309	90620107	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	4.0000	0.0000	4.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000
311	90620130	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	2.0000	0.0000	2.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000
314	90626698	0.0000	0.0000	0.0000	18.0000	0.0000	2.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	16.0000	0.0000	0.0000
368	90620101	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
307	90620105	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	4.0000	0.0000	2.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000
167	10430047	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
184	90110102	32.0000	12.0000	0.0000	8.0000	0.0000	4.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
206	90400205	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
266	90400206	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
262	90412504	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000
263	90412505	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000
36	10201061	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
443	CR034445120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
146	80100333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
439	CR035445120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7500
402	CHT520240	0.0000														









Line	Item #	Week 148 7 Days Ended 9/4/2011	Week 149 7 Days Ended 9/11/2011	Week 150 7 Days Ended 9/18/2011	Week 151 7 Days Ended 9/25/2011	Week 152 7 Days Ended 10/2/2011	Week 153 7 Days Ended 10/9/2011	Week 154 7 Days Ended 10/16/2011	Week 155 7 Days Ended 10/23/2011	Week 156 7 Days Ended 10/30/2011	Mean Weekly Demand (u)	3-Yr Std Dev of Weekly Dmd (s)	Coefficient of Variation $\frac{s}{\mu} = \frac{1}{r}$	Coefficient of Variation	Sequence #
236	90232100	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	1.1474	2.3150	2.02	142	
237	CRB360240	1.3332	1.5665	3.3330	2.8330	2.4531	27.7668	0.0000	0.0000	0.0000	1.6561	3.3380	2.02	143	
239	90603911	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9551	1.9690	2.06	144	
250	90400304	5.0000	2.0000	3.0000	9.0000	13.0000	1.0000	0.0000	0.0000	0.0000	1.8333	3.7500	2.07	144	
251	90400305	6.0000	0.0000	5.0000	9.0000	11.0000	0.0000	0.0000	0.0000	0.0000	1.8141	3.7650	2.08	145	
382	CD43460120	88.0000	81.0000	46.0000	9.0000	0.0000	0.0000	0.0000	21.0000	28.0000	21.8176	45.4550	2.08	146	
58	10424276	0.0000	0.0000	4.0000	0.0000	0.0000	4.0000	1.0000	2.0000	4.0000	1.1859	4.4750	2.09	147	
372	CA13466240	1.7250	7.6469	1.2000	0.7200	0.9375	0.9112	2.1562	0.1406	2.0718	0.4584	0.9600	2.09	148	
418	CRB460240	0.0000	0.7000	1.0000	8.4000	0.0000	8.4000	1.0000	0.0000	0.0000	0.4910	1.0320	2.10	149	
391	CFB3874240	4.0824	0.0000	12.0812	1.1664	1.6666	1.6666	6.6664	0.0000	0.0000	0.5532	3.3050	2.13	150	
208	90100080	0.0000	0.0000	4.0000	0.0000	0.0000	2.0000	2.0000	0.0000	0.0000	0.5769	1.2390	2.15	151	
247	90320100	3.0000	2.0000	7.0000	7.0000	7.0000	7.0000	0.0000	1.0000	8.0000	1.6474	3.5410	2.15	152	
420	CRB500240	0.0000	0.4966	0.6666	0.3333	0.0000	5.6006	0.0000	0.0657	0.0000	0.3032	0.6670	2.17	153	
187	90101017	0.0000	3.0000	4.0000	10.0000	0.0000	4.0000	0.0000	4.0000	3.0000	0.8333	1.6150	2.18	154	
152	10130004	6.0000	0.0000	9.0000	0.0000	14.0000	2.0000	6.0000	4.0000	3.0000	3.6218	7.9660	2.20	155	
145	90100001	0.0000	0.0000	4.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	0.6346	1.4190	2.24	156	
265	90210200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.7490	1.6150	2.24	157	
262	90210200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.2650	0.7300	2.25	158	
96	10771790	0.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.8524	1.8910	2.26	159	
362	90400307	5.0000	2.0000	3.0000	9.0000	13.0000	0.0000	0.0000	2.0000	0.0000	1.3013	3.0500	2.35	160	
364	AR03360066	3.0000	0.0000	5.0000	0.0000	0.0000	0.0000	3.0000	2.0000	7.0000	1.3013	3.0500	2.35	160	
163	80328600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5470	3.6238	2.36	161	
470	INTERNATIONAL	26.0000	0.0000	0.0000	1.0000	36.0000	0.0000	0.0000	0.0000	0.0000	1.2244	2.9020	2.37	162	
34	10200565	0.0000	0.0000	5.0000	0.0000	0.0000	0.0000	1.0000	22.0000	0.0000	2.6731	6.3610	2.38	163	
230	90200110	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	2.0000	2.0000	4.0000	0.5641	1.3500	2.41	164	
71	10500135	16.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5962	1.4360	2.41	165	
361	ARG1636144	12.0000	15.0000	0.0000	32.0000	40.0000	0.0000	0.0000	0.0000	0.0000	5.7564	13.9550	2.42	166	
31	10119626	6.0000	0.0000	10.0000	0.0000	0.2500	3.7000	3.6250	12.0000	3.7000	1.2164	2.9580	2.43	167	
73	10500141	16.0000	0.0000	6.0000	0.0000	40.0000	0.0000	0.0000	0.0000	14.0000	1.4808	3.6130	2.44	168	
56	10424267	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	1.0000	0.0000	0.6282	13.9160	2.47	169	
202	90100040	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	1.0000	0.4359	1.0910	2.50	170	
354	90810236	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2949	0.7470	2.53	172	
317	90832126	18.0000	3.0000	3.0000	12.0000	25.0000	0.0000	0.0000	0.0000	0.0000	0.5513	1.4160	2.57	174	
472	MAXX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6410	1.6880	2.63	176	
22	10105733	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.3055	3.0690	2.64	177	
161	10214694	0.0000	0.0000	0.0000	0.0000	20.0000	0.0000	0.0000	0.0000	0.0000	1.0045	2.4400	2.65	178	
181	90100000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	1.0045	2.4400	2.65	178	
261	90100000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	0.0000	1.0045	2.4400	2.65	178	
23	10105734	7.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.3907	3.0920	2.66	179	
35	10210420	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.8674	4.0680	2.67	181	
42	10210420	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.8674	4.0680	2.67	181	
176	80620021	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	2.0000	0.2500	0.6680	2.67	183	
178	80620022	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	2.0000	0.2500	0.6680	2.67	184	
178	80620023	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	2.0000	0.2500	0.6680	2.67	185	
229	90200050	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	2.0000	0.2500	0.6680	2.67	186	
233	90230020	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	2.0000	0.2500	0.6680	2.67	188	
244	90251200	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	2.0000	0.2500	0.6680	2.67	189	
293	90600110	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	2.0000	0.2500	0.6680	2.67	190	
308	90620106	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.6680	2.67	191	
309	90620107	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.6680	2.67	191	
311	90620730	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.3370	2.67	192	
314	90620908	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.3370	2.67	193	
308	90620101	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4359	3.8540	2.68	194	
307	90620105	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4615	1.2410	2.69	195	
184	90100102	77.0000	7.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	8.0000	0.9872	2.6640	2.70	196	
261	90412503	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	13.1667	35.6070	2.71	197	
263	90412504	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0231	10.6280	2.71	198	
263	90412505	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2964	0.6990	2.73	199	
263	90412506	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9154	1.9530	2.73	200	
36	10201061	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2766	0.6270	2.74	202	
36	10201061	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2766	0.6270	2.74	202	
443	CRG3448120	0.0000	0.0000	0.0000	0.0000	0.3653	3.4571	7.6708	0.3118	8.3052	0.7052	1.9530	2.75	203	
146	80100333	10.0000	5.0000	4.0000	7.0000	42.0000	0.0000	0.0000	14.0000	5.0000	2.9872	8.3000	2.78	204	
439	CRG3248120	0.0000	0.3333	0.0000	1.6554	1.6554	0.0000	0.8750	0.2500	0.0000	0.3906	0.8000	2.79	206	
402	CHT520240	0.0000	0.0260	0.0000	0.0750	0.0000	0.0000	0.0000	0.0000	0.0000	0.2907	0.8180	2.81	207	
77	10610121	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7564	2.1470	2.84	208	
357	925735	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0962	8.8270	2.85	209	
116	200A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2821	0.8100	2.87	210	
160	80320100	2.0000	0.0000	2.0000	1.0000	0.0000	0.0000	0.0000	3.0000	0.0000	1.1218	3.2240	2.87	211	
324	90632148	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4167	1.2020	2.88	212	



Line	Item #	Item Description	Week 1 7 Days Ended	Week 2 7 Days Ended	Week 3 7 Days Ended	Week 4 7 Days Ended	Week 5 7 Days Ended	Week 6 7 Days Ended	Week 7 7 Days Ended	Week 8 7 Days Ended	Week 9 7 Days Ended	Week 10 7 Days Ended	Week 11 7 Days Ended	Week 12 7 Days Ended
164	10430004	SWITCH PROXIMITY SENSOR	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
101	10802207	PLUG IN-CAB CONTROL PANEL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
102	10805736	FITTING LIQUID TIGHT SEAL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
358	923675	15-14 Gauge Male Terminal	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	0.0000	0.0000	3.0000	0.0000	0.0000
185	90010014	DECAL GREASE LBL - RL R/PV/ARM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
160	90014005	DECAL 7 HOLE - TOL SWITCH MTO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10.0000	0.0000	0.0000
266	90500035	LANYARD, CHUTE CABLE - 5F	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
267	90500054	LANYARD, CHUTE CABLE - 5F	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
303	90520044	SNAP RING, TRAPEZOIDAL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
303	90520044	SNAP RING, TRAPEZOIDAL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	10118612	HEAD, WATER TANK - 12"	0.0000	0.0000	0.0000	0.0000	0.0000	12.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
209	90110101	STRAP, CROSSMOUNT W/ 2"	0.0000	0.0000	0.0000	0.0000	0.0000	16.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
313	90626607	BLOCK, BROGSVR ARM PIVOT	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
322	90632144	SHAFT, DRIVE REAR PTO - CBMW	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	90015404	1/4" 25/160 X 100	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	10006696	PLATE, HOPPER LIP	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	10006696	ALARM BACKLIP, SMART ALARM-SM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
240	90353100	ROLLER ASSY, COMPL W/BRKT, CBMW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
310	90620375	3/8" X 3/16" X 4 1/4" X 26"	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
87	10632635	KIT, STRAP & BOLT - END YOKE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
268	90500065	LANYARD, CHUTE CABLE - 65"	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
88	10633635	END YOKE, PUMP FLANGE ADAPTER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
180	90010001	PLATE, PAVING MIXER	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
115	15317	5/8-11 X 3.5 HCS Gr 8 Y Zinc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
204	90100057	MUFFLER, AIR SOLENOID VALVE	0.0000	0.0000	0.0000	0.0000	0.0000	12.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
120	200P	BRIDGE SAVER	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
59	10424278	CABLE, REAR CONTROL CABLE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
48	10214862	PUMP ASSY, HYD - EANTON	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
162	80328195	TRACK, DRUM RING - MTM NS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
478	RIMS8WY1022	22.5 X 8.25 HP White	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
134	37024	3/8-16 X 1.25 HCS Gr 8 Y Zinc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
334	90810010	3/8-16 Nylock Inset Nut	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
154	80110475	KIT, LIGHT - FENDER EXTENSIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
401	CHT4850240	GASNET, FLANGE - FLAPPER VALVE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
484	TIRL21611R	3/4" (75) X .065 X .240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
167	80500048	11R222.5, 1Tr, 16 IP	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
27	10118816	HOOK, HOLD DOWN SNAP SAFETHOOK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	10100059	HEAD, WATER TANK - 16"	15.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
203	90100054	SWITCH, AIR - NEUTRAL	3.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
114	15313	CAP, AIR SOLENOID VALVE - 5M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
254	90600104	55-11 X 2.5 HCS Gr 8 Y Zinc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
379	COA3260720	3/16" 186X 60 X 120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
217	90191026	GAUGE, CALIB-GAULTR-1000378	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
152	80110472	FLAPPER-FLAPPER VALVE 63-1/4"	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
368	CHS3460120	1/4" 25/160 X 120	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
210	90110115	STRIP, RUBBER CHANNEL - 1-1/2"	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
467	FAB101	FAB MISC. SPECIAL PROJECTS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
207	90100150	VALVE, AIR - ELEC OVER AIR	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
151	80110471	SPRING, FLAPPER VALVE	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
53	10330700	VALVE, CONTROL - RE CONTROL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
150	80110461	ZERK-GREASE FITTING	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
376	CA4274240	1/2" 50X 3 X 3 240	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
161	80320150	TRACK, DRUM RING - MTM - LW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
144	50560304	CHAIN, SAFETY CHUTE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
395	CHS3254120	3/16" 1875X 54 X 120	12.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
431	CRG167144	100A, 1345X 72 X 144	0.6666	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
468	FIT1AAHJJA	1/4" FEMALE JIC CRIMP FTO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
166	80500045	1/4" HOSE BAE 100R5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
208	90600068	CHAIN SPlice-CHUTE SAFETY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
473	MAG3AX18	BLUSHING, UPPER LADDER - 2004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
474	NYLON58X1	MAGNET, EPOXY COATED GRD42	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
164	80361547	BOLT, 5/8" X 1", NYLON HEX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
164	80361547	GASKET, MANHOLE GASKET-SQUARE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

























Line	Item #	Week 148 7 Days Ended 9/4/2011	Week 149 7 Days Ended 9/11/2011	Week 150 7 Days Ended 9/18/2011	Week 151 7 Days Ended 9/25/2011	Week 152 7 Days Ended 10/2/2011	Week 153 7 Days Ended 10/9/2011	Week 154 7 Days Ended 10/16/2011	Week 155 7 Days Ended 10/23/2011	Week 156 7 Days Ended 10/30/2011	Mean Weekly Demand (μ)	3-Yr Std Deviatn of Weekly Dmd (σ)	Coefficient of Variation $\frac{\sigma}{\mu}$	Coefficient of Variation Sequence #
64	10430004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.2564	0.7440	2.90	214
101	10802207	0.0000	0.0000	0.0000	12.0000	0.0000	12.0000	4.0000	3.0000	12.0000	3.6923	10.7240	2.90	215
102	10802736	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5449	4.4800	2.90	216
358	922875	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	8.7020	2.90	217
185	90010014	0.0000	3.0000	0.0000	14.0000	10.0000	2.0000	0.0000	5.0000	3.0000	3.0705	8.9510	2.92	218
190	90014005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.9167	2.6780	2.92	219
266	90500035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4359	1.2810	2.94	220
267	90500054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6859	2.0310	2.96	221
6	10200026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4615	4.4000	3.01	222
303	90620044	0.0000	0.0000	0.0000	2.0000	2.0000	0.0000	1.0000	1.0000	2.0000	0.3013	0.9120	3.03	223
25	10118612	6.0000	0.0000	0.0000	0.0000	6.0000	6.0000	4.0000	6.0000	6.0000	1.6282	4.9500	3.04	224
209	90110101	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8846	2.6900	3.04	225
313	90629607	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0897	3.3880	3.11	226
322	90632144	0.0000	0.0000	0.0000	4.0000	5.0000	4.0000	16.0000	6.0000	6.0000	0.3782	1.1820	3.13	227
397	CH83460100	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	4.0000	0.0000	0.0000	0.4283	1.3460	3.16	228
154	90015404	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3205	1.0350	3.23	229
2	10000695	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4103	1.3670	3.33	230
249	90353100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3141	1.0460	3.33	231
310	90620375	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4231	1.4190	3.35	232
87	10632635	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	2.0000	0.2500	0.8550	3.42	234
268	90500065	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2528	0.9020	3.43	235
89	10632635	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	2.0000	0.2500	0.8620	3.45	236
180	90010001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3718	1.3010	3.50	237
115	15317	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.7821	23.9950	3.54	238
204	90100057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	8.3205	29.4770	3.54	238
120	200P	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.3141	1.1290	3.59	240
59	10424278	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2756	1.0450	3.79	241
46	10214052	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4679	1.7800	3.80	242
162	80329195	10.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.1659	4.6850	3.95	244
478	RMSRWY1022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2564	1.0340	4.05	244
113	15107	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6667	2.7200	4.08	247
134	37024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9867	2.7200	4.08	248
354	90810010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4251	1.6570	4.08	249
154	90110010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.9930	7.0115	4.23	249
404	CHT196240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3401	1.1680	4.23	251
464	TBL 21611R	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2602	1.1380	4.23	263
167	80500046	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.3333	5.6780	4.26	265
27	10118616	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5000	2.1630	4.33	265
7	10100030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3846	1.6870	4.30	267
203	90100054	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.7769	28.8730	4.30	268
114	15113	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	112.0000	0.0000	4.5385	20.0490	4.42	269
264	90620194	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3141	1.3950	4.44	269
370	CDAS360120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.9640	9.0050	4.54	261
217	90131026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6410	2.0480	4.56	262
152	80110472	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6410	2.0480	4.56	264
163	80110473	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5513	2.7340	4.96	270
368	CH83460120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0629	5.5930	5.12	271
210	90110115	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	21.6410	111.5000	5.15	272
211	90110130	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	15.3526	81.9930	5.34	275
467	FAB101	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4487	2.5000	5.57	278
207	90100150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5769	8.8140	5.59	279
151	80110471	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2549	1.6900	5.73	280
53	10230700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3013	1.7350	5.76	281
1	10000590	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.7500	34.4216	5.99	283
150	80110461	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3718	2.2380	6.02	284
376	CA4274240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7612	5.2370	6.88	287
161	80320150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8540	1.8540	6.89	288
144	50560304	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2865	1.9810	6.91	289
395	CH83254120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6410	4.4620	6.95	290
15	10101016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.0192	37.1470	7.40	292
431	CR31672144	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3580	2.7750	7.75	293
468	FT1AAHF14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3590	3.3500	9.33	294
469	HC9FC30004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.7949	16.7520	9.33	295
166	80500045	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.7051	16.2290	9.50	296
298	90629608	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.2949	12.4260	9.62	297
473	MAG3AX18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.1282	11.1580	9.89	298
474	NYLON5BK1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.1282	11.1580	9.89	299
164	80361547	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3910	4.8040	12.29	300

APPENDIX B  
INVENTORY ITEMS AND ATTRIBUTES USED  
IN SIMULATION STUDY

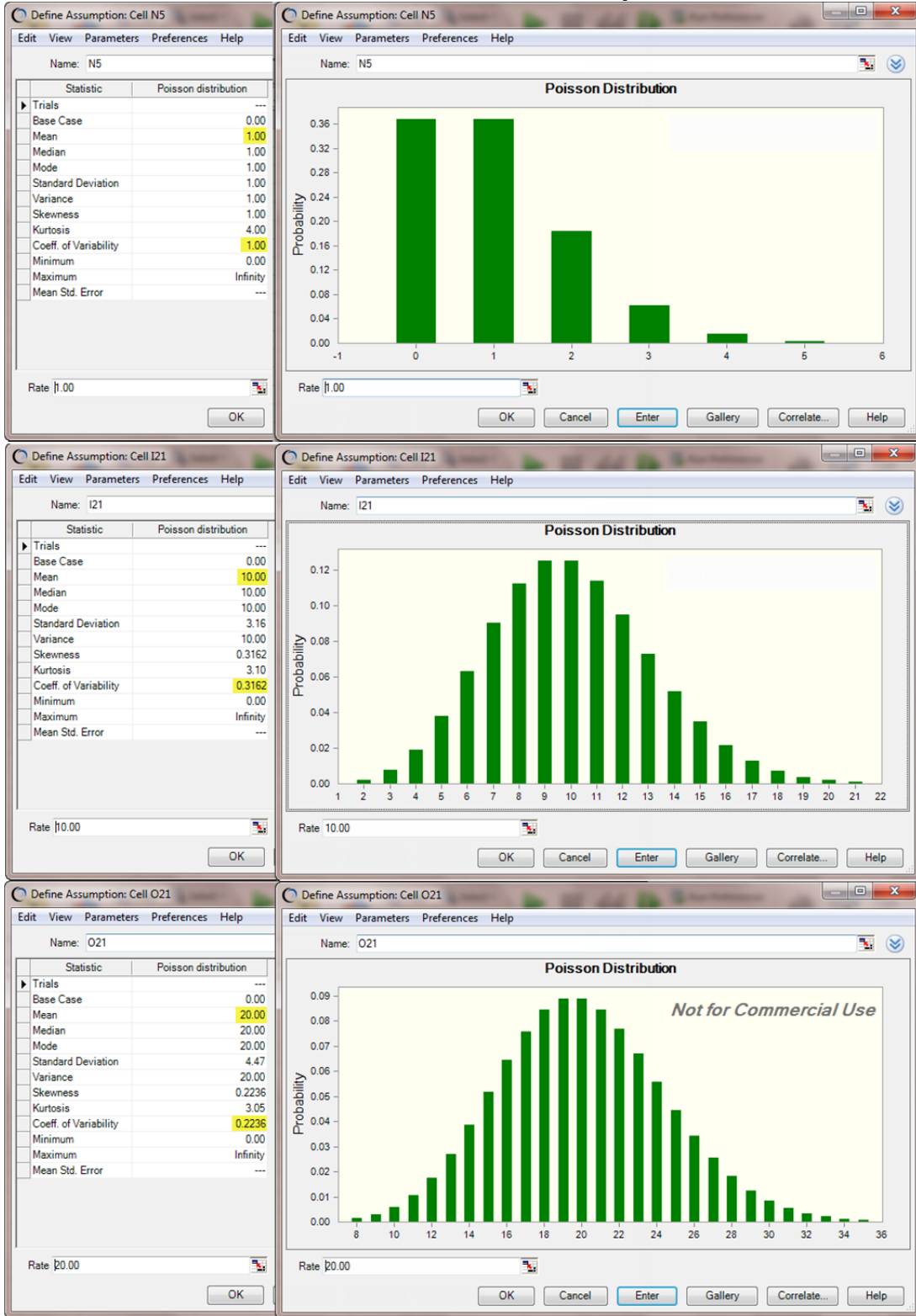
EOQ Simulation Study  
Inventory Items and Attributes Used in Simulation Study

Sequence #	Item #	Item Cost ( $v$ )	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand ( $D$ )	Lead Time Weeks ( $L$ )
1	C1D1L1	\$7.50	1	52	4
2	C2D1L1	\$75.00	1	52	4
3	C3D1L1	\$750.00	1	52	4
4	C1D1L2	\$7.50	1	52	6
5	C2D1L2	\$75.00	1	52	6
6	C3D1L2	\$750.00	1	52	6
7	C1D1L3	\$7.50	1	52	8
8	C2D1L3	\$75.00	1	52	8
9	C3D1L3	\$750.00	1	52	8
10	C1D1L4	\$7.50	1	52	10
11	C2D1L4	\$75.00	1	52	10
12	C3D1L4	\$750.00	1	52	10
13	C1D2L1	\$7.50	10	520	4
14	C2D2L1	\$75.00	10	520	4
15	C3D2L1	\$750.00	10	520	4
16	C1D2L2	\$7.50	10	520	6
17	C2D2L2	\$75.00	10	520	6
18	C3D2L2	\$750.00	10	520	6
19	C1D2L3	\$7.50	10	520	8
20	C2D2L3	\$75.00	10	520	8
21	C3D2L3	\$750.00	10	520	8
22	C1D2L4	\$7.50	10	520	10
23	C2D2L4	\$75.00	10	520	10
24	C3D2L4	\$750.00	10	520	10
25	C1D3L1	\$7.50	20	1,040	4
26	C2D3L1	\$75.00	20	1,040	4
27	C3D3L1	\$750.00	20	1,040	4
28	C1D3L2	\$7.50	20	1,040	6
29	C2D3L2	\$75.00	20	1,040	6
30	C3D3L2	\$750.00	20	1,040	6
31	C1D3L3	\$7.50	20	1,040	8
32	C2D3L3	\$75.00	20	1,040	8
33	C3D3L3	\$750.00	20	1,040	8
34	C1D3L4	\$7.50	20	1,040	10
35	C2D3L4	\$75.00	20	1,040	10
36	C3D3L4	\$750.00	20	1,040	10

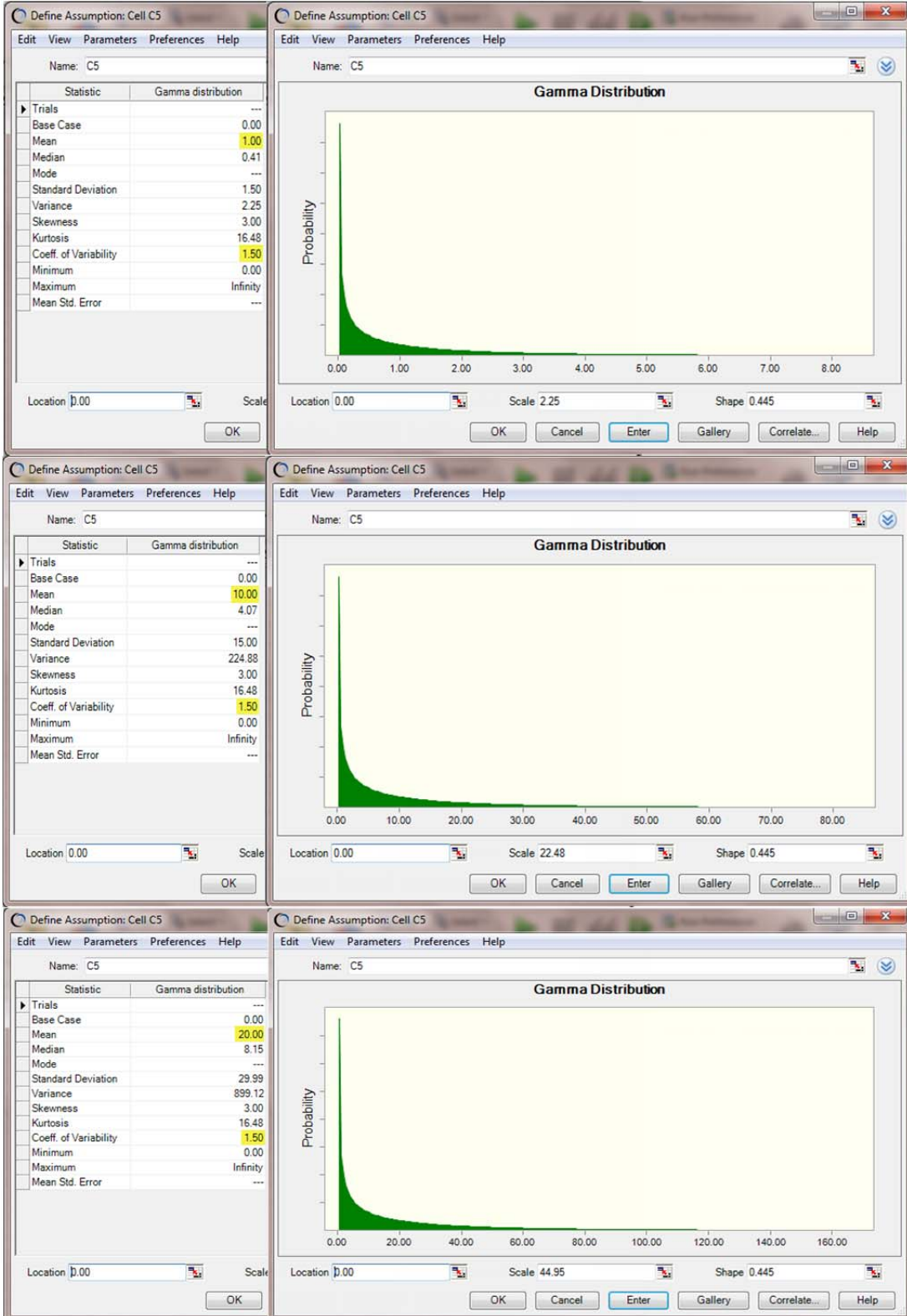
APPENDIX C  
PARAMETER VALUES FOR DEMAND  
PATTERN SIMULATION



Poisson Distribution Parameter Values for Variability:  $\lambda = 1, 10, \text{ and } 20$



Gamma Distribution Parameter Values for Variability: Coefficient of Variation = 1.5





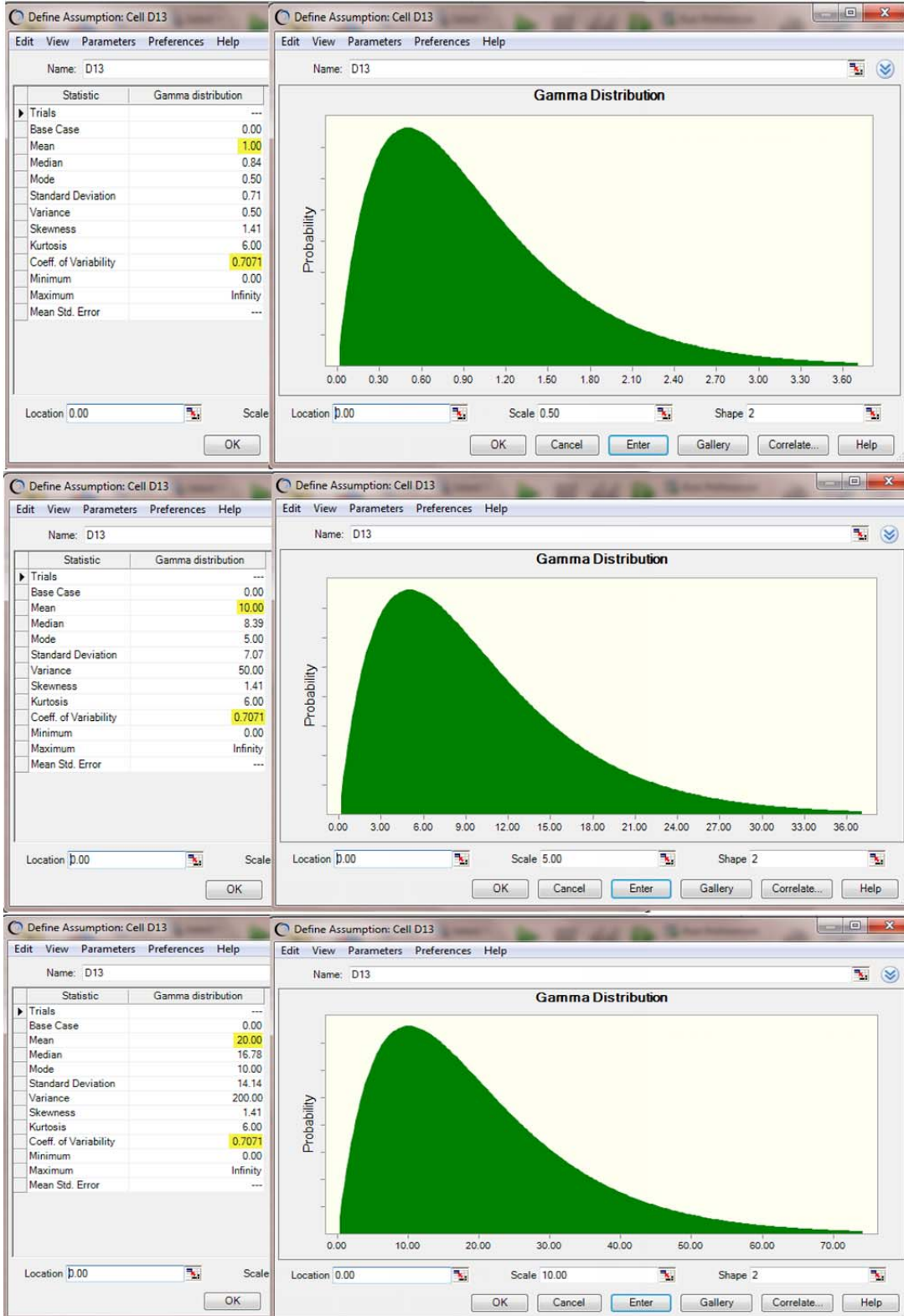
### Gamma Distribution Parameter Values for Variability: Coefficient of Variation = 4.0

The following table summarizes the parameters shown in the three screenshots:

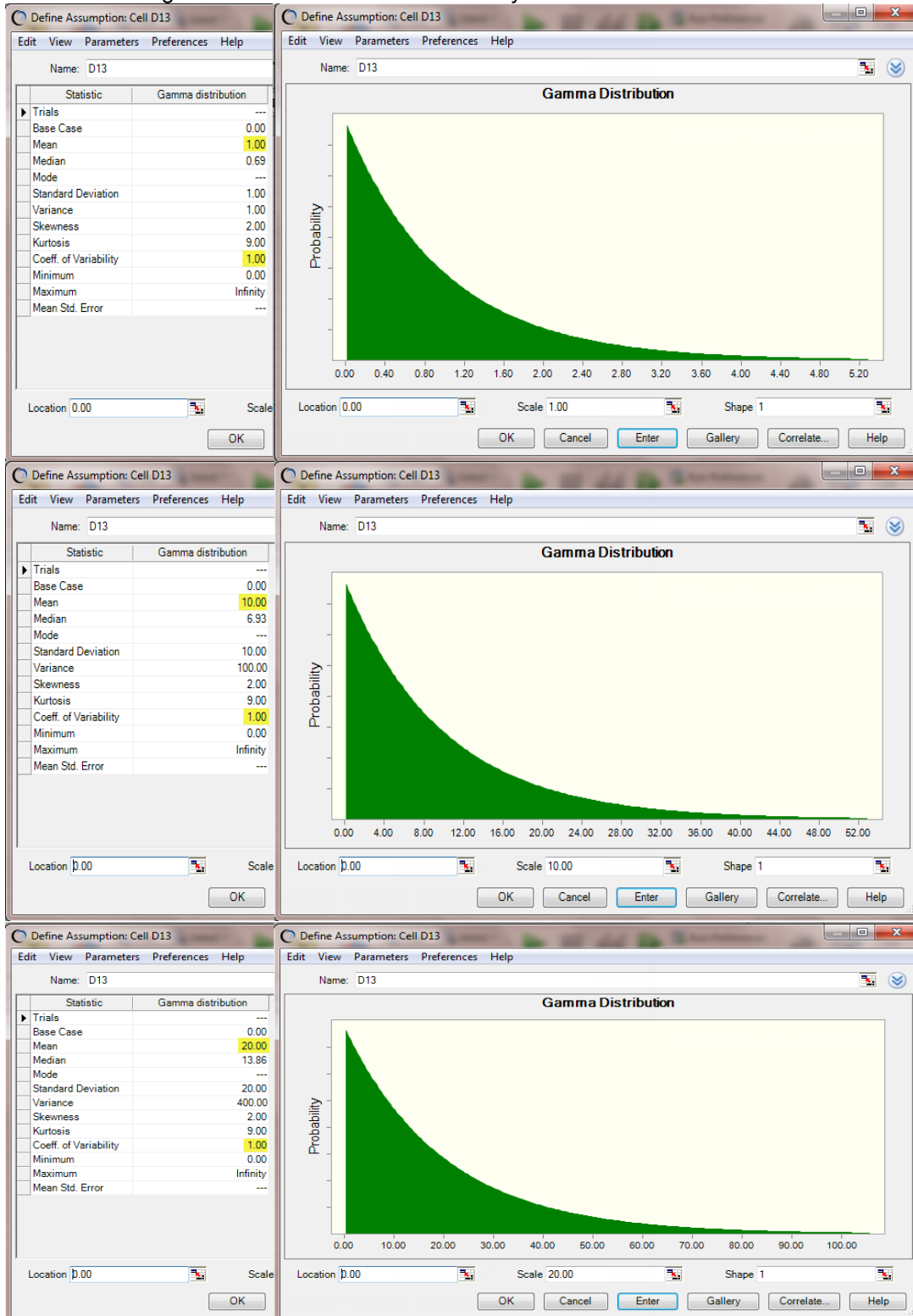
Mean	Standard Deviation	Variance	Scale
1.00	4.00	16.00	16.00
10.00	40.00	1,600.00	160.00
20.00	80.00	6,400.00	320.00

In all three cases, the Coefficient of Variability is 4.00, the Location is 0.00, and the Shape is 0.0625.

Erlang-C Parameter Values for Variability: Coefficient of Variability = 0.7071



### Erlang-C Parameter Values for Variability: Coefficient of Variation = 1.0



APPENDIX D  
SAMPLE SCREEN PRINTS FROM SIMULATION MODELS

## Sample Screen Prints from Simulation Models

### Simulated Demand Table: Trend Demand

Table X-11													
EOQ Simulation Study													
[(a + bt) x F] + ε Simulated Demand with Error Term													
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand (d̄)	Annual Unit Demand (D)	Lead Time Weeks (L)	[(a + bt) x F] + ε = Simulated Demand with Error Term-->							
						1	2	3	4				
681	11	C2D1L4	\$75.00	1	52	10	1	1	1	1			
682	12	C3D1L4	\$750.00	1	52	10	1	1	1	1			
683													
684	13	C1D2L1	\$7.50	10	520	4	8	5	5	5			
685	14	C2D2L1	\$75.00	10	520	4	5	7	6	5			
686	15	C3D2L1	\$750.00	10	520	4	5	5	8	7			
687													
688	16	C1D2L2	\$7.50	10	520	6	7	5	6	5			
689	17	C2D2L2	\$75.00	10	520	6	3	5	5	6			
690	18	C3D2L2	\$750.00	10	520	6	4	6	7	4			
691													
692	19	C1D2L3	\$7.50	10	520	8	5	8	5	7			
693	20	C2D2L3	\$75.00	10	520	8	6	7	5	7			
694	21	C3D2L3	\$750.00	10	520	8	7	6	4	8			
695													
696	22	C1D2L4	\$7.50	10	520	10	6	6	4	3			
697	23	C2D2L4	\$75.00	10	520	10	7	4	4	6			
698	24	C3D2L4	\$750.00	10	520	10	6	5	7	7			
699													
700	25	C1D3L1	\$7.50	20	1,040	4	14	10	12	13			

### Simulated Demand Table: Poisson Demand

Table X													
EOQ Simulation Study													
Simulated Demand in Units													
Case 5A: Poisson Distribution/Low Variability													
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand (d̄)	Annual Unit Demand (D)	Lead Time Weeks (L)	Parameters		Simulated Demand by Week in Units -->					
						Base Arrival Rate (λ)		1	2	3			
25	12	C3D1L4	\$750.00	1	52	10	1		2	1	1		
26													
27	13	C1D2L1	\$7.50	10	520	4	10		10	10	8		
28	14	C2D2L1	\$75.00	10	520	4	10		8	8	11		
29	15	C3D2L1	\$750.00	10	520	4	10		19	14	5		
30													
31	16	C1D2L2	\$7.50	10	520	6	10		14	12	7		
32	17	C2D2L2	\$75.00	10	520	6	10		11	8	11		
33	18	C3D2L2	\$750.00	10	520	6	10		12	10	5		
34													
35	19	C1D2L3	\$7.50	10	520	8	10		13	10	11		
36	20	C2D2L3	\$75.00	10	520	8	10		14	3	11		
37	21	C3D2L3	\$750.00	10	520	8	10		6	9	13		
38													
39	22	C1D2L4	\$7.50	10	520	10	10		7	8	9		
40	23	C2D2L4	\$75.00	10	520	10	10		12	10	13		
41	24	C3D2L4	\$750.00	10	520	10	10		14	8	5		
42													
43	25	C1D3L1	\$7.50	20	1,040	4	20		21	17	20		

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 1: Normal Demand/Low Variability

Table X-1 EOQ Simulation Study Beginning On-Hand Quantity (Units)										
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->				
						1	2	3	4	
1	1	C1D1L1	\$7.50	1	52	4	12	11	7	6
2	2	C2D1L1	\$75.00	1	52	4	12	11	11	10
3	3	C3D1L1	\$750.00	1	52	4	12	10	10	10
4	4	C1D1L2	\$7.50	1	52	6	15	10	10	7
5	5	C2D1L2	\$75.00	1	52	6	15	15	15	15
6	6	C3D1L2	\$750.00	1	52	6	15	13	13	11
7	7	C1D1L3	\$7.50	1	52	8	18	18	17	15
8	8	C2D1L3	\$75.00	1	52	8	18	18	17	15
9	9	C3D1L3	\$750.00	1	52	8	18	18	16	13
10	10	C1D1L4	\$7.50	1	52	10	21	21	19	17
11	11	C2D1L4	\$75.00	1	52	10	21	19	19	16
12	12	C3D1L4	\$750.00	1	52	10	21	20	18	17
13	13	C1D2L1	\$7.50	10	520	4	121	112	101	92
14	14	C2D2L1	\$75.00	10	520	4	121	104	60	38
15	15	C3D2L1	\$750.00	10	520	4	121	110	109	109
16	16	C1D2L2	\$7.50	10	520	6	150	133	123	123
17	17	C2D2L2	\$75.00	10	520	6	150	148	148	145

(R, s, S) EOQ Inventory System Cost Table 2: Normal Demand/Low Variability

Table X-2 EOQ Simulation Study Replenishment Quantity Received (Units)										
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->				
						1	2	3	4	
1	1	C1D1L1	\$7.50	1	52	4	0	0	0	0
2	2	C2D1L1	\$75.00	1	52	4	0	0	0	0
3	3	C3D1L1	\$750.00	1	52	4	0	0	0	0
4	4	C1D1L2	\$7.50	1	52	6	0	0	0	0
5	5	C2D1L2	\$75.00	1	52	6	0	0	0	0
6	6	C3D1L2	\$750.00	1	52	6	0	0	0	0
7	7	C1D1L3	\$7.50	1	52	8	0	0	0	0
8	8	C2D1L3	\$75.00	1	52	8	0	0	0	0
9	9	C3D1L3	\$750.00	1	52	8	0	0	0	0
10	10	C1D1L4	\$7.50	1	52	10	0	0	0	0
11	11	C2D1L4	\$75.00	1	52	10	0	0	0	0
12	12	C3D1L4	\$750.00	1	52	10	0	0	0	0
13	13	C1D2L1	\$7.50	10	520	4	0	0	0	0
14	14	C2D2L1	\$75.00	10	520	4	0	0	0	0
15	15	C3D2L1	\$750.00	10	520	4	0	0	0	0
16	16	C1D2L2	\$7.50	10	520	6	0	0	0	0
17	17	C2D2L2	\$75.00	10	520	6	0	0	0	0

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 3: Normal Demand/Low Variability

Table X-3 EOQ Simulation Study Total Quantity Available (Units)												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->						
						1	2	3	4			
123	1	C1D1L1	\$7.50	1	52	4	12	11	7	6		
124	2	C2D1L1	\$75.00	1	52	4	12	11	11	10		
125	3	C3D1L1	\$750.00	1	52	4	12	10	10	10		
127	4	C1D1L2	\$7.50	1	52	6	15	10	10	7		
128	5	C2D1L2	\$75.00	1	52	6	15	15	15	15		
129	6	C3D1L2	\$750.00	1	52	6	15	13	13	11		
131	7	C1D1L3	\$7.50	1	52	8	18	18	17	15		
132	8	C2D1L3	\$75.00	1	52	8	18	18	17	15		
133	9	C3D1L3	\$750.00	1	52	8	18	18	16	13		
135	10	C1D1L4	\$7.50	1	52	10	21	21	19	17		
136	11	C2D1L4	\$75.00	1	52	10	21	19	19	16		
137	12	C3D1L4	\$750.00	1	52	10	21	20	18	17		
139	13	C1D2L1	\$7.50	10	520	4	121	112	101	92		
140	14	C2D2L1	\$75.00	10	520	4	121	104	60	38		
141	15	C3D2L1	\$750.00	10	520	4	121	110	109	109		
143	16	C1D2L2	\$7.50	10	520	6	150	133	123	123		
144	17	C2D2L2	\$75.00	10	520	6	150	148	148	145		

(R, s, S) EOQ Inventory System Cost Table 4: Normal Demand/Low Variability

Table X-4 EOQ Simulation Study Simulated Weekly Demand (Units)												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->						
						1	2	3	4			
180	1	C1D1L1	\$7.50	1	52	4	1	4	1	1		
181	2	C2D1L1	\$75.00	1	52	4	1	0	1	3		
182	3	C3D1L1	\$750.00	1	52	4	2	0	0	1		
184	4	C1D1L2	\$7.50	1	52	6	5	0	3	1		
185	5	C2D1L2	\$75.00	1	52	6	0	0	0	2		
186	6	C3D1L2	\$750.00	1	52	6	2	0	2	2		
188	7	C1D1L3	\$7.50	1	52	8	0	1	2	2		
189	8	C2D1L3	\$75.00	1	52	8	0	1	2	3		
190	9	C3D1L3	\$750.00	1	52	8	0	2	3	2		
192	10	C1D1L4	\$7.50	1	52	10	0	2	2	3		
193	11	C2D1L4	\$75.00	1	52	10	2	0	3	1		
194	12	C3D1L4	\$750.00	1	52	10	1	2	1	0		
196	13	C1D2L1	\$7.50	10	520	4	9	11	9	3		
197	14	C2D2L1	\$75.00	10	520	4	17	44	22	0		
198	15	C3D2L1	\$750.00	10	520	4	11	1	0	0		
200	16	C1D2L2	\$7.50	10	520	6	17	10	0	49		
201	17	C2D2L2	\$75.00	10	520	6	2	0	3	12		

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 5: Normal Demand/Low Variability

Table X-5 EOQ Simulation Study Ending On-Hand Quantity for Reorder Point Test and Stockout Calculations (Units)												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->						
						1	2	3	4			
237	1	C1D1L1	\$7.50	1	52	4	11	7	6	5		
238	2	C2D1L1	\$75.00	1	52	4	11	11	10	7		
239	3	C3D1L1	\$750.00	1	52	4	10	10	10	9		
240	4	C1D1L2	\$7.50	1	52	6	10	10	7	6		
241	5	C2D1L2	\$75.00	1	52	6	15	15	15	13		
242	6	C3D1L2	\$750.00	1	52	6	13	13	11	9		
243	7	C1D1L3	\$7.50	1	52	8	18	17	15	13		
244	8	C2D1L3	\$75.00	1	52	8	18	17	15	12		
245	9	C3D1L3	\$750.00	1	52	8	18	16	13	11		
246	10	C1D1L4	\$7.50	1	52	10	21	19	17	14		
247	11	C2D1L4	\$75.00	1	52	10	19	19	16	15		
248	12	C3D1L4	\$750.00	1	52	10	20	18	17	17		
249	13	C1D2L1	\$7.50	10	520	4	112	101	92	89		
250	14	C2D2L1	\$75.00	10	520	4	104	60	38	38		
251	15	C3D2L1	\$750.00	10	520	4	110	109	109	109		
252	16	C1D2L2	\$7.50	10	520	6	133	123	123	74		
253	17	C2D2L2	\$75.00	10	520	6	148	148	145	133		

(R, s, S) EOQ Inventory System Cost Table 6: Normal Demand/Low Variability

Table X-6 EOQ Simulation Study Ending On-Hand Quantity Net of Stockouts--Positive Quantities Only (Units)												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->						
						1	2	3	4			
289	1	C1D1L1	\$7.50	1	52	4	11	7	6	5		
290	2	C2D1L1	\$75.00	1	52	4	11	11	10	7		
291	3	C3D1L1	\$750.00	1	52	4	10	10	10	9		
292	4	C1D1L2	\$7.50	1	52	6	10	10	7	6		
293	5	C2D1L2	\$75.00	1	52	6	15	15	15	13		
294	6	C3D1L2	\$750.00	1	52	6	13	13	11	9		
295	7	C1D1L3	\$7.50	1	52	8	18	17	15	13		
296	8	C2D1L3	\$75.00	1	52	8	18	17	15	12		
297	9	C3D1L3	\$750.00	1	52	8	18	16	13	11		
298	10	C1D1L4	\$7.50	1	52	10	21	19	17	14		
299	11	C2D1L4	\$75.00	1	52	10	19	19	16	15		
300	12	C3D1L4	\$750.00	1	52	10	20	18	17	17		
301	13	C1D2L1	\$7.50	10	520	4	112	101	92	89		
302	14	C2D2L1	\$75.00	10	520	4	104	60	38	38		
303	15	C3D2L1	\$750.00	10	520	4	110	109	109	109		
304	16	C1D2L2	\$7.50	10	520	6	133	123	123	74		
305	17	C2D2L2	\$75.00	10	520	6	148	148	145	133		



Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 7: Normal Demand/Low Variability

Table X-7																
EOQ Simulation Study																
Prior Open Replenishment Order Quantity Less Current Receipts (Units)																
Sequence	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->										
#						1	2	3	4							
346																
347																
348																
349																
350																
351	1	C1D1L1	\$7.50	1	52	4	0	94	94	94						
352	2	C2D1L1	\$75.00	1	52	4	0	30	30	30						
353	3	C3D1L1	\$750.00	1	52	4	0	11	11	11						
354	4	C1D1L2	\$7.50	1	52	6	0	98	98	98						
355	5	C2D1L2	\$75.00	1	52	6	0	29	29	29						
356	6	C3D1L2	\$750.00	1	52	6	0	11	11	11						
357																
358	7	C1D1L3	\$7.50	1	52	8	0	93	93	93						
359	8	C2D1L3	\$75.00	1	52	8	0	29	29	29						
360	9	C3D1L3	\$750.00	1	52	8	0	9	9	9						
361																
362	10	C1D1L4	\$7.50	1	52	10	0	93	93	93						
363	11	C2D1L4	\$75.00	1	52	10	0	31	31	31						
364	12	C3D1L4	\$750.00	1	52	10	0	10	10	10						
365																
366	13	C1D2L1	\$7.50	10	520	4	0	303	303	303						
367	14	C2D2L1	\$75.00	10	520	4	0	110	110	110						
368	15	C3D2L1	\$750.00	10	520	4	0	40	40	40						
369																
370	16	C1D2L2	\$7.50	10	520	6	0	311	311	311						
371	17	C2D2L2	\$75.00	10	520	6	0	95	95	95						
372																
373																
374																
375																

(R, s, S) EOQ Inventory System Cost Table 8: Normal Demand/Low Variability

Table X-8																
EOQ Simulation Study																
Inventory Position for Reorder Point Test (Units)																
Sequence	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->										
#						1	2	3	4							
403																
404																
405																
406																
407																
408	1	C1D1L1	\$7.50	1	52	4	11	101	100	99						
409	2	C2D1L1	\$75.00	1	52	4	11	41	40	37						
410	3	C3D1L1	\$750.00	1	52	4	10	21	21	20						
411																
412	4	C1D1L2	\$7.50	1	52	6	10	108	105	104						
413	5	C2D1L2	\$75.00	1	52	6	15	44	44	42						
414	6	C3D1L2	\$750.00	1	52	6	13	24	22	20						
415																
416	7	C1D1L3	\$7.50	1	52	8	18	110	108	106						
417	8	C2D1L3	\$75.00	1	52	8	18	46	44	41						
418	9	C3D1L3	\$750.00	1	52	8	18	25	22	20						
419																
420	10	C1D1L4	\$7.50	1	52	10	21	112	110	107						
421	11	C2D1L4	\$75.00	1	52	10	19	50	47	46						
422	12	C3D1L4	\$750.00	1	52	10	20	28	27	27						
423																
424	13	C1D2L1	\$7.50	10	520	4	112	404	395	392						
425	14	C2D2L1	\$75.00	10	520	4	104	170	148	148						
426	15	C3D2L1	\$750.00	10	520	4	110	149	149	149						
427																
428	16	C1D2L2	\$7.50	10	520	6	133	434	434	385						
429	17	C2D2L2	\$75.00	10	520	6	148	243	240	228						
430																
431																
432																

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 9: Normal Demand/Low Variability

Table X-9 EOQ Simulation Study Reorder Point s (Units)												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->						
						1	2	3	4			
468	1	C1D1L1	\$7.50	1	52	4	12	12	12	12		
469	2	C2D1L1	\$75.00	1	52	4	12	12	12	12		
470	3	C3D1L1	\$750.00	1	52	4	12	12	12	12		
472	4	C1D1L2	\$7.50	1	52	6	15	15	15	15		
473	5	C2D1L2	\$75.00	1	52	6	15	15	15	15		
474	6	C3D1L2	\$750.00	1	52	6	15	15	15	15		
476	7	C1D1L3	\$7.50	1	52	8	18	18	18	18		
477	8	C2D1L3	\$75.00	1	52	8	18	18	18	18		
478	9	C3D1L3	\$750.00	1	52	8	18	18	18	18		
480	10	C1D1L4	\$7.50	1	52	10	21	21	21	21		
481	11	C2D1L4	\$75.00	1	52	10	21	21	21	21		
482	12	C3D1L4	\$750.00	1	52	10	21	21	21	21		
484	13	C1D2L1	\$7.50	10	520	4	121	121	121	121		
485	14	C2D2L1	\$75.00	10	520	4	121	121	121	121		
486	15	C3D2L1	\$750.00	10	520	4	121	121	121	121		
488	16	C1D2L2	\$7.50	10	520	6	150	150	150	150		
489	17	C2D2L2	\$75.00	10	520	6	150	150	150	150		

(R, s, S) EOQ Inventory System Cost Table 10: Normal Demand/Low Variability

Table X-10 EOQ Simulation Study Reorder Point Test (1 = Order; 0 = No Order)												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->						
						1	2	3	4			
524	1	C1D1L1	\$7.50	1	52	4	1		0			
526	2	C2D1L1	\$75.00	1	52	4	1		0			
527	3	C3D1L1	\$750.00	1	52	4	1		0			
529	4	C1D1L2	\$7.50	1	52	6	1		0			
530	5	C2D1L2	\$75.00	1	52	6	1		0			
531	6	C3D1L2	\$750.00	1	52	6	1		0			
533	7	C1D1L3	\$7.50	1	52	8	1		0			
534	8	C2D1L3	\$75.00	1	52	8	1		0			
535	9	C3D1L3	\$750.00	1	52	8	1		0			
537	10	C1D1L4	\$7.50	1	52	10	1		0			
538	11	C2D1L4	\$75.00	1	52	10	1		0			
539	12	C3D1L4	\$750.00	1	52	10	1		0			
541	13	C1D2L1	\$7.50	10	520	4	1		0			
542	14	C2D2L1	\$75.00	10	520	4	1		0			
543	15	C3D2L1	\$750.00	10	520	4	1		0			
545	16	C1D2L2	\$7.50	10	520	6	1		0			
546	17	C2D2L2	\$75.00	10	520	6	1		0			

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 11: Normal Demand/Low Variability

Table X-11 EOQ Simulation Study Order Up To Target S (Units)												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->						
						1	2	3	4			
579	1	C1D1L1	\$7.50	1	52	4	105	105	105	105		
580	2	C2D1L1	\$75.00	1	52	4	41	41	41	41		
581	3	C3D1L1	\$750.00	1	52	4	21	21	21	21		
582	4	C1D1L2	\$7.50	1	52	6	108	108	108	108		
583	5	C2D1L2	\$75.00	1	52	6	44	44	44	44		
584	6	C3D1L2	\$750.00	1	52	6	24	24	24	24		
585	7	C1D1L3	\$7.50	1	52	8	111	111	111	111		
586	8	C2D1L3	\$75.00	1	52	8	47	47	47	47		
587	9	C3D1L3	\$750.00	1	52	8	27	27	27	27		
588	10	C1D1L4	\$7.50	1	52	10	114	114	114	114		
589	11	C2D1L4	\$75.00	1	52	10	50	50	50	50		
590	12	C3D1L4	\$750.00	1	52	10	30	30	30	30		
591	13	C1D2L1	\$7.50	10	520	4	415	415	415	415		
592	14	C2D2L1	\$75.00	10	520	4	214	214	214	214		
593	15	C3D2L1	\$750.00	10	520	4	150	150	150	150		
594	16	C1D2L2	\$7.50	10	520	6	444	444	444	444		
595	17	C2D2L2	\$75.00	10	520	6	243	243	243	243		

(R, s, S) EOQ Inventory System Cost Table 12: Normal Demand/Low Variability

Table X-12 EOQ Simulation Study Order Quantity (Units)												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->						
						1	2	3	4			
636	1	C1D1L1	\$7.50	1	52	4	94	0	0	0		
637	2	C2D1L1	\$75.00	1	52	4	30	0	0	0		
638	3	C3D1L1	\$750.00	1	52	4	11	0	0	0		
639	4	C1D1L2	\$7.50	1	52	6	98	0	0	0		
640	5	C2D1L2	\$75.00	1	52	6	29	0	0	0		
641	6	C3D1L2	\$750.00	1	52	6	11	0	0	0		
642	7	C1D1L3	\$7.50	1	52	8	93	0	0	0		
643	8	C2D1L3	\$75.00	1	52	8	29	0	0	0		
644	9	C3D1L3	\$750.00	1	52	8	9	0	0	0		
645	10	C1D1L4	\$7.50	1	52	10	93	0	0	0		
646	11	C2D1L4	\$75.00	1	52	10	31	0	0	0		
647	12	C3D1L4	\$750.00	1	52	10	10	0	0	0		
648	13	C1D2L1	\$7.50	10	520	4	303	0	0	0		
649	14	C2D2L1	\$75.00	10	520	4	110	0	0	0		
650	15	C3D2L1	\$750.00	10	520	4	40	0	0	0		
651	16	C1D2L2	\$7.50	10	520	6	311	0	0	0		
652	17	C2D2L2	\$75.00	10	520	6	95	0	0	0		

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 13: Normal Demand/Low Variability

Table X-13																
EOQ Simulation Study																
Ending Open Replenishment Order Quantity (Units)																
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->										
						1	2	3	4							
696	1	C1D1L1	\$7.50	1	52	4	94	94	94	94						
697	2	C2D1L1	\$75.00	1	52	4	30	30	30	30						
698	3	C3D1L1	\$750.00	1	52	4	11	11	11	11						
700	4	C1D1L2	\$7.50	1	52	6	98	98	98	98						
701	5	C2D1L2	\$75.00	1	52	6	29	29	29	29						
702	6	C3D1L2	\$750.00	1	52	6	11	11	11	11						
704	7	C1D1L3	\$7.50	1	52	8	93	93	93	93						
705	8	C2D1L3	\$75.00	1	52	8	29	29	29	29						
706	9	C3D1L3	\$750.00	1	52	8	9	9	9	9						
708	10	C1D1L4	\$7.50	1	52	10	93	93	93	93						
709	11	C2D1L4	\$75.00	1	52	10	31	31	31	31						
710	12	C3D1L4	\$750.00	1	52	10	10	10	10	10						
712	13	C1D2L1	\$7.50	10	520	4	303	303	303	303						
713	14	C2D2L1	\$75.00	10	520	4	110	110	110	110						
714	15	C3D2L1	\$750.00	10	520	4	40	40	40	40						
716	16	C1D2L2	\$7.50	10	520	6	311	311	311	311						
717	17	C2D2L2	\$75.00	10	520	6	95	95	95	95						

(R, s, S) EOQ Inventory System Cost Table 14: Normal Demand/Low Variability

Table X-14																
EOQ Simulation Study																
Ending Inventory Cost (v × Ending On Hand Quantity)																
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->										
						1	2	3	4							
753	1	C1D1L1	\$7.50	1	52	4	82.50	52.50	45.00	37.50						
754	2	C2D1L1	\$75.00	1	52	4	825.00	825.00	750.00	525.00						
755	3	C3D1L1	\$750.00	1	52	4	7,500.00	7,500.00	7,500.00	6,750.00						
757	4	C1D1L2	\$7.50	1	52	6	75.00	75.00	52.50	45.00						
758	5	C2D1L2	\$75.00	1	52	6	1,125.00	1,125.00	1,125.00	975.00						
759	6	C3D1L2	\$750.00	1	52	6	9,750.00	9,750.00	8,250.00	6,750.00						
761	7	C1D1L3	\$7.50	1	52	8	135.00	127.50	112.50	97.50						
762	8	C2D1L3	\$75.00	1	52	8	1,350.00	1,275.00	1,125.00	900.00						
763	9	C3D1L3	\$750.00	1	52	8	13,500.00	12,000.00	9,750.00	8,250.00						
765	10	C1D1L4	\$7.50	1	52	10	157.50	142.50	127.50	105.00						
766	11	C2D1L4	\$75.00	1	52	10	1,425.00	1,425.00	1,200.00	1,125.00						
767	12	C3D1L4	\$750.00	1	52	10	15,000.00	13,500.00	12,750.00	12,750.00						
769	13	C1D2L1	\$7.50	10	520	4	840.00	757.50	690.00	667.50						
770	14	C2D2L1	\$75.00	10	520	4	7,800.00	4,500.00	2,850.00	2,850.00						
771	15	C3D2L1	\$750.00	10	520	4	82,500.00	81,750.00	81,750.00	81,750.00						
773	16	C1D2L2	\$7.50	10	520	6	997.50	922.50	922.50	555.00						
774	17	C2D2L2	\$75.00	10	520	6	11,100.00	11,100.00	10,875.00	9,975.00						

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 15: Normal Demand/Low Variability

Table X-15 EOQ Simulation Study Ordering Cost																
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->										
						1	2	3	4							
813	1	C1D1L1	\$7.50	1	52	4	75.00	0.00	0.00	0.00						
814	2	C2D1L1	\$75.00	1	52	4	75.00	0.00	0.00	0.00						
815	3	C3D1L1	\$750.00	1	52	4	75.00	0.00	0.00	0.00						
817	4	C1D1L2	\$7.50	1	52	6	75.00	0.00	0.00	0.00						
818	5	C2D1L2	\$75.00	1	52	6	75.00	0.00	0.00	0.00						
819	6	C3D1L2	\$750.00	1	52	6	75.00	0.00	0.00	0.00						
821	7	C1D1L3	\$7.50	1	52	8	75.00	0.00	0.00	0.00						
822	8	C2D1L3	\$75.00	1	52	8	75.00	0.00	0.00	0.00						
823	9	C3D1L3	\$750.00	1	52	8	75.00	0.00	0.00	0.00						
825	10	C1D1L4	\$7.50	1	52	10	75.00	0.00	0.00	0.00						
826	11	C2D1L4	\$75.00	1	52	10	75.00	0.00	0.00	0.00						
827	12	C3D1L4	\$750.00	1	52	10	75.00	0.00	0.00	0.00						
829	13	C1D2L1	\$7.50	10	520	4	75.00	0.00	0.00	0.00						
830	14	C2D2L1	\$75.00	10	520	4	75.00	0.00	0.00	0.00						
831	15	C3D2L1	\$750.00	10	520	4	75.00	0.00	0.00	0.00						
833	16	C1D2L2	\$7.50	10	520	6	75.00	0.00	0.00	0.00						
834	17	C2D2L2	\$75.00	10	520	6	75.00	0.00	0.00	0.00						

(R, s, S) EOQ Inventory System Cost Table 16: Normal Demand/Low Variability

Table X-16 EOQ Simulation Study Inventory Holding Cost [(Ending Qty x v) x (r/52)]																
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->										
						1	2	3	4							
873	1	C1D1L1	\$7.50	1	52	4	0.19	0.12	0.10	0.09						
874	2	C2D1L1	\$75.00	1	52	4	1.90	1.90	1.73	1.21						
875	3	C3D1L1	\$750.00	1	52	4	17.31	17.31	17.31	15.58						
877	4	C1D1L2	\$7.50	1	52	6	0.17	0.17	0.12	0.10						
878	5	C2D1L2	\$75.00	1	52	6	2.60	2.60	2.60	2.25						
879	6	C3D1L2	\$750.00	1	52	6	22.50	22.50	19.04	15.58						
881	7	C1D1L3	\$7.50	1	52	8	0.31	0.29	0.26	0.23						
882	8	C2D1L3	\$75.00	1	52	8	3.12	2.94	2.60	2.08						
883	9	C3D1L3	\$750.00	1	52	8	31.16	27.70	22.50	19.04						
885	10	C1D1L4	\$7.50	1	52	10	0.36	0.33	0.29	0.24						
886	11	C2D1L4	\$75.00	1	52	10	3.29	3.29	2.77	2.60						
887	12	C3D1L4	\$750.00	1	52	10	34.62	31.16	29.43	29.43						
889	13	C1D2L1	\$7.50	10	520	4	1.94	1.75	1.59	1.54						
890	14	C2D2L1	\$75.00	10	520	4	18.00	10.39	6.58	6.58						
891	15	C3D2L1	\$750.00	10	520	4	190.41	188.68	188.68	188.68						
893	16	C1D2L2	\$7.50	10	520	6	2.30	2.13	2.13	1.28						
894	17	C2D2L2	\$75.00	10	520	6	25.62	25.62	25.10	23.02						

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 17: Normal Demand/Low Variability

Table X-17																				
EOQ Simulation Study																				
Inventory Stockout Cost																				
															Fixed Order Cost		A =		\$75.00	
Sequence	Item #	Item Cost (v)	Weekly Unit Demand (d)	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->														
#						1	2	3	4											
930	1	C1D1L1	\$7.50	1	52	4	0.00	0.00	0.00	0.00										
931	2	C2D1L1	\$75.00	1	52	4	0.00	0.00	0.00	0.00										
932	3	C3D1L1	\$750.00	1	52	4	0.00	0.00	0.00	0.00										
933	4	C1D1L2	\$7.50	1	52	6	0.00	0.00	0.00	0.00										
934	5	C2D1L2	\$75.00	1	52	6	0.00	0.00	0.00	0.00										
935	6	C3D1L2	\$750.00	1	52	6	0.00	0.00	0.00	0.00										
936	7	C1D1L3	\$7.50	1	52	8	0.00	0.00	0.00	0.00										
937	8	C2D1L3	\$75.00	1	52	8	0.00	0.00	0.00	0.00										
938	9	C3D1L3	\$750.00	1	52	8	0.00	0.00	0.00	0.00										
939	10	C1D1L4	\$7.50	1	52	10	0.00	0.00	0.00	0.00										
940	11	C2D1L4	\$75.00	1	52	10	0.00	0.00	0.00	0.00										
941	12	C3D1L4	\$750.00	1	52	10	0.00	0.00	0.00	0.00										
942	13	C1D2L1	\$7.50	10	520	4	0.00	0.00	0.00	0.00										
943	14	C2D2L1	\$75.00	10	520	4	0.00	0.00	0.00	0.00										
944	15	C3D2L1	\$750.00	10	520	4	0.00	0.00	0.00	0.00										
945	16	C1D2L2	\$7.50	10	520	6	0.00	0.00	0.00	0.00										
946	17	C2D2L2	\$75.00	10	520	6	0.00	0.00	0.00	0.00										

(R, s, S) EOQ Inventory System Cost Table 18: Normal Demand/Low Variability

Table X-18																
EOQ Simulation Study																
Total Inventory System Cost (Ordering Cost + Carrying Cost + Stockout Cost)																
Sequence	Item #	Item Cost (v)	Weekly Unit Demand (d)	Annual Unit Demand (D)	Lead Time Weeks (L)	Time Period (Week #) -->										
#						1	2	3	4							
1000	1	C1D1L1	\$7.50	1	52	4	75.19	0.12	0.10	0.09						
1001	2	C2D1L1	\$75.00	1	52	4	76.90	1.90	1.73	1.21						
1002	3	C3D1L1	\$750.00	1	52	4	92.31	17.31	17.31	15.58						
1003	4	C1D1L2	\$7.50	1	52	6	75.17	0.17	0.12	0.10						
1004	5	C2D1L2	\$75.00	1	52	6	77.60	2.60	2.60	2.25						
1005	6	C3D1L2	\$750.00	1	52	6	97.50	22.50	19.04	15.58						
1006	7	C1D1L3	\$7.50	1	52	8	75.31	0.29	0.26	0.23						
1007	8	C2D1L3	\$75.00	1	52	8	78.12	2.94	2.60	2.08						
1008	9	C3D1L3	\$750.00	1	52	8	106.16	27.70	22.50	19.04						
1009	10	C1D1L4	\$7.50	1	52	10	75.36	0.33	0.29	0.24						
1010	11	C2D1L4	\$75.00	1	52	10	78.29	3.29	2.77	2.60						
1011	12	C3D1L4	\$750.00	1	52	10	109.62	31.16	29.43	29.43						
1012	13	C1D2L1	\$7.50	10	520	4	76.94	1.75	1.59	1.54						
1013	14	C2D2L1	\$75.00	10	520	4	93.00	10.39	6.58	6.58						
1014	15	C3D2L1	\$750.00	10	520	4	265.41	188.68	188.68	188.68						
1015	16	C1D2L2	\$7.50	10	520	6	77.30	2.13	2.13	1.28						
1016	17	C2D2L2	\$75.00	10	520	6	100.62	25.62	25.10	23.02						

Sample Screen Prints from Simulation Models (Continued)

(R, s, S) EOQ Inventory System Cost Table 19: Normal Demand/Low Variability

Table X-19 EOQ Simulation Study Inventory System Performance Statistics												
Sequence #	Item #	Item Cost (v)	Weekly Unit Demand ( $\bar{d}$ )	Annual Unit Demand (D)	Lead Time Weeks (L)	Number of Stockout Wks by Item	% of Stockout Wks by Item	Average Inventory Cost	Cost of Sales COS = (D × v)	Inventory Turnover Ratio (COS ÷ Avg Inv Cost)		
1069												
1070	1	C1D1L1	\$7.50	1	52	4	0	0.0%	485.91	450.00	0.93	
1071	2	C2D1L1	\$75.00	1	52	4	0	0.0%	1,700.48	4,050.00	2.38	
1072	3	C3D1L1	\$750.00	1	52	4	0	0.0%	8,913.46	50,250.00	5.64	
1073												
1074	4	C1D1L2	\$7.50	1	52	6	0	0.0%	512.74	412.50	0.80	
1075	5	C2D1L2	\$75.00	1	52	6	0	0.0%	1,899.52	3,900.00	2.05	
1076	6	C3D1L2	\$750.00	1	52	6	0	0.0%	9,187.50	45,750.00	4.98	
1077												
1078	7	C1D1L3	\$7.50	1	52	8	0	0.0%	451.73	525.00	1.16	
1079	8	C2D1L3	\$75.00	1	52	8	0	0.0%	1,466.83	5,625.00	3.83	
1080	9	C3D1L3	\$750.00	1	52	8	0	0.0%	9,475.96	49,500.00	5.22	
1081												
1082	10	C1D1L4	\$7.50	1	52	10	0	0.0%	481.88	450.00	0.93	
1083	11	C2D1L4	\$75.00	1	52	10	0	0.0%	1,812.98	4,350.00	2.40	
1084	12	C3D1L4	\$750.00	1	52	10	0	0.0%	8,509.62	60,000.00	7.05	
1085												
1086	13	C1D2L1	\$7.50	10	520	4	0	0.0%	1,680.58	5,032.50	2.99	
1087	14	C2D2L1	\$75.00	10	520	4	0	0.0%	8,069.71	56,475.00	7.00	
1088	15	C3D2L1	\$750.00	10	520	4	0	0.0%	67,875.00	456,000.00	6.72	
1089												

APPENDIX E

T-TEST SAMPLE OUTPUT: SAME DEMAND PATTERN /  
ALTERNATIVE REPLENISHMENT MODELS



**Two-Sample Test Report**

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**Descriptive Statistics Section**

Variable	Count	Mean	Standard Deviation	Standard Error	95.0% LCL of Mean	95.0% UCL of Mean
X1A_1	1000	156527	844.7332	26.71281	156474.5	156579.4
X1A_2	1000	171196.8	960.1318	30.36203	171137.1	171256.4

Note: T-alpha (X1A\_1) = 1.9647, T-alpha (X1A\_2) = 1.9647

**Confidence-Limits of Difference Section**

Variance Assumption	DF	Mean Difference	Standard Deviation	Standard Error	95.0% LCL Difference	95.0% UCL Difference
Equal	1998	-14669.82	904.2752	40.44041	-14749.08	-14590.56
Unequal	1966.11	-14669.82	1278.838	40.44041	-14749.08	14590.56

Note: T-alpha (Equal) = 1.9600, T-alpha (Unequal) = 1.9600

**Equal-Variance T-Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-362.7515	0.000000	Yes	1.000000	1.000000
Randomization Test		0.001000	Yes		
Difference < 0	-362.7515	0.000000	Yes	1.000000	1.000000
Difference > 0	-362.7515	1.000000	No	0.000000	0.000000

Difference: (X1A\_1)-(X1A\_2)  
 The randomization test results are based on 1000 Monte Carlo samples.

**Aspin-Welch Unequal-Variance Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-362.7515	0.000000	Yes	1.000000	1.000000
Randomization Test		0.001000	Yes		
Difference < 0	-362.7515	0.000000	Yes	1.000000	1.000000
Difference > 0	-362.7515	1.000000	No	0.000000	0.000000

Difference: (X1A\_1)-(X1A\_2)  
 The randomization test results are based on 1000 Monte Carlo samples.

**Tests of Assumptions Section**

Assumption	Value	Probability	Decision(.050)
Skewness Normality (X1A_1)	-1.2140	0.224764	Cannot reject normality
Kurtosis Normality (X1A_1)	1.2573	0.208655	Cannot reject normality
Omnibus Normality (X1A_1)	3.0544	0.217140	Cannot reject normality
Skewness Normality (X1A_2)	0.4394	0.660345	Cannot reject normality
Kurtosis Normality (X1A_2)	0.5526	0.580512	Cannot reject normality
Omnibus Normality (X1A_2)	0.4985	0.779380	Cannot reject normality
Variance-Ratio Equal-Variance Test	1.2919	0.000053	Reject equal variances
Modified-Levene Equal-Variance Test	16.6604	0.000046	Reject equal variances

### Two-Sample Test Report

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#### Median Statistics

Variable	Count	Median	95.0% LCL of Median	95.0% UCL of Median
X1A_1	1000	156534.1	156470.6	156582.9
X1A_2	1000	171218.4	171127.2	171275.1

#### Mann-Whitney U or Wilcoxon Rank-Sum Test for Difference in Medians

Variable	Mann Whitney U	W Sum Ranks	Mean of W	Std Dev of W
X1A_1	0	500500	1000500	12913.17
X1A_2	1000000	1500500	1000500	12913.17

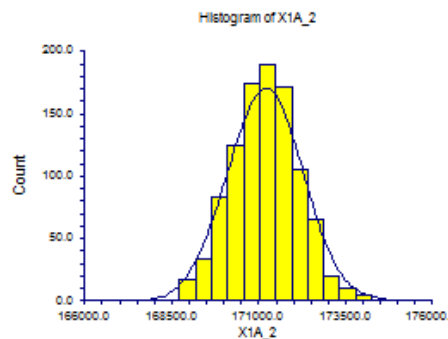
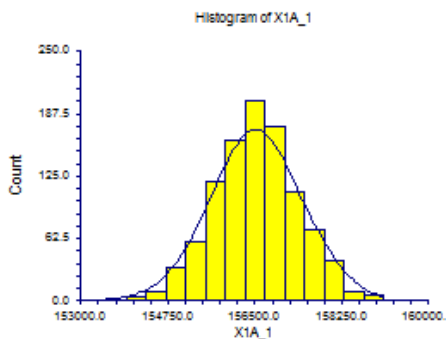
Number Sets of Ties = 5, Multiplicity Factor = 30

Alternative Hypothesis	Exact Probability		Approximation Without Correction			Approximation With Correction		
	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050
Diff<>0			-38.7202	0.000000	Yes	-38.7201	0.000000	Yes
Diff<0			-38.7202	0.000000	Yes	-38.7201	0.000000	Yes
Diff>0			-38.7202	1.000000	No	-38.7202	1.000000	No

#### Kolmogorov-Smirnov Test For Different Distributions

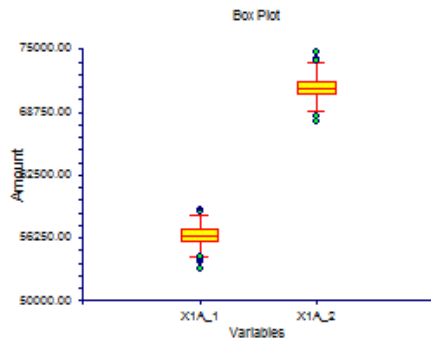
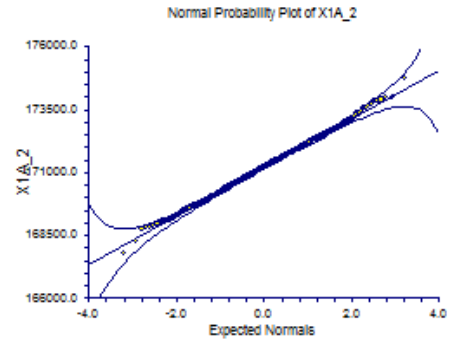
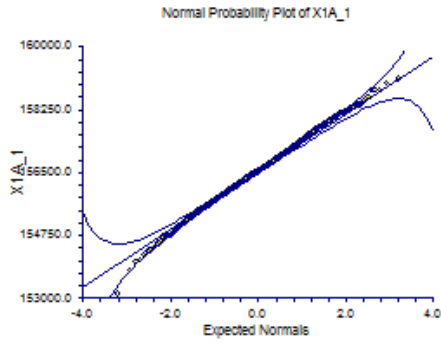
Alternative Hypothesis	Dmn Criterion Value	Reject H0 if Greater Than	Test Alpha Level	Reject H0 (Test Alpha)	Prob Level
D(1)<>D(2)	1.000000	0.0608	.050	Yes	0.0000
D(1)<D(2)	1.000000	0.0608	.025	Yes	
D(1)>D(2)	0.000000	0.0608	.025	No	

#### Plots Section



### Two-Sample Test Report

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**Two-Sample Test Report**

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**Descriptive Statistics Section**

Variable	Count	Mean	Standard Deviation	Standard Error	95.0% LCL of Mean	95.0% UCL of Mean
X1A_1	1000	156527	844.7332	26.71281	156474.5	156579.4
X1A_3	1000	156975.3	833.6879	26.36353	156923.5	157027.1

Note: T-alpha (X1A\_1) = 1.9647, T-alpha (X1A\_3) = 1.9647

**Confidence-Limits of Difference Section**

Variance Assumption	DF	Mean Difference	Standard Deviation	Standard Error	95.0% LCL Difference	95.0% UCL Difference
Equal	1998	-448.3082	839.2287	37.53145	-521.8685	-374.7479
Unequal	1997.65	-448.3082	839.2287	37.53145	-521.8685	-374.7479

Note: T-alpha (Equal) = 1.9600, T-alpha (Unequal) = 1.9600

**Equal-Variance T-Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-11.9449	0.000000	Yes	1.000000	1.000000
Randomization Test		0.001000	Yes		
Difference < 0	-11.9449	0.000000	Yes	1.000000	1.000000
Difference > 0	-11.9449	1.000000	No	0.000000	0.000000

Difference: (X1A\_1)-(X1A\_3)  
 The randomization test results are based on 1000 Monte Carlo samples.

**Aspin-Welch Unequal-Variance Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-11.9449	0.000000	Yes	1.000000	1.000000
Randomization Test		0.001000	Yes		
Difference < 0	-11.9449	0.000000	Yes	1.000000	1.000000
Difference > 0	-11.9449	1.000000	No	0.000000	0.000000

Difference: (X1A\_1)-(X1A\_3)  
 The randomization test results are based on 1000 Monte Carlo samples.

**Tests of Assumptions Section**

Assumption	Value	Probability	Decision(.050)
Skewness Normality (X1A_1)	-1.2140	0.224764	Cannot reject normality
Kurtosis Normality (X1A_1)	1.2573	0.208655	Cannot reject normality
Omnibus Normality (X1A_1)	3.0544	0.217140	Cannot reject normality
Skewness Normality (X1A_3)	0.2160	0.829023	Cannot reject normality
Kurtosis Normality (X1A_3)	-0.8849	0.376196	Cannot reject normality
Omnibus Normality (X1A_3)	0.8297	0.660429	Cannot reject normality
Variance-Ratio Equal-Variance Test	1.0267	0.677490	Cannot reject equal variances
Modified-Levene Equal-Variance Test	0.0009	0.975806	Cannot reject equal variances

### Two-Sample Test Report

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#### Median Statistics

Variable	Count	Median	95.0% LCL of Median	95.0% UCL of Median
X1A_1	1000	156534.1	156470.6	156582.9
X1A_3	1000	156967.9	156918.8	157009.7

#### Mann-Whitney U or Wilcoxon Rank-Sum Test for Difference in Medians

Variable	Mann Whitney U	W Sum Ranks	Mean of W	Std Dev of W
X1A_1	353654	854154	1000500	12913.17
X1A_3	646346	1146846	1000500	12913.17

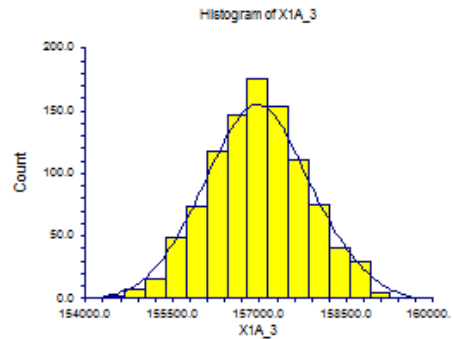
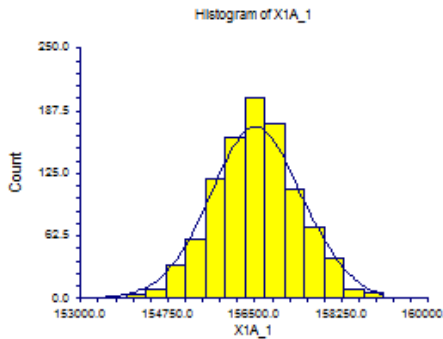
Number Sets of Ties = 8, Multiplicity Factor = 48

Alternative Hypothesis	Exact Probability		Approximation Without Correction		Approximation With Correction			
	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050
Diff<>0			-11.3331	0.000000	Yes	-11.3330	0.000000	Yes
Diff<0			-11.3331	0.000000	Yes	-11.3330	0.000000	Yes
Diff>0			-11.3331	1.000000	No	-11.3331	1.000000	No

#### Kolmogorov-Smirnov Test For Different Distributions

Alternative Hypothesis	Dmn Criterion Value	Reject H0 if Greater Than	Test Alpha Level	Reject H0 (Test Alpha)	Prob Level
D(1)<>D(2)	0.235000	0.0608	.050	Yes	0.0000
D(1)<D(2)	0.235000	0.0608	.025	Yes	
D(1)>D(2)	0.000000	0.0608	.025	No	

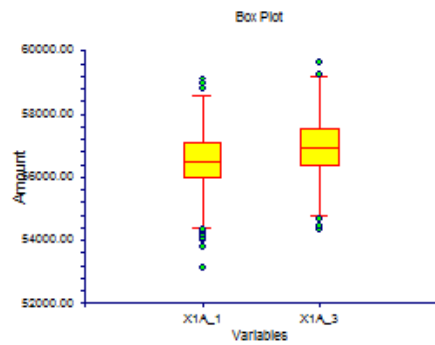
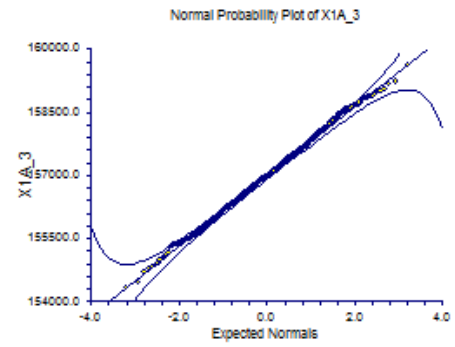
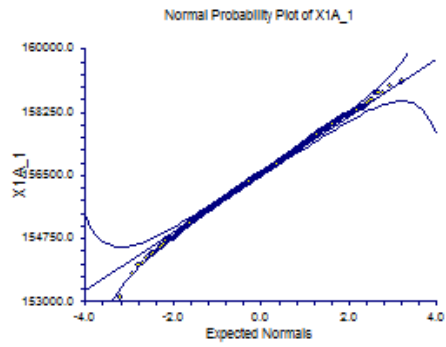
#### Plots Section



## Two-Sample Test Report

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APPENDIX F

T-TEST SAMPLE OUTPUT: SAME REPLENISHMENT MODEL /  
ALTERNATIVE DEMAND PATTERNS

**Two-Sample Test Report**

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**Descriptive Statistics Section**

Variable	Count	Mean	Standard Deviation	Standard Error	95.0% LCL of Mean	95.0% UCL of Mean
X4A_1	1000	143497.6	4920.687	155.6058	143191.9	143803.4
X5A_1	1000	156000.6	951.7637	30.09741	155941.5	156059.8

Note: T-alpha (X4A\_1) = 1.9647, T-alpha (X5A\_1) = 1.9647

**Confidence-Limits of Difference Section**

Variance Assumption	DF	Mean Difference	Standard Deviation	Standard Error	95.0% LCL Difference	95.0% UCL Difference
Equal	1998	-12502.99	3543.94	158.4898	-12813.63	-12192.36
Unequal	1073.64	-12502.99	5011.888	12192.36	158.4898	-12813.63

Note: T-alpha (Equal) = 1.9600, T-alpha (Unequal) = 1.9600

**Equal-Variance T-Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-78.8883	0.000000	Yes	1.000000	1.000000
Difference < 0	-78.8883	0.000000	Yes	1.000000	1.000000
Difference > 0	-78.8883	1.000000	No	0.000000	0.000000

Difference: (X4A\_1)-(X5A\_1)

**Aspin-Welch Unequal-Variance Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-78.8883	0.000000	Yes	1.000000	1.000000
Difference < 0	-78.8883	0.000000	Yes	1.000000	1.000000
Difference > 0	-78.8883	1.000000	No	0.000000	0.000000

Difference: (X4A\_1)-(X5A\_1)

**Tests of Assumptions Section**

Assumption	Value	Probability	Decision(.050)
Skewness Normality (X4A_1)	9.6166	0.000000	Reject normality
Kurtosis Normality (X4A_1)	8.3085	0.000000	Reject normality
Omnibus Normality (X4A_1)	161.5097	0.000000	Reject normality
Skewness Normality (X5A_1)	-0.5619	0.574154	Cannot reject normality
Kurtosis Normality (X5A_1)	0.6826	0.494876	Cannot reject normality
Omnibus Normality (X5A_1)	0.7817	0.676485	Cannot reject normality
Variance-Ratio Equal-Variance Test	26.7297	0.000000	Reject equal variances
Modified-Levene Equal-Variance Test	903.1848	0.000000	Reject equal variances



### Two-Sample Test Report

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#### Median Statistics

Variable	Count	Median	95.0% LCL of Median	95.0% UCL of Median
X4A_1	1000	143302.5	142848	143599.5
X5A_1	1000	155986.1	155929.9	156068.9

#### Mann-Whitney U or Wilcoxon Rank-Sum Test for Difference in Medians

Variable	Mann Whitney U	W Sum Ranks	Mean of W	Std Dev of W
X4A_1	13648	514148	1000500	12913.17
X5A_1	986352	1486852	1000500	12913.17

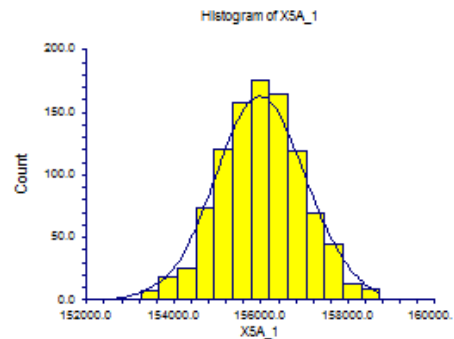
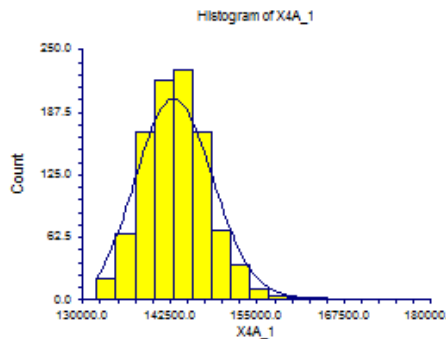
Number Sets of Ties = 3, Multiplicity Factor = 18

Alternative Hypothesis	Exact Probability		Approximation Without Correction			Approximation With Correction		
	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050
Diff<>0			-37.6632	0.000000	Yes	-37.6632	0.000000	Yes
Diff<0			-37.6632	0.000000	Yes	-37.6632	0.000000	Yes
Diff>0			-37.6632	1.000000	No	-37.6633	1.000000	No

#### Kolmogorov-Smirnov Test For Different Distributions

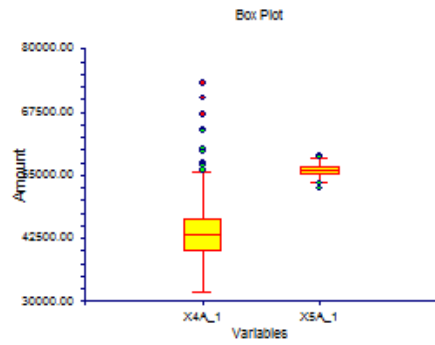
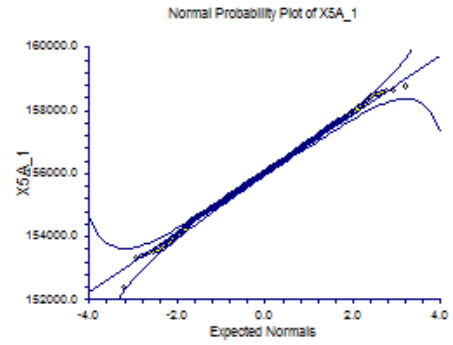
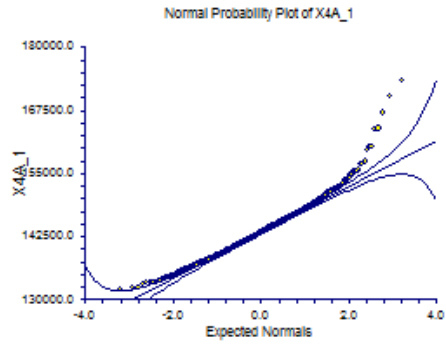
Alternative Hypothesis	Dmn Criterion Value	Reject H0 if Greater Than	Test Alpha Level	Reject H0 (Test Alpha)	Prob Level
D(1)<>D(2)	0.971000	0.0608	.050	Yes	0.0000
D(1)<D(2)	0.971000	0.0608	.025	Yes	
D(1)>D(2)	0.008000	0.0608	.025	No	

#### Plots Section



## Two-Sample Test Report

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**Two-Sample Test Report**

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**Descriptive Statistics Section**

Variable	Count	Mean	Standard Deviation	Standard Error	95.0% LCL of Mean	95.0% UCL of Mean
X4A_1	1000	143497.6	4920.687	155.6058	143191.9	143803.4
X6A_1	1000	170959.1	15137.58	478.6923	170018.6	171899.6

Note: T-alpha (X4A\_1) = 1.9647, T-alpha (X6A\_1) = 1.9647

**Confidence-Limits of Difference Section**

Variance Assumption	DF	Mean Difference	Standard Deviation	Standard Error	95.0% LCL Difference	95.0% UCL Difference
Equal	1998	-27461.45	11255.21	503.3483	-28448	-26474.91
Unequal	1207.79	-27461.45	15917.27	503.3483	-28448	-26474.91

Note: T-alpha (Equal) = 1.9600, T-alpha (Unequal) = 1.9600

**Equal-Variance T-Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-54.5576	0.000000	Yes	1.000000	1.000000
Difference < 0	-54.5576	0.000000	Yes	1.000000	1.000000
Difference > 0	-54.5576	1.000000	No	0.000000	0.000000

Difference: (X4A\_1)-(X6A\_1)

**Aspin-Welch Unequal-Variance Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-54.5576	0.000000	Yes	1.000000	1.000000
Difference < 0	-54.5576	0.000000	Yes	1.000000	1.000000
Difference > 0	-54.5576	1.000000	No	0.000000	0.000000

Difference: (X4A\_1)-(X6A\_1)

**Tests of Assumptions Section**

Assumption	Value	Probability	Decision(.050)
Skewness Normality (X4A_1)	9.6166	0.000000	Reject normality
Kurtosis Normality (X4A_1)	8.3085	0.000000	Reject normality
Omnibus Normality (X4A_1)	161.5097	0.000000	Reject normality
Skewness Normality (X6A_1)	21.0706	0.000000	Reject normality
Kurtosis Normality (X6A_1)	15.1009	0.000000	Reject normality
Omnibus Normality (X6A_1)	672.0073	0.000000	Reject normality
Variance-Ratio Equal-Variance Test	9.4637	0.000000	Reject equal variances
Modified-Levene Equal-Variance Test	197.1425	0.000000	Reject equal variances

## Two-Sample Test Report

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### Median Statistics

Variable	Count	Median	95.0% LCL of Median	95.0% UCL of Median
X4A_1	1000	143302.5	142848	143599.5
X6A_1	1000	166872	166325.3	167617.3

### Mann-Whitney U or Wilcoxon Rank-Sum Test for Difference in Medians

Variable	Mann Whitney U	W Sum Ranks	Mean of W	Std Dev of W
X4A_1	4014	504514	1000500	12913.17
X6A_1	995986	1496486	1000500	12913.17

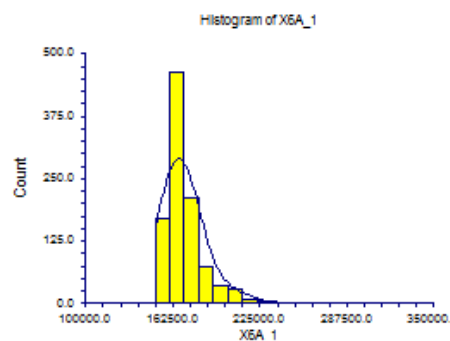
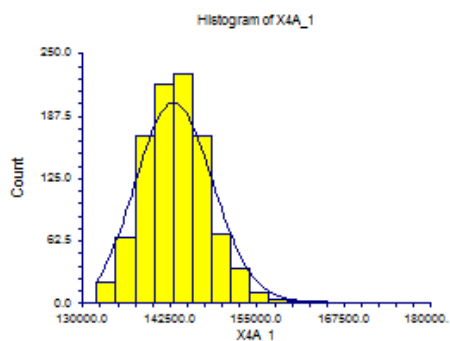
Number Sets of Ties = 2, Multiplicity Factor = 12

Alternative Hypothesis	Exact Probability		Approximation Without Correction			Approximation With Correction		
	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050
Diff<>0			-38.4093	0.000000	Yes	-38.4093	0.000000	Yes
Diff<0			-38.4093	0.000000	Yes	-38.4093	0.000000	Yes
Diff>0			-38.4093	1.000000	No	-38.4093	1.000000	No

### Kolmogorov-Smirnov Test For Different Distributions

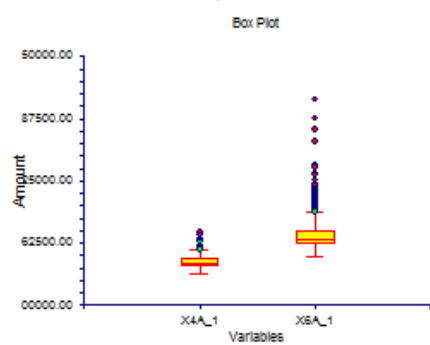
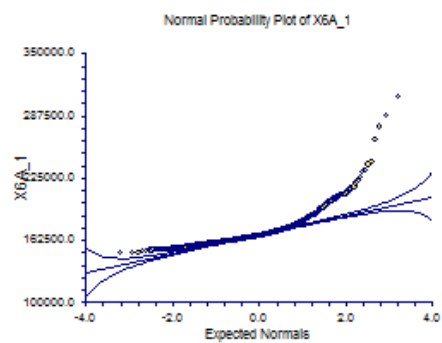
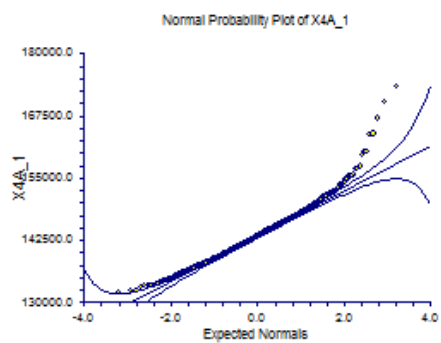
Alternative Hypothesis	Dmn Criterion Value	Reject H0 if Greater Than	Test Alpha Level	Reject H0 (Test Alpha)	Prob Level
D(1)<>D(2)	0.961000	0.0608	.050	Yes	0.0000
D(1)<D(2)	0.961000	0.0608	.025	Yes	
D(1)>D(2)	0.000000	0.0608	.025	No	

### Plots Section



## Two-Sample Test Report

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APPENDIX G

INVENTORY SYSTEM COST AT FACTOR LEVELS  
OF COST, DEMAND, AND LEAD TIME

Table G-1  
EOQ Simulation Study  
Total Inventory System Cost Comparison: Cost Factor Levels

Case #	Demand Pattern	Variability	Total Inventory System Cost: Cost Level 1 Items			Total Inventory System Cost: Cost Level 2 Items			Total Inventory System Cost: Cost Level 3 Items		
			EOQ Model	EOQ Range	Silver-Meal Heuristic	EOQ Model	EOQ Range	Silver-Meal Heuristic	EOQ Model	EOQ Range	Silver-Meal Heuristic
1A	Seasonal	Low	4,342	7,681	4,306	19,507	25,706	19,569	132,678	137,809	133,101
2A	Trend	Low	4,433	7,680	4,469	19,731	26,139	19,865	135,468	139,567	135,603
3A	Seasonal/Trend	Low	4,440	7,650	4,480	19,757	26,000	19,852	135,255	139,786	135,453
4A	Normal	Low	4,448	8,260	4,608	18,898	23,951	18,923	120,151	118,670	119,992
5A	Poisson	Low	4,332	7,659	4,307	19,486	25,020	19,635	132,182	135,499	132,862
6A	Gamma	Low	4,514	7,364	4,492	20,602	24,226	20,612	145,843	146,368	145,756
7A	Erlang-C	Low	4,341	7,435	4,305	19,560	24,314	19,588	133,058	133,542	132,946
1B	Seasonal	High	5,688	9,093	5,717	33,066	38,701	33,093	267,216	268,786	267,157
2B	Trend	High	5,782	9,076	5,824	33,355	38,776	33,396	269,605	270,767	269,532
3B	Seasonal/Trend	High	5,787	9,089	5,840	33,355	38,793	33,398	269,592	270,873	269,546
4B	Normal	High	6,569	12,130	6,745	30,314	36,147	30,341	220,803	223,830	220,829
5B	Poisson	High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6B	Gamma	High	7,107	8,993	7,162	45,745	49,000	45,748	404,189	406,126	404,144
7B	Erlang-C	High	5,717	8,600	5,679	33,270	37,138	33,301	269,607	267,930	269,450

Case #	Demand Pattern	Variability	Total Inventory System Cost: All Cost Levels			Verification Cells: Factor Total = Summary Total		
			EOQ Model	EOQ Range	Silver-Meal Heuristic	EOQ Model	EOQ Range	Silver-Meal Heuristic
1A	Seasonal	Low	156,527	171,197	156,975	TRUE	TRUE	TRUE
2A	Trend	Low	159,663	173,386	159,937	TRUE	TRUE	TRUE
3A	Seasonal/Trend	Low	159,452	173,436	159,785	TRUE	TRUE	TRUE
4A	Normal	Low	143,498	150,780	143,522	TRUE	TRUE	TRUE
5A	Poisson	Low	156,001	168,178	156,805	TRUE	TRUE	TRUE
6A	Gamma	Low	170,959	177,958	170,860	TRUE	TRUE	TRUE
7A	Erlang-C	Low	156,957	165,291	156,839	TRUE	TRUE	TRUE
1B	Seasonal	High	305,970	316,581	305,967	TRUE	TRUE	TRUE
2B	Trend	High	308,741	318,619	308,752	TRUE	TRUE	TRUE
3B	Seasonal/Trend	High	308,734	318,855	308,784	TRUE	TRUE	TRUE
4B	Normal	High	257,686	272,107	257,915	TRUE	TRUE	TRUE
5B	Poisson	High	N/A	N/A	N/A			
6B	Gamma	High	457,040	463,118	457,052	TRUE	TRUE	TRUE
7B	Erlang-C	High	308,584	313,068	308,431	TRUE	TRUE	TRUE

Table G-2  
EOQ Simulation Study  
Total Inventory System Cost Comparison: Demand Factor Levels

Case #	Demand Pattern	Variability	Total Inventory System Cost: Dmd Level 1 Items			Total Inventory System Cost: Dmd Level 2 Items			Total Inventory System Cost: Dmd Level 3 Items		
			(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic
1A	Seasonal	Low	8,872	15,477	8,834	51,889	58,944	52,061	95,756	98,778	98,051
2A	Trend	Low	8,934	15,183	8,881	52,787	57,793	52,861	97,961	100,420	98,095
3A	Seasonal/Trend	Low	8,935	15,300	8,976	52,805	57,750	52,930	97,713	100,387	97,879
4A	Normal	Low	8,813	13,263	8,868	48,083	50,450	48,163	86,602	87,068	86,392
5A	Poisson	Low	8,952	12,821	8,947	51,988	56,696	52,176	95,050	98,661	95,682
6A	Gamma	Low	9,305	12,389	9,284	56,517	59,070	56,561	105,138	108,489	105,014
7A	Erlang-C	Low	8,953	13,272	8,920	52,179	55,238	52,248	95,825	96,781	95,671
1B	Seasonal	High	13,779	18,881	13,818	100,313	104,228	100,355	191,877	193,471	191,794
2B	Trend	High	13,907	18,791	13,956	101,160	104,776	101,205	193,674	195,052	193,500
3B	Seasonal/Trend	High	13,907	18,843	13,964	101,187	104,885	101,251	193,640	195,126	193,569
4B	Normal	High	13,806	18,908	13,781	84,378	89,304	84,446	159,702	163,897	159,688
5B	Poisson	High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6B	Gamma	High	18,008	19,894	18,061	149,831	152,082	149,766	288,203	291,142	289,195
7B	Erlang-C	High	13,891	17,401	13,854	101,240	103,040	101,319	193,463	193,226	193,258

Case #	Demand Pattern	Variability	Total Inventory System Cost: All Cost Levels			Verification Cells: Factor Total = Summary Total		
			(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic
1A	Seasonal	Low	156,527	171,197	158,975	TRUE	TRUE	TRUE
2A	Trend	Low	159,863	173,386	159,937	TRUE	TRUE	TRUE
3A	Seasonal/Trend	Low	159,452	173,436	159,785	TRUE	TRUE	TRUE
4A	Normal	Low	143,498	150,790	143,522	TRUE	TRUE	TRUE
5A	Poisson	Low	159,001	168,178	159,805	TRUE	TRUE	TRUE
6A	Gamma	Low	170,959	177,958	170,860	TRUE	TRUE	TRUE
7A	Erlang-C	Low	156,957	165,291	158,939	TRUE	TRUE	TRUE
1B	Seasonal	High	305,970	316,581	305,967	TRUE	TRUE	TRUE
2B	Trend	High	308,741	318,619	308,752	TRUE	TRUE	TRUE
3B	Seasonal/Trend	High	308,734	318,855	308,784	TRUE	TRUE	TRUE
4B	Normal	High	257,886	272,107	257,915	TRUE	TRUE	TRUE
5B	Poisson	High	N/A	N/A	N/A	N/A	N/A	N/A
6B	Gamma	High	457,040	463,118	457,052	TRUE	TRUE	TRUE
7B	Erlang-C	High	308,594	313,668	308,431	TRUE	TRUE	TRUE



Table G-3  
EOQ Simulation Study  
Total Inventory System Cost Comparison: Lead Time Factor Levels

Case #	Demand Pattern	Total Inventory System Cost: Lead Time Level 1			Total Inventory System Cost: Lead Time Level 2			Total Inventory System Cost: Lead Time Level 3			Total Inventory System Cost: Lead Time Level 4		
		(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic
1A	Seasonal	34,341	37,840	34,443	37,582	41,176	37,690	40,746	44,476	40,877	43,859	47,705	43,988
2A	Trend	34,684	37,863	34,756	38,166	41,532	38,243	41,655	45,159	41,719	45,148	48,802	45,219
3A	Seasonal/Trend	34,688	37,650	34,732	35,084	41,516	38,184	41,613	45,184	41,086	45,087	48,786	45,183
4A	Normal	32,601	33,810	32,503	34,777	36,391	34,786	38,640	38,919	38,680	38,280	41,660	39,283
5A	Poisson	34,189	37,058	34,394	37,439	40,428	37,632	40,607	43,711	40,813	43,787	46,962	43,968
6A	Gamma	37,047	38,390	37,000	41,105	42,780	41,067	44,664	46,567	44,839	46,143	50,221	48,123
7A	Erlang-C	34,480	36,384	34,443	37,672	39,680	37,643	40,871	43,033	40,843	43,933	46,214	43,911
1B	Seasonal	65,337	67,704	65,228	73,209	76,801	73,208	80,318	83,033	80,322	87,104	89,952	87,112
2B	Trend	65,571	67,769	65,563	73,663	76,037	73,660	81,141	83,700	81,155	86,376	89,386	86,386
3B	Seasonal/Trend	65,518	67,829	65,528	73,702	76,159	73,710	81,128	83,739	81,145	88,385	91,128	88,403
4B	Normal	56,182	57,600	56,184	60,689	63,444	60,697	67,127	71,479	67,206	73,707	79,524	73,827
5B	Poisson	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6B	Gamma	94,708	95,624	94,740	109,772	111,255	109,789	125,603	127,545	125,604	126,957	128,694	126,919
7B	Erlang-C	65,615	66,652	65,565	73,648	74,867	73,608	81,210	82,547	81,172	88,124	89,602	88,085

Case #	Demand Pattern	Total Inventory System Cost: All Cost Levels			Verification Cells: Factor Total = Summary Total		
		(R, s, S) EOQ Model	EOQ Range Model	Variability	(R, s, S) EOQ Model	EOQ Range Model	Silver-Meal Heuristic
1A	Seasonal	156,627	171,107	Low	156,627	171,107	156,075
2A	Trend	159,663	173,386	Low	159,663	173,386	159,037
3A	Seasonal/Trend	159,452	173,436	Low	159,452	173,436	159,785
4A	Normal	143,468	150,780	Low	143,468	150,780	143,522
5A	Poisson	156,001	168,178	Low	156,001	168,178	159,805
6A	Gamma	170,859	177,858	Low	170,859	177,858	170,880
7A	Erlang-C	156,857	165,291	Low	156,857	165,291	156,839
1B	Seasonal	305,970	316,581	High	305,970	316,581	305,987
2B	Trend	308,741	318,619	High	308,741	318,619	308,762
3B	Seasonal/Trend	308,734	318,655	High	308,734	318,655	308,784
4B	Normal	272,060	272,107	High	272,060	272,107	257,915
5B	Poisson	N/A	N/A	High	N/A	N/A	N/A
6B	Gamma	467,040	463,118	High	467,040	463,118	467,052
7B	Erlang-C	308,594	313,668	High	308,594	313,668	308,431

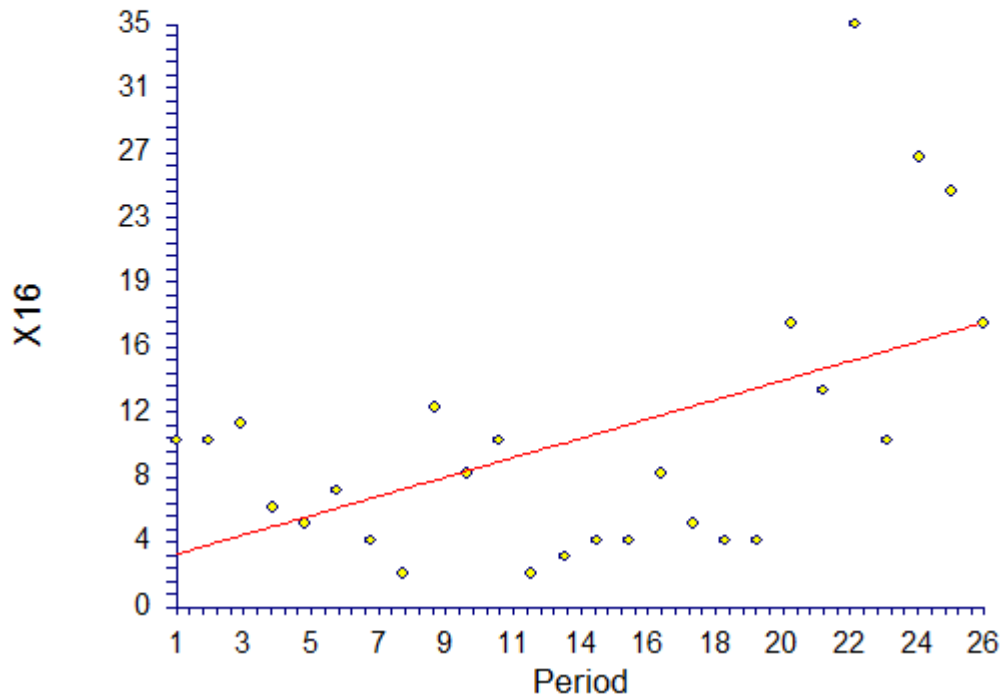
APPENDIX H  
SAMPLE REGRESSION REPORTS AND STACKED  
TIME SERIES PLOTS FROM  
VALIDATION STUDY

### Linear Regression Report

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Y = X16 X = Period

#### Linear Regression Plot Section

### X16 vs Period



#### Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	X16	Rows Processed	26
Independent Variable	Period	Rows Used in Estimation	26
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	2.6062	Rows Prediction Only	0
Slope	0.5562	Sum of Frequencies	26
R-Squared	0.2676	Sum of Weights	26.0000
Correlation	0.5173	Coefficient of Variation	0.7101
Mean Square Error	51.58971	Square Root of MSE	7.182598

## Linear Regression Report

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Y = X16 X = Period

### Summary Statement

The equation of the straight line relating X16 and Period is estimated as:  $X16 = (2.6062) + (0.5562) \text{ Period}$  using the 26 observations in this dataset. The y-intercept, the estimated value of X16 when Period is zero, is 2.6062 with a standard error of 2.9005. The slope, the estimated change in X16 per unit change in Period, is 0.5562 with a standard error of 0.1878. The value of R-Squared, the proportion of the variation in X16 that can be accounted for by variation in Period, is 0.2676. The correlation between X16 and Period is 0.5173.

A significance test that the slope is zero resulted in a t-value of 2.9616. The significance level of this t-test is 0.0068. Since  $0.0068 < 0.0500$ , the hypothesis that the slope is zero is rejected.

The estimated slope is 0.5562. The lower limit of the 95% confidence interval for the slope is 0.1686 and the upper limit is 0.9439. The estimated intercept is 2.6062. The lower limit of the 95% confidence interval for the intercept is -3.3803 and the upper limit is 8.5926.

### Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	X16	Period
Count	26	26
Mean	10.1154	13.5000
Standard Deviation	8.2235	7.6485
Minimum	2.0000	1.0000
Maximum	35.0000	26.0000

### Linear Regression Report

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Y = X16 X = Period

#### Regression Estimation Section

Parameter	Intercept B(0)	Slope B(1)
Regression Coefficients	2.6062	0.5562
Lower 95% Confidence Limit	-3.3803	0.1686
Upper 95% Confidence Limit	8.5926	0.9439
Standard Error	2.9005	0.1878
Standardized Coefficient	0.0000	0.5173
T Value	0.8985	2.9616
Prob Level (T Test)	0.3778	0.0068
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.1387	0.8109
Regression of Y on X	2.6062	0.5562
Inverse Regression from X on Y	-17.9409	2.0782
Orthogonal Regression of Y and X	-5.4098	1.1500

#### Notes:

The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

### Linear Regression Report

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Y = X16 X = Period

#### Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
<b>Residuals follow Normal Distribution?</b>			
Shapiro Wilk	0.9279	0.068983	No
Anderson Darling	0.5060	0.201682	Yes
D'Agostino Skewness	2.0627	0.039145	No
D'Agostino Kurtosis	1.2812	0.200119	Yes
D'Agostino Omnibus	5.8961	0.052443	No
<b>Constant Residual Variance?</b>			
Modified Levene Test	1.9616	0.174138	No
<b>Relationship is a Straight Line?</b>			
Lack of Linear Fit F(0, 0) Test	0.0000	0.000000	No

#### No Serial Correlation?

Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

#### Notes:

A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.

A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say  $N > 500$ ) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

#### Normality and Constant Residual Variance:

Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

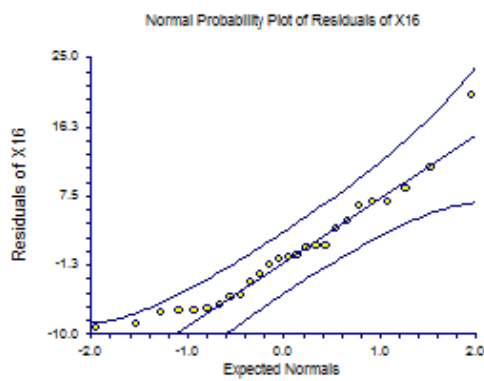
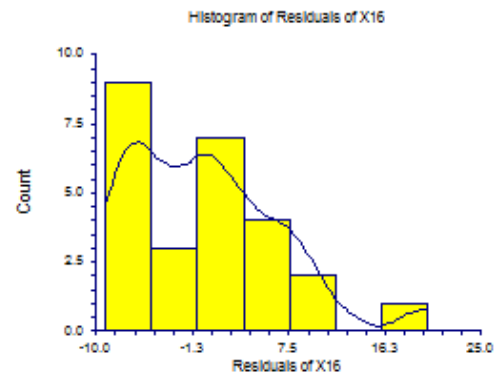
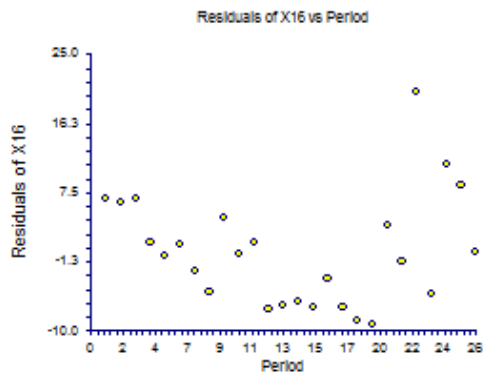
#### Straight-Line:

Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

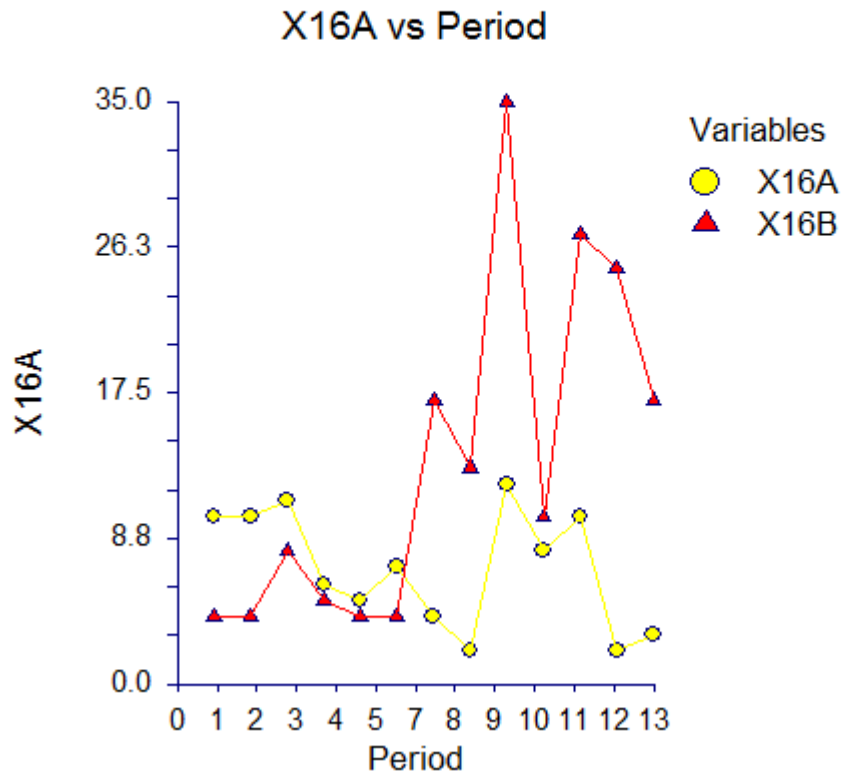
## Linear Regression Report

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Y = X16 X = Period

### Residual Plots Section



Scatter Plot Section



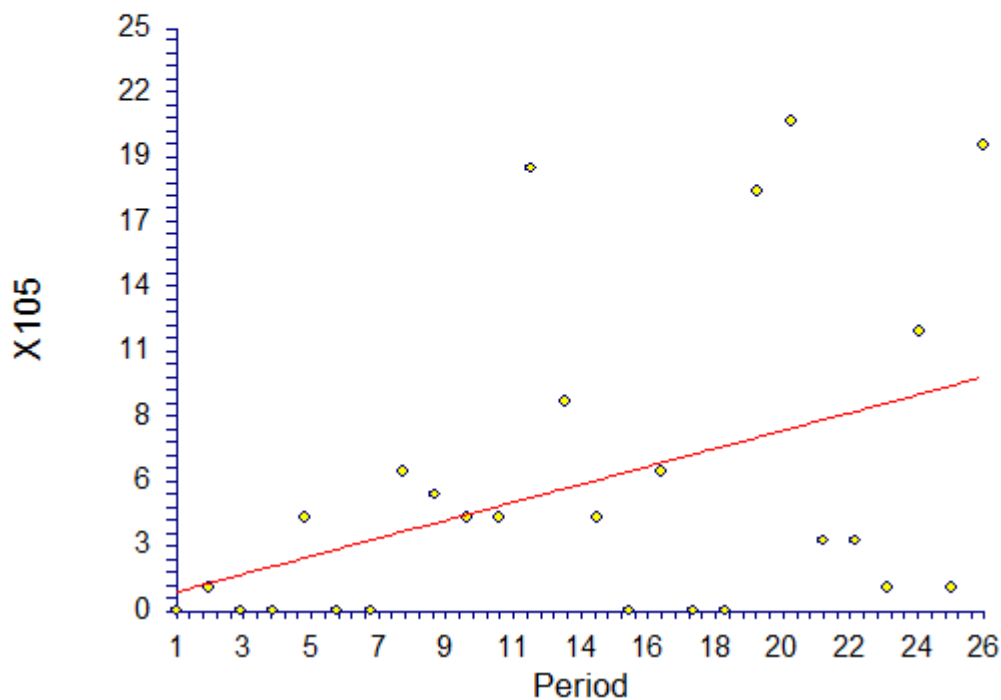


### Linear Regression Report

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 Y = X105 X = Period

#### Linear Regression Plot Section

X105 vs Period



#### Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	X105	Rows Processed	26
Independent Variable	Period	Rows Used in Estimation	26
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	0.4431	Rows Prediction Only	0
Slope	0.3689	Sum of Frequencies	26
R-Squared	0.1703	Sum of Weights	26.0000
Correlation	0.4127	Coefficient of Variation	1.1719
Mean Square Error	40.38877	Square Root of MSE	6.355217

## Linear Regression Report

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Y = X105 X = Period

### Summary Statement

The equation of the straight line relating X105 and Period is estimated as:  $X105 = (0.4431) + (0.3689) \text{ Period}$  using the 26 observations in this dataset. The y-intercept, the estimated value of X105 when Period is zero, is 0.4431 with a standard error of 2.5664. The slope, the estimated change in X105 per unit change in Period, is 0.3689 with a standard error of 0.1662. The value of R-Squared, the proportion of the variation in X105 that can be accounted for by variation in Period, is 0.1703. The correlation between X105 and Period is 0.4127.

A significance test that the slope is zero resulted in a t-value of 2.2198. The significance level of this t-test is 0.0361. Since  $0.0361 < 0.0500$ , the hypothesis that the slope is zero is rejected.

The estimated slope is 0.3689. The lower limit of the 95% confidence interval for the slope is 0.0259 and the upper limit is 0.7119. The estimated intercept is 0.4431. The lower limit of the 95% confidence interval for the intercept is -4.8537 and the upper limit is 5.7399.

### Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	X105	Period
Count	26	26
Mean	5.4231	13.5000
Standard Deviation	6.8362	7.6485
Minimum	0.0000	1.0000
Maximum	21.0000	26.0000

### Linear Regression Report

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 Y = X105 X = Period

#### Regression Estimation Section

Parameter	Intercept B(0)	Slope B(1)
Regression Coefficients	0.4431	0.3689
Lower 95% Confidence Limit	-4.8537	0.0259
Upper 95% Confidence Limit	5.7399	0.7119
Standard Error	2.5664	0.1662
Standardized Coefficient	0.0000	0.4127
T Value	0.1726	2.2198
Prob Level (T Test)	0.8644	0.0361
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.0532	0.5677
Regression of Y on X	0.4431	0.3689
Inverse Regression from X on Y	-23.8126	2.1656
Orthogonal Regression of Y and X	-4.8893	0.7639

**Notes:**

The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

**Estimated Model**

$$(.443076923076919) + (.368888888888889) * (\text{Period})$$

#### Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	764.6539	764.6539			
Slope	1	199.0155	199.0155	4.9275	0.0361	0.5677
Error	24	969.3306	40.38877			
Adj. Total	25	1168.346	46.73384			
Total	26	1933				

$$s = \text{Square Root}(40.38877) = 6.355217$$

**Notes:**

The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

## Linear Regression Report

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Y = X105 X = Period

### Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
<b>Residuals follow Normal Distribution?</b>			
Shapiro Wilk	0.9124	0.029986	No
Anderson Darling	0.8145	0.035295	No
D'Agostino Skewness	1.9364	0.052822	No
D'Agostino Kurtosis	0.5946	0.552078	Yes
D'Agostino Omnibus	4.1031	0.128533	No
<b>Constant Residual Variance?</b>			
Modified Levene Test	2.5504	0.123353	No
<b>Relationship is a Straight Line?</b>			
Lack of Linear Fit F(0, 0) Test	0.0000	0.000000	No

### No Serial Correlation?

Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

### Notes:

A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.

A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say  $N > 500$ ) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

### Normality and Constant Residual Variance:

Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

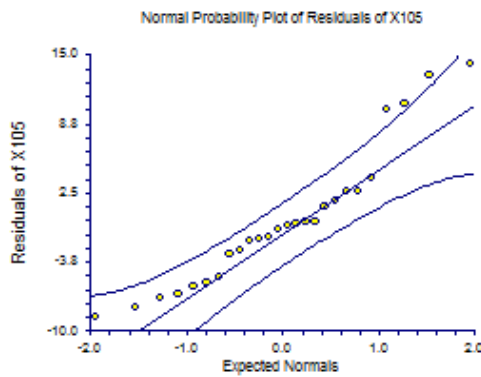
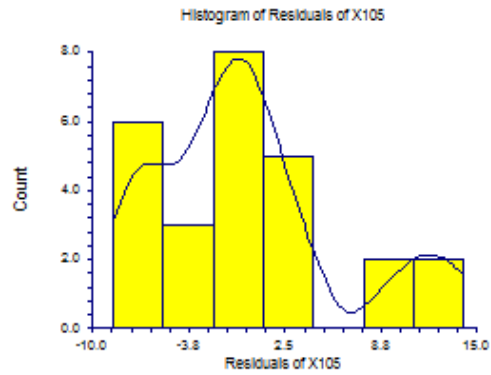
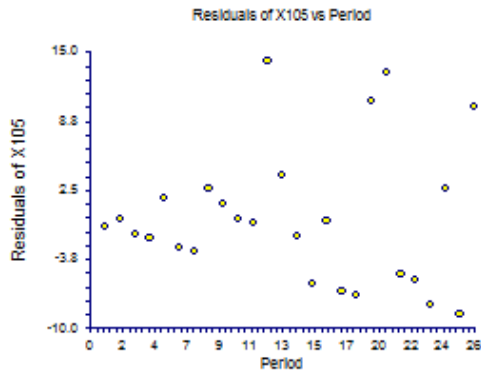
### Straight-Line:

Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

## Linear Regression Report

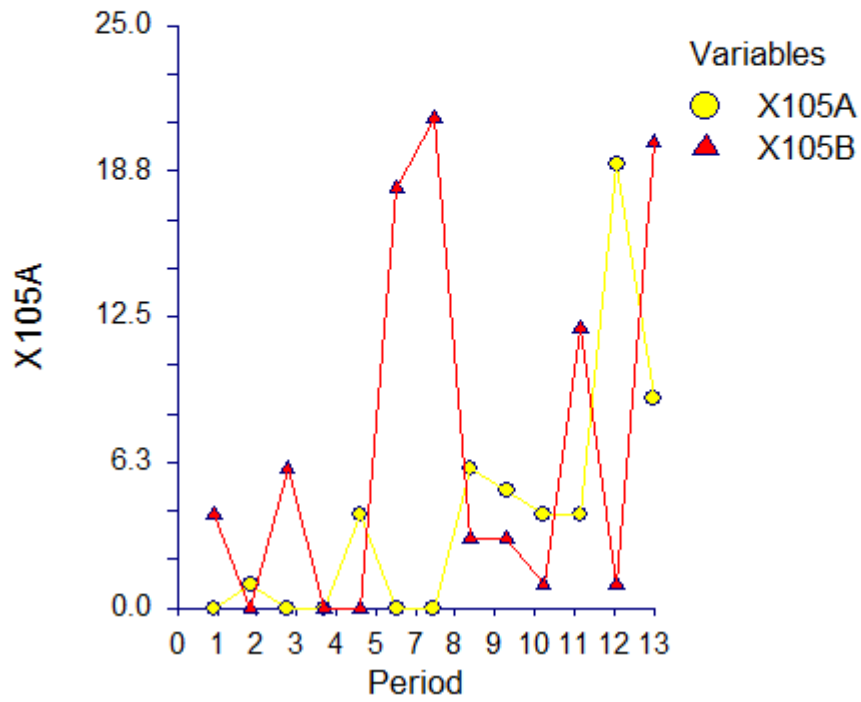
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Y = X105 X = Period

### Residual Plots Section



Scatter Plot Section

X105A vs Period



APPENDIX I  
SAMPLE SCREEN PRINTS FROM  
VALIDATION STUDY

## Sample Screen Prints from Validation Study

### Lot Size Calculation: (R, s, S) EOQ Model

Table X-2										
Empirical Validation Study										
(R, s, S) EOQ Model Lot Sizing Calculations										
(R, s, S) EOQ Model Lot Sizes for Retrofit Study:										
Line ID #	Item #	Item Description	Item Cost (v)	Best Pattern or Distribution	Variability Level Low or High	Demand Retrofit Case Assignment	Weekly Unit Demand (Q)	Annual Unit Demand (D)	Lead Time Weeks (L)	EOQ = $\sqrt{\frac{2AD}{vr}}$ (R, s, S) EOQ Lot Size
10	10201442	FILTER, ELEMEN	11.71	Trend	Low	2A	13	686	8	271
11	CRB3800240	3/8(375)X 240	5.08	Trend	Low	2A	11	574	8	376
12	90240041	GAUGE ASSY, C	20.16	Trend	Low	2A	7	358	8	149
13	10431903	SWITCH, PROXIM	33.52	Trend	Low	2A	7	372	8	118
14	10432608	COUNTER, REV	17.48	Trend	Low	2A	6	336	8	155
15	80572116	SEAL, OIL - CHU	3.59	Trend	Low	2A	13	666	8	482
16	10100162	HOSE-WASH DOWN	10.55	Trend	Low	2A	7	346	8	202
17	80100466	VALVE, SAFETY	12.83	Trend	Low	2A	7	370	8	190
18	90132008	VALVE, WATER	4.08	Trend	Low	2A	14	718	8	469
19	CRG3848096	3/8(375)X 48 X 9	185.36	Seasonal w/Trend	Low	3A	9	480	8	57
20	10100154	VALVE- 3WAY /	11.05	Trend	Low	2A	8	440	8	223
21	90550428	SKIRT, COLL. CHI	31.68	Trend	Low	2A	7	340	8	116
22	CRG2072144	12GA( 1046)X 72	179.46	Trend	Low	2A	14	724	8	71
23	80202901	HEAD, HYDRAU	12.42	Trend	Low	2A	7	350	8	188
24	10130188	TUBE, SIGHT GL	4.80	Trend	Low	2A	7	344	8	299
25	10610122	MUD FLAP-FENI	3.71	Trend	Low	2A	14	748	8	502
26	90010100	DECAL-MIXER S	40.07	Trend	Low	2A	6	308	8	98
27	10100163	AIR REGULATO	13.29	Trend	Low	2A	9	448	8	205

### Assignment to Demand Classes Based on Mean Absolute Deviation

Appendix A			Yr 3 Forecast Accuracy Metrics									
EOQ Retrofit Study			MAD = $\frac{\sum  E_t }{n}$ or $\frac{\sum (D_t - F_t)}{n}$									
Purchased Independent Demand Items and Weekly Consumption (Units)			Mean Absolute Deviation (MAD)									
Three Fiscal Years from 11/1/08 to 10/31/2011												
Line	Item #	Item Description	Stationary Mean	Seasonal	Trend	Seasonal w/ Trend	Best Pattern	Best Stationary Mean Distribution	Best Pattern or Distribution			
78	10610122	MUD FLAP-FENDER MUD FLAP24X24	30.54	25.69	15.31	19.38	Trend		Trend			
186	90010100	DECAL-MIXER SAFETY DECAL KIT	17.85	14.62	9.69	11.85	Trend		Trend			
12	10100163	AIR REGULATOR-AIR	18.46	15.08	9.77	11.85	Trend		Trend			
215	90122002	PLATE, FACE - CBMW GAUGE BOX	20.23	15.62	10.00	12.62	Trend		Trend			
8	10100147	GAUGE-PRESSURE/0-100PSI-BACKMT	19.85	16.38	11.54	13.62	Trend		Trend			
81	10611700	MUD FLAP, CBMW/NRMCA VISION	35.62	29.62	19.62	23.92	Trend		Trend			
214	90122001	BOX, CBMW WATER TANK GAUGE	15.69	14.00	12.23	11.54	Seasonal w/Trend		Seasonal w/Trend			
222	90132001	ELBOW, SIGHT TUBE ADAPTOR - 90	30.46	23.92	16.00	18.69	Trend		Trend			
353	90810227	HARNESS, L/H TAIL LIGHT - 108"	21.54	16.23	10.15	12.62	Trend		Trend			
346	90810206	HARNESS, TRIPLE MARKER LIGHT	17.38	12.46	7.69	9.15	Trend		Trend			
10	10100160	NOZZLE-WATER-WASH DOWN-H D	35.85	27.15	16.85	21.00	Trend		Trend			
83	10630643	YOKE, FLANGE	16.38	13.85	8.23	10.38	Trend		Trend			
110	10810424	LIGHT KIT-STOP/TAIL/TURN-LED	42.77	31.85	18.46	24.62	Trend		Trend			
170	80572117	BEARING, CONE - CHUTE PIVOT	24.54	34.46	26.23	29.85	Stationary Mean	Discrete Uniform	Discrete Uniform			
171	80572118	BEARING, CUP - CHUTE PIVOT	25.62	34.46	26.23	29.85	Stationary Mean	Discrete Uniform	Discrete Uniform			
172	80572128	SPACER, LOWER PIVOT BEARING	12.31	16.54	12.54	14.15	Stationary Mean	Poisson				
72	10600140	HANDLE, CHUTE HANDLE/HOLD DOWN	52.92	62.77	36.46	48.62	Trend		Trend			
442	CRG3448096	1/4( 25)X 48 X 96	14.62	12.31	10.00	11.00	Trend		Trend			
111	10810425	LIGHT KIT-RED CLEARANCE - LED	90.00	86.23	51.31	67.15	Trend		Trend			
433	CRG2060120	12GA( 1046)X 60 X 120	6.54	5.77	5.92	5.62	Seasonal w/Trend		Seasonal w/Trend			
269	90500261	SKIRT, ROCK BLOCKER - CBMW N/S	20.00	15.00	8.62	11.46	Trend		Trend			



Sample Screen Prints from Validation Study (Continued)

Inventory System Cost Calculation: (R, s, S) EOQ Model, Table 1

Table X-1 EOQ Retrofit Study Beginning On-Hand Quantity (Units)											Time Period (Week #) -->	
Line ID #	Item #	Item Description	Item Cost (v)	Best Pattern or Distribution	Variability Level Low or High	Demand Retrofit Case Assignment	Lead Time Weeks (L)					
								1	2			
8	10	10201442	FILTER, ELEMENT - HYD. OIL	11.71	Trend	Low	2A	8	170.00	160.00		
9	11	CRB3800240	3/8( 375)X 240	5.08	Trend	Low	2A	8	140.00	131.41		
10	12	90240041	GAUGE ASSY,OIL RESERVIOR-CBMW	20.16	Trend	Low	2A	8	89.00	86.00		
11	13	10431903	SWITCH,PROXIMITY SENSOR	33.52	Trend	Low	2A	8	93.00	90.00		
12	14	10432608	COUNTER, REVOLUTION - ELEC.	17.48	Trend	Low	2A	8	85.00	82.00		
13	15	80572116	SEAL, OIL - CHUTE PIVOT	3.59	Trend	Low	2A	8	168.00	162.00		
14	16	10100162	HOSE-WASH DOWN HOSE ASSY -.25FT	10.55	Trend	Low	2A	8	87.00	80.00		
15	17	80100466	VALVE, SAFETY-PRESSURE RELIEF	12.83	Trend	Low	2A	8	94.00	91.00		
16	18	90132008	VALVE, WATER GAUGE BODY - CBMW	4.08	Trend	Low	2A	8	184.00	178.00		
17	19	CRG3848096	3/8( 375)X 48 X 96	185.36	Seasonl w/Trend	Low	3A	8	119.00	117.59		
18	20	10100154	VALVE- 3WAY AIR VALVE - 1/4"	11.05	Trend	Low	2A	8	114.00	111.00		
19	21	90550428	SKIRT,COLL.CHUTE-11 HOLE SPCL.	31.68	Trend	Low	2A	8	85.00	78.00		
20	22	CRG2072144	12GA( 1046)X 72 X 144	179.46	Trend	Low	2A	8	187.00	184.17		
21	23	80202901	HEAD, HYDRAULIC FILTER	12.42	Trend	Low	2A	8	90.00	87.00		
22	24	10130188	TUBE,SIGHT GLASS-36"RED STRIPE	4.80	Trend	Low	2A	8	87.00	80.00		
23	25	10610122	MUD FLAP-FENDER MUD FLAP24X24	3.71	Trend	Low	2A	8	189.00	175.00		
24	26	90010100	DECAL-MIXER SAFETY DECAL KIT	40.07	Trend	Low	2A	8	79.00	72.00		
25	27	10100163	AIR REGULATOR-AIR	13.29	Trend	Low	2A	8	115.00	112.00		
26	28	90122002	PLATE,FACE - CBMW GAUGE BOX	2.49	Trend	Low	2A	8	114.00	107.00		
27	29	10100147	GAUGE-PRESSURE/0-100PSI-BACKMT	2.11	Trend	Low	2A	8	116.00	109.00		
28	30	10611700	MUD FLAP, CBMW/NRMCA VISION	5.67	Trend	Low	2A	8	163.00	149.00		
29	31	90122001	BOX, CBMW WATER TANK GAUGE	18.94	Seasonl w/Trend	Low	3A	8	136.00	136.00		
30	32	90132001	ELBOW, SIGHT TUBE ADAPTOR - 90	4.28	Trend	Low	2A	8	181.00	177.00		

APPENDIX J

T-TEST OUTPUT: VALIDATION STUDY ALTERNATIVE  
REPLENISHMENT MODELS

### Two-Sample Test Report

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#### Descriptive Statistics Section

Variable	Count	Mean	Standard Deviation	Standard Error	95.0% LCL of Mean	95.0% UCL of Mean
EOQ	278	1512.124	5126.466	307.465	906.8588	2117.388
Range_EOQ	278	2024.451	6038.275	362.1517	1311.532	2737.37

Note: T-alpha (EOQ) = 1.9686, T-alpha (Range\_EOQ) = 1.9686

#### Confidence-Limits of Difference Section

Variance Assumption	DF	Mean Difference	Standard Deviation	Standard Error	95.0% LCL Difference	95.0% UCL Difference
Equal	554	-512.3271	5600.956	475.0669	-1445.48	420.8255
Unequal	539.79	-512.3271	7920.948	475.0669	-1445.534	420.8793

Note: T-alpha (Equal) = 1.9643, T-alpha (Unequal) = 1.9644

#### Equal-Variance T-Test Section

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-1.0784	0.281311	No	0.190204	0.067274
Difference < 0	-1.0784	0.140655	No	0.285553	0.106031
Difference > 0	-1.0784	0.859345	No	0.003232	0.000331

Difference: (EOQ)-(Range\_EOQ)

#### Aspin-Welch Unequal-Variance Test Section

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-1.0784	0.281323	No	0.190204	0.067274
Difference < 0	-1.0784	0.140661	No	0.285553	0.106031
Difference > 0	-1.0784	0.859339	No	0.003232	0.000331

Difference: (EOQ)-(Range\_EOQ)

#### Tests of Assumptions Section

Assumption	Value	Probability	Decision(.050)
Skewness Normality (EOQ)	18.0233	0.000000	Reject normality
Kurtosis Normality (EOQ)	11.6908	0.000000	Reject normality
Omnibus Normality (EOQ)	461.5151	0.000000	Reject normality
Skewness Normality (Range_EOQ)	17.8501	0.000000	Reject normality
Kurtosis Normality (Range_EOQ)	11.5982	0.000000	Reject normality
Omnibus Normality (Range_EOQ)	453.1416	0.000000	Reject normality
Variance-Ratio Equal-Variance Test	1.3874	0.006607	Reject equal variances
Modified-Levene Equal-Variance Test	0.7351	0.391596	Cannot reject equal variances

### Two-Sample Test Report

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#### Median Statistics

Variable	Count	Median	95.0% LCL of Median	95.0% UCL of Median
EOQ	278	358.32	308.47	440.08
Range_EOQ	278	625.83	552.06	722.24

#### Mann-Whitney U or Wilcoxon Rank-Sum Test for Difference in Medians

Variable	Mann Whitney U	W Sum Ranks	Mean of W	Std Dev of W
EOQ	30389	69170	77423	1894.008
Range_EOQ	46895	85676	77423	1894.008

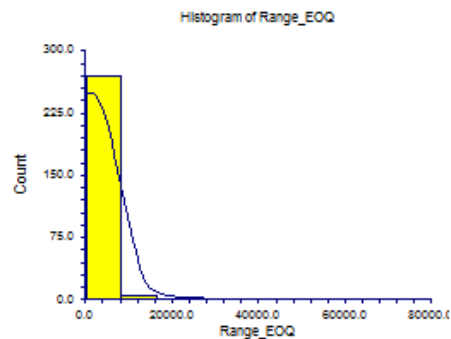
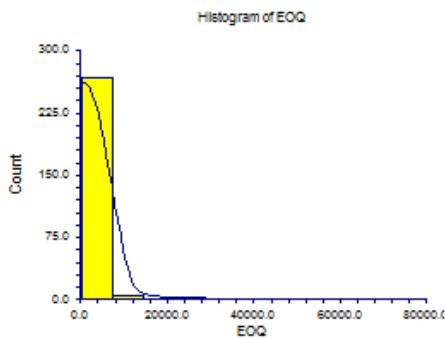
Number Sets of Ties = 5, Multiplicity Factor = 48

Alternative Hypothesis	Exact Probability		Approximation Without Correction				Approximation With Correction	
	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050
Diff<>0			-4.3574	0.000013	Yes	-4.3572	0.000013	Yes
Diff<0			-4.3574	0.000007	Yes	-4.3572	0.000007	Yes
Diff>0			-4.3574	0.999993	No	-4.3577	0.999993	No

#### Kolmogorov-Smirnov Test For Different Distributions

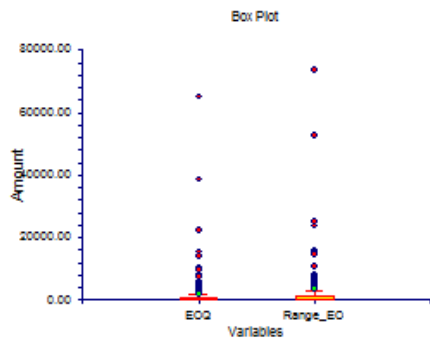
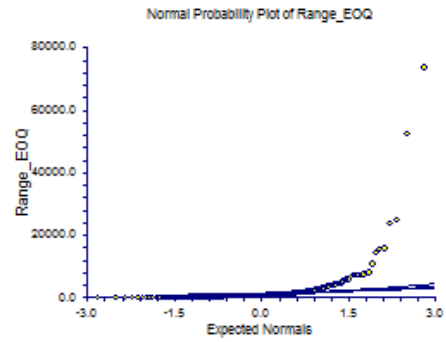
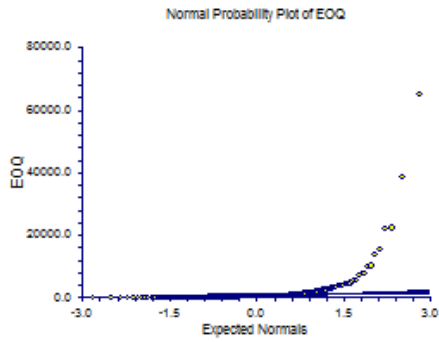
Alternative Hypothesis	Dmn Criterion Value	Reject H0 if Greater Than	Test Alpha Level	Reject H0 (Test Alpha)	Prob Level
D(1)<>D(2)	0.226619	0.1154	.050	Yes	0.0000
D(1)<D(2)	0.226619	0.1154	.025	Yes	
D(1)>D(2)	0.021583	0.1154	.025	No	

#### Plots Section



### Two-Sample Test Report

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**Two-Sample Test Report**

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**Descriptive Statistics Section**

Variable	Count	Mean	Standard Deviation	Standard Error	95.0% LCL of Mean	95.0% UCL of Mean
EOQ	278	1512.124	5126.466	307.465	906.8588	2117.388
Silver_Meal	278	1604.218	5133.605	307.8932	998.11	2210.325

Note: T-alpha (EOQ) = 1.9686, T-alpha (Silver\_Meal) = 1.9686

**Confidence-Limits of Difference Section**

Variance Assumption	DF	Mean Difference	Standard Deviation	Standard Error	95.0% LCL Difference	95.0% UCL Difference
Equal	554	-92.09403	5130.037	435.1241	-946.7888	762.6007
Unequal	554.00	-92.09403	7254.968	435.1241	-946.7888	762.6007

Note: T-alpha (Equal) = 1.9643, T-alpha (Unequal) = 1.9643

**Equal-Variance T-Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-0.2117	0.832458	No	0.055147	0.011691
Difference < 0	-0.2117	0.416229	No	0.075900	0.017228
Difference > 0	-0.2117	0.583771	No	0.031691	0.005574

Difference: (EOQ)-(Silver\_Meal)

**Aspin-Welch Unequal-Variance Test Section**

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	-0.2117	0.832458	No	0.055147	0.011691
Difference < 0	-0.2117	0.416229	No	0.075900	0.017228
Difference > 0	-0.2117	0.583771	No	0.031691	0.005574

Difference: (EOQ)-(Silver\_Meal)

**Tests of Assumptions Section**

Assumption	Value	Probability	Decision(.050)
Skewness Normality (EOQ)	18.0233	0.000000	Reject normality
Kurtosis Normality (EOQ)	11.6908	0.000000	Reject normality
Omnibus Normality (EOQ)	461.5151	0.000000	Reject normality
Skewness Normality (Silver_Meal)	17.9681	0.000000	Reject normality
Kurtosis Normality (Silver_Meal)	11.6755	0.000000	Reject normality
Omnibus Normality (Silver_Meal)	459.1673	0.000000	Reject normality
Variance-Ratio Equal-Variance Test	1.0028	0.981539	Cannot reject equal variances
Modified-Levene Equal-Variance Test	0.0321	0.857826	Cannot reject equal variances

### Two-Sample Test Report

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#### Median Statistics

Variable	Count	Median	95.0% LCL of Median	95.0% UCL of Median
EOQ	278	358.32	308.47	440.08
Silver_Meal	278	390.275	321.37	469.33

#### Mann-Whitney U or Wilcoxon Rank-Sum Test for Difference in Medians

Variable	Mann Whitney U	W Sum Ranks	Mean of W	Std Dev of W
EOQ	36619	75400	77423	1894.006
Silver_Meal	40665	79446	77423	1894.006

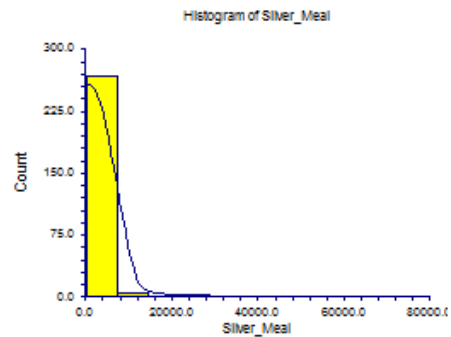
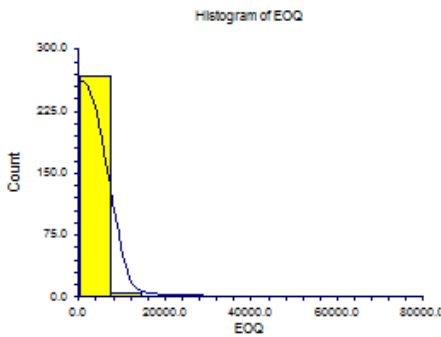
Number Sets of Ties = 44, Multiplicity Factor = 282

Alternative Hypothesis	Exact Probability		Approximation Without Correction		Approximation With Correction		Reject H0 at .050	Prob Level
	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Z-Value	Prob Level		
Diff<>0			-1.0681	0.285473	No	-1.0678	0.285592	No
Diff<0			-1.0681	0.142736	No	-1.0678	0.142796	No
Diff>0			-1.0681	0.857264	No	-1.0684	0.857323	No

#### Kolmogorov-Smirnov Test For Different Distributions

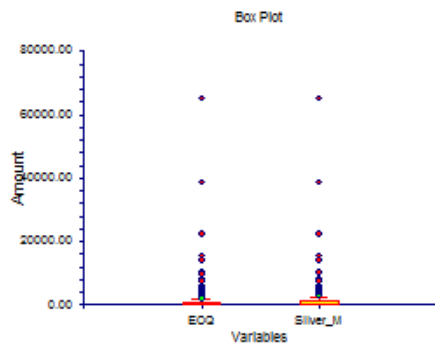
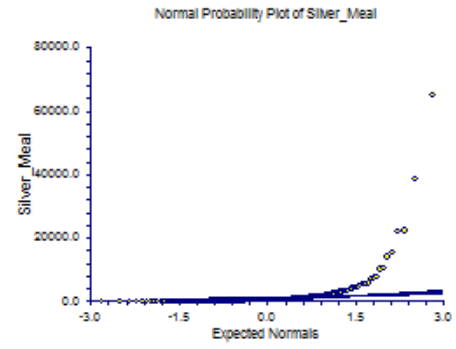
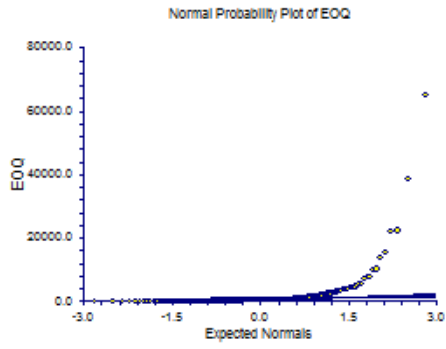
Alternative Hypothesis	Dmn Criterion Value	Reject H0 if Greater Than	Test Alpha Level	Reject H0 (Test Alpha)	Prob Level
D(1)<>D(2)	0.057554	0.1154	.050	No	0.7476
D(1)<D(2)	0.057554	0.1154	.025	No	
D(1)>D(2)	0.017986	0.1154	.025	No	

#### Plots Section



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### Descriptive Statistics Section

Variable	Count	Mean	Standard Deviation	Standard Error	95.0% LCL of Mean	95.0% UCL of Mean
Range_EOQ	278	2024.451	6038.275	362.1517	1311.532	2737.37
Silver_Meal	278	1604.218	5133.605	307.8932	998.11	2210.325

Note: T-alpha (Range\_EOQ) = 1.9686, T-alpha (Silver\_Meal) = 1.9686

### Confidence-Limits of Difference Section

Variance Assumption	DF	Mean Difference	Standard Deviation	Standard Error	95.0% LCL Difference	95.0% UCL Difference
Equal	554	420.2331	5604.225	475.3441	-513.4641	1353.93
Unequal	540.02	420.2331	7925.57	475.3441	-513.517	1353.983

Note: T-alpha (Equal) = 1.9643, T-alpha (Unequal) = 1.9644

### Equal-Variance T-Test Section

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	0.8841	0.377047	No	0.143213	0.045615
Difference < 0	0.8841	0.811477	No	0.005721	0.000663
Difference > 0	0.8841	0.188523	No	0.223390	0.074611

Difference: (Range\_EOQ)-(Silver\_Meal)

### Aspin-Welch Unequal-Variance Test Section

Alternative Hypothesis	T-Value	Prob Level	Reject H0 at .050	Power (Alpha=.050)	Power (Alpha=.010)
Difference <> 0	0.8841	0.377057	No	0.143213	0.045615
Difference < 0	0.8841	0.811472	No	0.005721	0.000663
Difference > 0	0.8841	0.188528	No	0.223390	0.074611

Difference: (Range\_EOQ)-(Silver\_Meal)

### Tests of Assumptions Section

Assumption	Value	Probability	Decision(.050)
Skewness Normality (Range_EOQ)	17.8501	0.000000	Reject normality
Kurtosis Normality (Range_EOQ)	11.5982	0.000000	Reject normality
Omnibus Normality (Range_EOQ)	453.1416	0.000000	Reject normality
Skewness Normality (Silver_Meal)	17.9681	0.000000	Reject normality
Kurtosis Normality (Silver_Meal)	11.6755	0.000000	Reject normality
Omnibus Normality (Silver_Meal)	459.1673	0.000000	Reject normality
Variance-Ratio Equal-Variance Test	1.3835	0.007080	Reject equal variances
Modified-Levene Equal-Variance Test	0.4799	0.488775	Cannot reject equal variances

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#### Median Statistics

Variable	Count	Median	95.0% LCL of Median	95.0% UCL of Median
Range_EOQ	278	625.83	552.06	722.24
Silver_Meal	278	390.275	321.37	469.33

#### Mann-Whitney U or Wilcoxon Rank-Sum Test for Difference in Medians

Variable	Mann Whitney U	W Sum Ranks	Mean of W	Std Dev of W
Range_EOQ	44790	83571	77423	1894.005
Silver_Meal	32494	71275	77423	1894.005

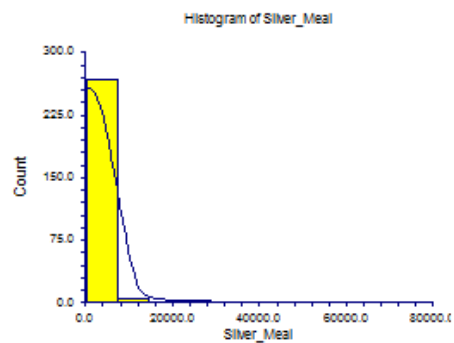
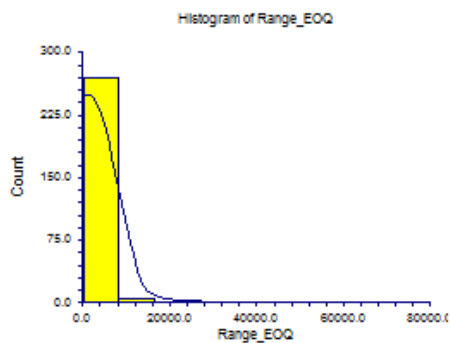
Number Sets of Ties = 37, Multiplicity Factor = 426

Alternative Hypothesis	Exact Probability		Approximation Without Correction		Approximation With Correction			
	Prob Level	Reject H0 at .050	Z-Value	Prob Level	Reject H0 at .050	Prob Level	Reject H0 at .050	
Diff<>0			3.2460	0.001170	Yes	3.2458	0.001171	Yes
Diff<0			3.2460	0.999415	No	3.2463	0.999415	No
Diff>0			3.2460	0.000585	Yes	3.2458	0.000586	Yes

#### Kolmogorov-Smirnov Test For Different Distributions

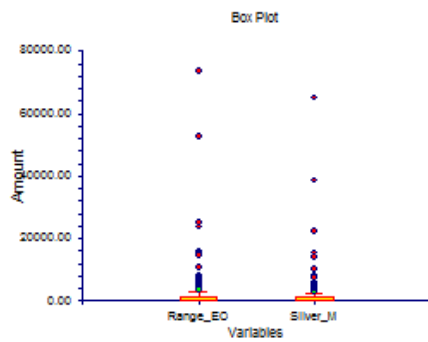
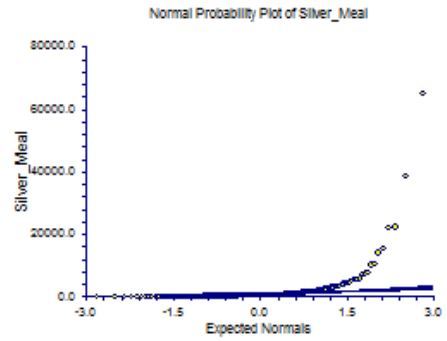
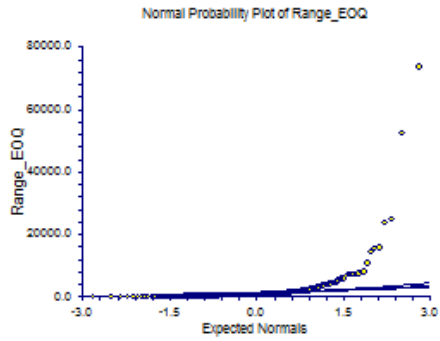
Alternative Hypothesis	Dmn Criterion Value	Reject H0 if Greater Than	Test Alpha Level	Reject H0 (Test Alpha)	Prob Level
D(1)<>D(2)	0.179856	0.1154	.050	Yes	0.0002
D(1)<D(2)	0.014388	0.1154	.025	No	
D(1)>D(2)	0.179856	0.1154	.025	Yes	

#### Plots Section



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## BIOGRAPHICAL INFORMATION

Before entering graduate study at The University of Texas at Arlington, Randall A. Napier earned a B.A. in Economics from Northwestern University, an M.S. in Accounting from Florida International University, and a J.D. from the University of Houston Law Center. He is qualified as a Certified Public Accountant, and has earned the Certified Fellow in Production and Inventory Management (CFPIM) designation from APICS, the Association for Operations Management. His research interests focus on the use of quantitative tools and techniques to understand and improve business processes.