PHARMACEUTICAL INVENTORY FORECASTING AT THE WRIGHT-PATTERSON MEDICAL CENTER

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THESIS

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Capt Patrick Reymann

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Abstract

This research was conducted to determine the accuracy of statistical forecasting techniques forecasting the inventory of pharmaceutical items. Because pharmaceutical items are subject to a degree of seasonality of demand, the Director of Medical Logistics at the Wright-Patterson Medical Center believed that the use of such techniques may provide a more accurate forecast for the items stocked by the Outpatient Pharmacy. In addition to the technige used by the Outpatient Pharmacy (the 12 month simple moving average) three statistical forecasting methods were employed: the 6 month simple moving average, simple exponential smoothing, and the Winter's exponential smoothing. These techniques were used to obtain forecasts, and the results were analyzed for measurement error. The Winter's exponential smoothing method prove superior in nearly all cases, and offers the best potential for use.

PHARMACEUTICAL INVENTORY FORECASTING AT THE WRIGHT-PATTERSON MEDICAL CENTER

I. Introduction

Subject

The Wright-Patterson Medical Center (WPMC) maintains an inventory of over 1100 prescription items and fills prescriptions for over 4000 customers each day. (Romeyn, 1994). A staff of 60 personnel of the Directorate of Medical Logistics oversees the inventory. The Directorate of Medical Logistics utilizes the Automated Inventory Management System (AIMS) to maintain and control the inventory. The control of this inventory is the subject of this research.

This chapter presents a brief background which explains the current inventory concerns at the Outpatient Pharmacy (OP) at the WPMC. The specific problem addressed by this research and the research objectives are presented. In order to conduct the research, certain assumptions are made, and those assumptions are defined. Likewise, the research's scope is limited by a variety of factors, which are also presented. The intended managerial implications of this research for the staff of the WPMC are offered. Finally, the chapter is summarized, and an overall blueprint is given for subsequent chapters.

Background

The 645th Medical Group at Wright-Patterson AFB (WPAFB), hereafter referred to as the Wright-Patterson Medical Center, has experienced an ongoing, long-term problem of out-of-stock medications for months (Romeyn, 1994:1). In an attempt to evaluate the scope of the problem, it was decided, in late 1993, to track the number of stockouts which occurred each day in the OP. A stockout is the condition which exists when an inventory item is depleted to a zero balance and a demand cannot be met (Gilloth and others, 1979:7). In this case, a stockout results in the pharmacy not having a particular drug when a patient presents a prescription at the pharmacy window for that drug (Romeyn, 1994:1). The stockout condition is chosen by Romeyn because it was felt it represents the endpoint, or final outcome, of the restocking and inventory management process as a whole.

An initial review of stockouts at the WPMC OP found the pharmacy experienced an average of 17 stockouts every day. To put this in terms of the individual customer, these 17 stockouts a day resulted in approximately 60 patients a day being given an "out label" or IOU, and sent away without medication (Romeyn, 1994:1). While non-availability of prescription items did not pose a life-threatening situation for the patient, the inconvenience of the subsequent one day delay is not the type of performance that the customer-driven WPMC desired. These results indicated to the OP that the process needed greater attention and improvements were necessary.

The organizations within the WPMC which most directly influence the inventory management process at the pharmacy are Medical Logistics and the OP. Traditionally, the OP tabulates the inventory levels and prepares orders for the pharmacy stockroom. The orders are relayed to Medical Logistics, who acquire the items from their warehouse and stock them in the pharmacy stockroom.

The OP at the WPMC had set stockage level of eight to ten days. It was under this level that the 17 daily stockouts (out of approximately 4000 daily filled prescriptions) existed. The Air Force logistics standard requires a 95 percent fill rate. Medical Logistics consistently maintained a 95 percent fill rate or higher (Romeyn, 1994:2). Yet, the WPMC OP staff felt the number of stockouts was still too high and could be reduced.

A process action team (PAT) was formed to address the problem. It was determined to set a goal of zero stockouts. The PAT recommended changes to the process and the changes were implemented. Medical Logistics personnel were assigned to the pharmacy to order and stock orders. A three day level was set for items in the dispensing area and the pharmacy stockroom. The pharmacy was automated with bar-code technology. When the pharmacy needs an item from the pharmacy stockroom, the entire three day quantity was pulled from the shelves, leaving an empty space. (Romeyn, 1994:3) Each day, a Medical Logistics technician scans each empty space in the stockroom with a bar-code reader (Romeyn, 1994:3). The demands for the items out-of-stock are transferred to Medical Logistics, who replenish the items the next morning.

The new process resulted in a reduction of stockouts from 17 per day to less than three. In a one year period, the reduction of stockage level from eight to ten days to three days yielded a $200,000 reduction in pharmacy shelf stock (Romeyn, 1994:3). Similarly, Medical Logistics was able to reduce the Defense Business Operation Fund (DBOF) inventory by $750,000 (Romeyn, 1994:3).

The inventory tracking system used by the OP is MEDLOG. MEDLOG is the standard Air Force medical facility inventory tracking system. MEDLOG provides a demand forecast for items by compiling the last 12 months of demand data and dividing the data by 365 to get the average daily demand rate. Thus, the system forecasts demand by utilizing a moving average.

To account for variations caused by seasonal demand patterns, the OP personnel adjust the stock levels for those items they deem as exhibiting seasonal demand patterns. The level of adjustment is based on the personnel's experience and knowledge of past seasonal demand patterns for the respective items. Typically, the level of adjustment is approximately 25 percent (Spilker, 1944). If the actual demand is greater than anticipated, the appropriate stockage level in increased. Similarly, if the actual demand is less than anticipated, the stockage level is decreased.

Specific Problem

The purpose of this study is to forecast the demand of seasonal items at the WPMC. An accurate forecasting system can relieve the subjective approach to seasonal predictions and help to anticipate potential stockout conditions brought on by significant variations in demand. A forecasting system may also prevent potential problems brought about by personnel turnover at the OP, and the subsequent loss of expertise and experience. An accurate forecasting model can alleviate the arduous task of determining stock levels for seasonal items and recommend stock levels based on statistically proven methods.

The objective of the MEDLOG used at the Wright-Patterson Medical Center is to provide optimal logistics support. Optimal logistics support provides for both minimum stockout of prescription items and minimum inventory levels. The inventory control procedures outlined in AFM 67-1, Volume V. require a minimum of 95 percent fill-rate on customer demands, while maintaining an economic level of inventory (AFM 67-1: 1-1). While the requirements are being satisfied, staff personnel also believe more optimal logistics support could be achieved with a lower level of inventory (Romeyn, 1994). Specifically, the use of forecasting techniques in determining stockage levels for seasonal demand items may reduce the required inventory while reducing stockout conditions.

Research Objectives

The following areas are addressed to determine if statistical forecasting techniques for prescription seasonal demand items (what items to treat as seasonable and how many of those items to stock) can be developed for the WPMC. The result of these objectives will determine if statistical forecasting techniques can be used to increase the accuracy of the OP in determining inventory levels for seasonal demand prescription items. To assess the adequacy of the WPMC inventory management system in addressing seasonal trends, the following research questions are developed:

1. To determine if the items, as identified as exhibiting seasonal trends by the staff of OP, actually display seasonality.
2. To determine if a forecasting model applied to the inventory management system at the WPMC will detect the seasonality of demand.
3. To determine which forecasting techniques tested produce the forecast with the least forecast error.

Assumptions The following is a list of assumptions made in the course of this research study.

1. Cancellation of demand is not allowed.

2. Unit inventory costs have no bearing on the quantity of inventory items procured. The amount procured reflects only the necessary amount to satisfy demand over the three day period set for inventory levels by the OP.

3. Changes in climatic environment at Wright-Patterson AFB over the data history do significantly impact the seasonality of demand.

4. Future monthly demand patterns will be similar from year to year.

5. All resupply items ordered were actually received. Supplies lost, pilfered, or that became outdated were not considered in the study.

Scope/Limitations. The following list illustrates the scope and limitations of this research study.

1. The forecasting techniques used do not consider cyclical factors. The demand data used in this research covers a four year period. Cyclical factors, such as budgetary, shifts in manpower, and shifts in the population of potential patients, may not necessarily follow cyclical patterns. Additionally, any cyclical nature of such factors would occur within various time periods and would not necessarily fit the four year period of demand data.

2. The limited amount of demand history data and the number of medical facilities analyzed do not permit generalization

of the results throughout the Air Force. The various factors affecting any military medical facility (mentioned above) are not consistent throughout the military.

3. Variations in the method of determination of seasonality by the WPMC personnel may not make those items chosen as seasonal representative of other USAF medical facilities. Weather patterns in the Dayton, Ohio area is one such factor which would cause differing demand for like items at different military medical facilities.

4. Physician turnover in the hospital may have forced a change in demand rates for varied medical items as some drug usage is contingent on physician preference.

5. The management of other resources such as medical equipment and non-medical supplies are applicable to the methods used in this study. However, these items are not considered in this research.

6. Inventory depends on the stock of materials on hand at a given time (i.e. - tangible assets which can be seen, measured, and counted) (Tersine, 1994:3).

Managerial Implications

It is intended that this research yields results which will support the use of alternate forecasting techniques for the OP at the WPMC. The use of such a forecasting technique would allow more accurate forecasts of demand for seasonal prescription items. Such forecasts can be used to set inventory levels which will more closely match actual demand. As a result, stockout conditions may be reduced, yielding higher fill rates and allow the OP to provide a better service for its customers. Additionally, more accurate forecasts may lead to lower inventory costs, as OP personnel may be able to reduce the amount of inventory held and/or reduce the number of orders for prescription items.

Methodology

This study applies statistical forecasting techniques to four years of demand data of two sets of data. The first set involves those prescription items which are identified as exhibiting seasonal demand patterns by personnel of the WPMC OP. A second set of prescription items is chosen randomly by the author. Both sets of data are tested for seasonality, and the techniques are applied. The forecasting techniques are then applied to these items, and the results from the two sets are compared. Additionally, the results are compared with the technique currently used by the OP, a 12 month simple moving average. The resultant data is analyzed to determine if any of the techniques yield results which differ in accuracy from the currently used technique.

Summary

This chapter has presented the purpose of this research, which is to apply statistical forecasting techniques to the seasonal prescription items at the WPMC OP. The management of pharmaceutical inventory at the WPMC was explained. Following this explanation was a discussion of the specific problem and the associated research objectives. The research problem is to determine if statistical forecasting techniques can be used to obtain more accurate forecasts for determining inventory demand. Should such techniques be shown to be more accurate, they can then be used as a managerial tool to more accurately set inventory levels. The results would include improved customer service and lower inventory costs.

Because this study involves inventory management and statistical forecasting techniques, a review of both topics is provided in Chapter Two. A review of inventory is provided so that the reader understands what it is, why it is held, its associated costs, and how it is commonly managed. Associated with inventory is the Economic Order Quantity, which is a predetermined fixed order quantity. The WPMC OP inventory model is presented.

A discussion of forecasting follows. Time series data are discussed. Tests for seasonality are illustrated. Previous related research is presented and applicable findings are illustrated.

Chapter Three presents the research design. The chapter describes the data population and proceeds with the selection of forecasting techniques to apply to the data.

The research questions and their respective hypotheses are presented, and the chapter is summarized.

Chapter Four presents the results of the computations involved in answering the research questions. This chapter presents the data which reports the research.

Chapter Five presents the interpretations and conclusions of the research. It comments on the research implications for the WPMC OP and suggests areas for future study. Finally, the chapter summarizes the thesis.

II. Literature Review

Overview

The objective of the medical logistics inventory computer system (MEDLOG) used at the Wright-Patterson Medical Center is to provide optimal logistics support. Optimal logistics support provides for both minimum stockout of prescription items and minimum inventory levels. The inventory control procedures outlined in AFM 67-1, Volume V. require a minimum of 95 percent fill-rate on customer demand, while maintaining an economic level of inventory (AFM 67-1: 1-1). While personnel at the Directorate of Medical Logistics believe the requirements are being satisfied, staff personnel also believe more optimal logistics support could be achieved while operating with inventory levels less than those currently maintained (Romeyn, 1994).

This chapter discusses inventory theory and its properties. Inventory, its purpose and use, is explored. The classic Economic Order Quantity (EOQ) model is presented so that the concepts of the medical inventory models may be understood. A discussion of forecasting follows, leading to a more specific discussion of various forecasting models. The measurement errors used to evaluate those forecasting models are presented. Previous pertinent studies are presented, which are used to aid the reader's comprehension of the subject. Lastly, the chapter is summarized.

Inventory

Organizations maintain inventory because it is physically impossible or uneconomical to purchase supplies in such a manner as to assure their arrival at the moment of actual demand (Hadley and Whiten, 1969:1). Expressed another way, inventory is an alternative to future production or procurement (Vonderembse and White, 1991:625). Inventory exists because supply and demand are difficult to synchronize exactly. Additionally, inventory allows a reduction in the time to meet demand. There are several reasons why supply and demand frequently differ in the rates at which they respectively provide and require stock. Those factors are time, discontinuity, uncertainty, and economy (Tersine, 1994:6).

An explanation of each of the previously mentioned factors further illustrates the need to carry inventory. The time factor represents the length of time that inventory assets (raw materials, in-process inventory, finished goods inventory) are used in procurement, storage, transport and production before the good is available to the consumer. The discontinuity factor is identified as that which allows the various dependent operations of retailing, distribution, warehousing, manufacturing, and purchasing to act in an independent and economic manner. For example, the finished goods inventory isolates the customer from the producer (Tersine,1994:7). The uncertainty factor represents the protection provided by inventory against unforeseen variations in demand. The economy factor reflects lower unit costs due to bulk or large order quantities.

The two key problems that usually face any firm when attempting to establish an appropriate level of inventory are when to order and how much to order (Mayer, 1965:475). The inventory on hand depends on the amount of consumption and the length of lead time needed to acquire replenishment stocks. In a deterministic model, where it is assumed that demand and lead time are known, it becomes very easy to determine when an order should be placed and how much should be ordered. An order is placed when the balance will just be adequate to fill demand during the lead time. The order will then arrive at exactly the time that the inventory balance reaches zero. The quantity to be ordered will be the quantity needed to bring the stock up to the predetermined level (Gilloth and other, 1979:6).

Inventory Costs. Inventory costs are costs associated with the operation of an inventory system. They result from action or lack of action of management on establishing the inventory system. The costs serves a parameters for any inventory decision model (Tersine, 1982:16). There are four principal costs associated with inventory, and they are explained in Table 1.

Table 1. Inventory Costs

Cost	Description
Purchase Cost	Unit purchase price if obtained externally; unit production cost if produced internally.
Order/Setup Cost	Originates from the expense of issuing a purchase order. Includes such items as making requisitions, analyzing vendors, writing purchase orders, receiving materials, inspecting materials, following up orders, and the associated paperwork.
Holding Cost	Also known as carrying cost. Includes such items as capital cost, taxes, insurance, handling, storage, shrinkage, obsolescence, and deterioration. Typically 20-40% of the inventory investment.
Stockout Cost	Results from internal and external shortages. An external shortage occurs when a customer of the organization does not have his/her order filled. An internal shortage occurs when a group or department within an organization does not have its order filled. Contingent upon the customer's reaction to the out-of-stock condition.

(Adapted from Tersine, 1982:16-17)

Safety Stock. Rarely are managers able to determine with certainty what the demand and the lead time will be. Accordingly, safety levels know as safety stock are used. Almost all inventory control in use today recognize, in one way or another, the need for safety, or cushion, to protect service (Brown, 1959:81). Safety stock is the amount of stock held to compensate for both lead time demand and order and shipping times (Syzdek,1989:10). The safety stock level is set according to the risk of a stockout condition which exists when a demand cannot be met by existing stocks. No institution can afford to carry inventories for all items so large that it can protect itself against every situation (Syzdek,1989:59). The OP at the WPMC does not consider cost of items when setting its safety stock.

Thus, the model used to account for safety stock is based on the probability that demand and lead time will fluctuate within certain limits. This means that the model is stochastic. When the demand exceeds available stock, a stockout condition exists. The safety stock model adds a buffer amount, or safety stock, to increase the stock level by the amount of safety stock. This buffer cushions against the uncertainty of demand and lead time variations. When the stock level drops to the reorder point, a replenishment request is made. See Figures 1 and 2 for illustrations.

The MEDLOG inventory system establishes its safety level by setting it equal to a one month of stock based on the previous 12 month average (AFM 67-1, 8-5). The safety stock level can be expressed mathematically as:

$$SSL = 1/m\sum_{i=1}^{m} D_i \qquad (1)$$

where:

SSL = safety stock level
m = months of history consumption
D_i = actual demand for the ith month

Economic Order Quantity

One common inventory planning model as defined by AFM 67-1, Volume V. is the economic order quantity (EOQ) (AFM67-1:3-4). This model uses a minimum stock level to determine when to reorder a predetermined fixed quantity, or EOQ.

The EOQ is based on several assumptions. The assumptions are:

1) A continuous, constant and known demand rate;
2) A constant and known replenishment or lead time;
3) The satisfaction of all demand;
4) Constant price or cost that is independent of the order quantity or time;
5) No inventory in transit;
6) One item of inventory or no interaction between items;
7) Infinite planning horizon;
8) No limit on capital availability.

(Coyle, 1988:221)

Given these assumptions, the simple EOQ model considers the following types of costs: inventory carrying cost (or holding cost), ordering or setup costs (Coyle, 1988:222). The simple EOQ formula, then is given as:

$$Q = (2DC_o/C_h)^{1/2} \qquad (2)$$

where:

Q = optimal order quantity
D = annual demand rate
C_o = cost to place an order
C_h = cost to hold one unit of the item in stock for one year

The EOQ was developed to consider a combination of cost factors. It determines the optimum order quantity that will minimize the cost of ordering and the cost of holding inventory. It is based on four factors: the cost to order the item, the cost to hold the item in inventory, the annual demand for the item, and the purchase price of the item (Syzdek,1989:8).

The EOQ affects the number of requisitions initiated during the year (Gilloth, 1979:21). The reorder point is contingent on the inventory level. Because the assumptions of constant and known demand rate and lead time are made, the reorder point can be calculated by multiplying the lead time length by the daily demand rate, and then adding the safety sotck. Illustrations of the deterministic and stochastic models are represented in the following illustrations.

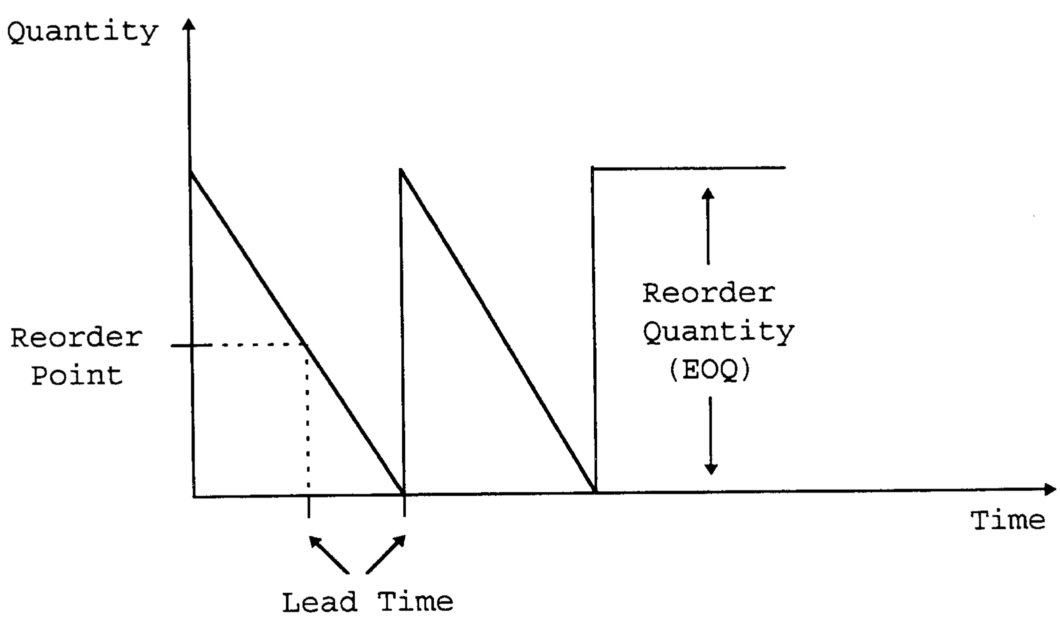

Figure 1. Deterministic EOQ Model

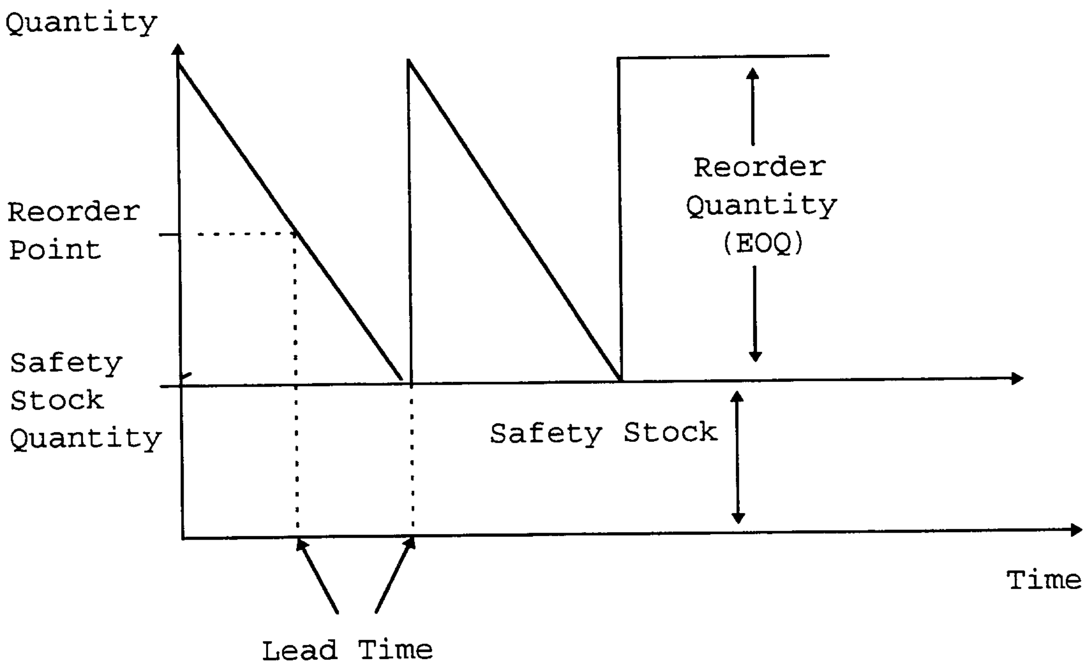

Figure 2. Stochastic EOQ Model

Daily Demand Rate. The daily demand rate (DDR) is computed using the sum of the issues in the available consumption history divided by the number of days in the consumption history, up the 365 days (Gilloth and others, 1979:13). This consumption is expressed as:

$$DDR = 1/D \sum_{i=1}^{D} ISS_i \tag{3}$$

where:

DDR = daily demand rate

ISS_i = number of daily issues
D = # of days in consumption history
(Gilloth, 1979:22)

Once the item's consumption history has reached 12 months, the number of days in the consumption period is set at 365 days. In this way, the rate is a result of the past year's data, and is, in effect, a twelve month moving average.

Medical Supply Inventory Models

Due to the focus of this research, attention is focused upon fixed order quantity models - the type used by the Air Force Medical Service.

There are three common types of inventory control systems found in hospitals: no control, order point, and periodic control (Ammer, 1983:118). "No control" systems are primarily use in small facilities where a very limited number of personnel have control over inventory. Order point controls involve EOQ models and other fixed order quantity systems (Hill, 1988:12). More sophisticated health care institutions may have computer systems which print out, by vendor, items at reorder point (Ammer, 1983:121).

EOQ models, which are used at the WPMC, represent the traditional method of inventory control found in hospitals (Hill, 1988:13). To assist in management of their inventory systems, there are at least twelve major computer software inventory management systems commercially available to hospitals (Sneider, 1987:40).

Forecasting

Forecasting is aimed at reducing the uncertainty that surrounds the future (Tersine, 1974:34). Because of the uncertainty in predicting demand levels for prescription items, the use of forecasting is explored.

There are difficulties, however, in satisfying the assumptions of the EOQ model which are necessary for use in hospital environments (Hill, 1988:13). For example, the demand and lead time for medical subscriptions may not be constant. Many prescription items can be substituted for one other, which violates one of the EOQ assumptions. Additionally, not all demand is satisfied.

Forecasting techniques may be qualitative or quantitative. Quantitative analysis relies on statistical methods, while qualitative analysis is based on judgmental analysis. Quantitative techniques utilize three basic demand forecasting models - time series analysis, economic indicators, and econometric. Qualitative methods model demand from solicited opinions. For products (in the case of this research problem, prescription items) with demand histories, future activity can be based more quantitatively on past performance (Tersine, 1994:40).

Quantitative methods consist of two major types - time series and causal. The casual relationship assumes a constant cause and effect relationship between some input and its respective output. Any change in input will affect the output of the system in a predictable way. The causal model is generally reserved for models with variables other the time (Wheelwright and Makridakis, 1985:40).

Time Series Components. Time series analysis predicts the future from the past (Tersine, 1994:44). In evaluating a variable's changes over time, the relationship between demand and time is assessed. In this way, the future is predicted. Two considerations are involved in producing an accurate and useful forecast of a time series. The first consideration is to collect data that are relevant to the forecasting task. The second consideration is to choose a forecasting technique that will utilize the information contained in the time series components to the fullest (Hanke and Reitsch, 1992:140).

Time series components may contain up to five interacting components. The five components are raw data, trend, seasonal, cyclical, and random. If the historical components continue in the future, reliable forecasts will be obtained (Tersine, 1994:44).

The first component is raw data, or the level component. This is the central tendency of a time series at any given time (Syzdek, 1989:16). The trend represents a long term component which shows a rate of growth or decline. The basic forces that affect and help explain the trend component are population growth, price inflation, technological change, and productivity increases (Hanke and Reitsch, 1992:92). The seasonal component is represented by fluctuations about the trend line which repeat from season to season or year to year. Seasonal variation may reflect weather conditions, holidays, or length of calendar months (Hanke and Reitsch, 1992:92). Cyclical variations may or may not be periodic, but often are a result of business cycles of expansion and contraction of economic activity over a number of years (Tersine, 1994:44). The random component measures the variability of the time series after the other components have been removed (Hanke and Reitsch, 1992:93). Random variations are those in the data which cannot be accounted for otherwise and have no identifiable pattern (Syzdek, 1989:18). The seasonal component is further explained in the next section.

Seasonality. Seasonality is present when demand fluctuates in a similar pattern within each year. The twelve month cycle may be related to factors such as weather patterns, holidays, school openings, vacations, etc (Tersine, 1982:36). In the hospital environment, the flu season which occurs during the winter months causes extreme demand increases for many prescription items, which during the rest of the year show normal and random demand variations. AFM 67-1, Volume V. specifies that variations in stock control levels and EOQs may be necessary for certain items under certain conditions, such as seasonal items with negligible off-season consumption (AFM 67-1:1-1).

Peterson and Silver provide three criteria for manually determining if seasonal trends exist:

1) The peak demand should be substantially higher than the random fluctuations or "noise" in the demand;
2) The peak demand must occur during the same time period each year;
3) The reason for the peak must be known.

(Peterson and Silver, 1979:40)

Using the above first two criteria, a sample plot of demand over time would reveal the existence of seasonality. The reason for the peaks (for example, flu season) is known in advance. A strong indication of seasonality would be a pattern of demand generally repeating itself over several years, with peaks and lower demand periods considered significant if greater than two standard deviations from the mean demand (Syzdek, 1989:35). This simplistic method of detecting seasonality relies on its user's subjective interpretation of "substantially higher".

Autocorrelation. A more statistically verifiable method for determining seasonality would employ the use of a autocorrelation. Autocorrelation among successive values of a time series is a key tool in identifying the basic pattern and determining an appropriate model corresponding to a data series (Wheelwright and Makridakis, 1985:111). The degree of correlation between two variables is measured by the correlation coefficient, expressed as r. This describes what tends to happen to one of the variables if there is a change in the other. The correlation coefficient varies between -1 and +1. A value close to -1 or +1 indicates a strong negative or positive linear relationship, respectively, between the two variables. The closer the coefficient is to zero, the less is the statistical relationship between the variables.

The autocorrelation coefficient (ACF) is similar to the correlation coefficient except that it describes the association among values of the same variable at different time periods. The correlation between the original data set and the second data (representing some different time period) shows how data from different time periods are correlated and whether they tend to move in the same direction (Syzdek, 1989:37). Thus, the same data set is analyzed, only at some different time - hence the term autocorrelation.

The correlation coefficient between the original data set and the second data set shows how data one period (lag) apart are correlated and whether they tend to move in the same direction (Syzdek, 1989:37). Autocorrelation occurs where one observation tends to be correlated with the next (Tersine, 1994:51). For example, if the autocorrelation factor for the 12th lag for monthly data (data point 12 months apart) is statistically significant, then the data can be reasonably assumed seasonal (Wheelwright and Makridakis, 1977:176).

Forecasting Models

All time series smoothing methods use some form of weighted averages of past observations to suppress short term fluctuations. The underlying assumptions of these methods is that the fluctuations in past values represent random departures from some smooth curve that, once identified, can plausibly be extrapolated into the future to produce a forecast or series of forecasts (Wilson and Keating, 1994:103). Five smoothing methods are examined. The methods are:

1) Moving average;
2) Exponential smoothing;
3) Holt's exponential smoothing;
4) Winter's exponential smoothing;
5) Box-Jenkins time series model.

Moving Average. The moving average method generates the next period's forecast by averaging the actual demand for the last n periods (Wilson and Keating, 1985:103). Mathematically, it is represented as:

$$F_{t+1} = (Y_t + Y_{t-1} + \ldots + Y_{t-n+1})/n \qquad (4)$$

where:

Y_t = actual datum in time period t
F_{t+1} = forecast made in time period t for t+1
n = number of terms in the moving average

(Hanke and Reitsch, 1992:134)

This technique gives more weight to more current time periods. If the number of periods is small, this model is more responsive to fluctuations in the data pattern. For large numbers of periods, the moving average model can be very small. The moving average model performs best with stationary data; however, it does not handle trend or seasonality very well.

(Hanke and Reitsch, 1992:134-5)

Exponential Smoothing. Simple exponential smoothing, like moving averages, uses only past values of a time series to forecast future values of the same series and is properly employed where there is no trend or seasonality present in the data (Wheelwright and Makridakis, 1985:107). This model averages past values of demands in a decreasing and exponential manner. As such, the more recent the data, the more weight it receives. This assumes that the most recent date contains the most relevant information. Accordingly, exponential smoothing is responsive to change in data patterns. One advantage of exponential smoothing is that it is a simple technique and requires little historical data (Evans, 1993:740). It is expressed mathematically as:

$$F_{t+1} = \alpha X_t + (1-\alpha) F_t \quad (5)$$

where:

F_{t+1} = forecast value for period t + 1
α = smoothing constant ($0<\alpha<1$)
X_t = actual value now (in period t)
F_t = forecast made in month t
(Wheelwright and Makridakis, 1985:108)

As the value of the smoothing constant approaches 1, more weight is given to recent data. Generally, the α which results in the lowest root-mean-squared error (RMSE) is chosen, though any value in the range $0<\alpha<1$ can be used.

With exponential smoothing, forecasting equations can be quickly revised with a relatively small number of calculations as each new data point in collected. Another advantage is that is permits the forecaster to place more weitht on current data rather than treating all data points equally. Exponential smoothing also minimizes data storage requirements when calculations are performed manually or with a computer. (Sullivan and Claycombe, 1977:83). The main disadvantage of exponential smoothing methods concerns the basic assumption that trends and patterns of the past will continue in the future. (Sullivan and Claycombe, 1977:83).

Holt's Exponential Smoothing. Holt's exponential smoothing is an extension of simple exponential smoothing. Holt's model adds a trend factor to the smoothing equation to adjust for trends.

A second smoothing constant is applied to account for the trend factor. The equations are expressed as follows: (Wilson and Keating, 1994:111)

$$F_{t+1} = \alpha X_t + (1-\alpha)(F_t + T_t) \qquad (6)$$

$$T_{t+1} = \beta(F_{t+1} - F_t) + (1 - \beta)T_t \qquad (7)$$

$$H_{t+m} = F_{t+1} + mT_{t+1} \qquad (8)$$

where:

T_{t+1} = trend estimate
β = smoothing constant for trend

estimate $(0,\beta<1)$

m = # of periods ahead to be forecast

H_{t+m} = Holt's forecast for period t+m

Equation 6 adjusts F_{t+1} for the growth of the previous period, T_t by adding T_t to the smoothed value of the previous period F_t. Equation 7 represents the trend estimate. The most recent trend, $(F_{t+1} - F_t)$ is weighted by β and the last previous smoothed trend, T, is weighted by $(1 - \beta)$. The sum of the weighted values is the new smoothed trend value, T_{t+1} (Wilson and Keating, 1994:113).

The trend component makes this model able to handle trends, but the lack of a seasonal component leaves it unable to adjust for seasonality. The model require few data points, but is more complex than simple moving averages. A possible disadvantage of Holt's exponential smoothing is that for data with no trend, the forecast may be underestimated or overestimated (Hanke and Reitsch, 1992:150).

Winter's Exponential Smoothing. The Winter's exponential smoothing (WES) model is the second extension of simple exponential smoothing. Winter's model adds a seasonal factor to Holt's model. A third smoothing constant is applied. It is expressed mathematically as:

$$F_t = \alpha X_t / S_{t-p} + (1-\alpha)(F_{t-1} + T_{t-1}) \quad (9)$$

$$S_t = \beta X_t / F_t + (1 - \beta) S_{t-p} \quad (10)$$

$$T_t = \gamma(F_t - F_{t-1}) + (1 - \gamma) T_{t-1} \quad (11)$$

$$W_{t+m} = (F_t + mT_t) S_t \quad (12)$$

where:

S_t = seasonality estimate
β = smoothing constant for seasonality estimate
γ = smoothing constant for trend estimate
m = # of periods in forecast lead period
p = # of periods in seasonal cycle
W_{t+m} = Winter's forecast for m periods
(Wilson and Keating, 1994:113)

Winter's model is useful for data patterns which exhibit both trend and seasonality tendencies. However, the model is more difficult to use due to the presence of the three smoothing constants. This greatly increases the data requirements and computer time required to generate forecasts (Syzdek, 1989:24).

Box-Jenkins Time Series Model. Box and Jenkins presented a formally structured class of time series models that are sufficiently flexible to describe many practical situations (Cleary, 1982:222). These models are know as autoregressive integrated moving average (ARIMA) models, and they describe phenomena in a statistical rather than a deterministic manner. Box-Jenkins methodology refers to a family of forecasting models rather than one single family and can be categorized into three basic classes - autoregressive models, moving average models, and mixed autoregressive moving average (Bowerman, 1987:20). A three stage procedure of identification, estimation, and diagnostic checking is used to arrive at a specific model (Sullivan, 1977:223).

In the autoregressive relationship, an equation such as the following is used to develop a forecast based on a linear, weighted sum of previous data:

$$y^* = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \ldots + \phi_p y_{t-p} + e_t \qquad (13)$$

where:

y^* is the forecast
y_i ($i = 1,2,\ldots,p$) is the observed value at time i
ϕ_i is the weighting coefficient for the pth previous period
e_t is the expected forecast error at time t

The weights and the e_t values are determined by using multiple regression analysis; hence the name autoregressive (Sullivan, 1977:224).

The second relationship is that of a moving average in which the forecast is a function of previous forecast errors.

$$y^* = e_t - \theta_1 e_{t-1} - \theta_2 e_{t-2} - \ldots - \theta_q e_{t-q} \qquad (14)$$

where:

y^* is the forecast
e_{t-i} ($i=1,2,\ldots,q$) is the forecast error at time t
θ_i ($i=1,2,\ldots,q$) is a weighting coefficient for the qth previous period, which is calculated by a nonlinear least-squares method

The third relationship is a combination of the first two, referred to as the mixed autoregressive moving average model (Sullivan, 1977:225).

To successfully apply the Box-Jenkins forecasting method, most experts recommend that a minimum of 40 periods of data, and preferably 50 periods be used (Hoff, 1983:30). While there are strong proponents of the Box-Jenkins approach to forecasting, it has not been widely applied to inventory control (Tersine, 1988:69). The reasons cited are that the procedure is difficult to understand and to master, and the data must often be transformed to make it suitable for use. Finally, it is more time consuming and requires greater computational capabilities, and is thus more costly than smoothing methods (Tersine, 1988:70).

The accuracy of many different forecasting techniques was compared in competition (later known as the M-Competition) in which experts in each of the main time series forecasting methods prepared forecasts for up to 1001 actual time series (Wheelwright and Makridakis, 1985:265). Twenty-four methods were compared based upon their mean absolute percentage error (MAPE) for forecasts covering ten different time horizons from 1 to 18 months (Hill, 1988:35). The results indicated that increasing the complexity and statistical sophistication did not automatically mean an improvement in forecasting accuracy. (Wheelwright and Makridakis, 1985:265). Simplicity was seen to be a positive factor.

Table 2.

Ratings of Forecasting Methods Considered

Model	Simplicity	Data Points Required	Ability to Handle Trends	Ability to Handle Seasonality	Responsive to Change
Moving Average	Excellent	Few	Poor	No	Poor
Exponential Smoothing	Excellent	Few	Fair	Poor	Fair
Holt's	Fair	Few	Good	Poor	Good
Winter's	Fair	Few	Good	Good	Fair
Box-Jenkins	Poor	40-50	Good	Good	Fair

(Hill, 1988:50)

Forecasting Measurement Errors

Forecasting error measures are used to compare forecast data to actual results. The basic assumption of many forecasting techniques is that there is a fundamental pattern to the observations, plus some error or fluctuation (Syzdek, 1989:38). Forecasting error measures involve comparing the average value of the differences between the observed and forecasted data. Three such methods are used in this research study: Mean Absolute Deviation (MAD), Mean Square Error (MSE), and Mean Absolute Percentage Error (MAPE).

The MAD measures the mean absolute difference between the forecast and actual values. It is used in this study because MAD is most useful when analysts want to measure the forecast error in the same units as the original series (Hanke, 1992:113). However, because the value yielded by MAD is in the same units as the original series, it is not a relative measure across time series. The MAD formula is presented in Equation 14.

$$\text{MAD} = \frac{\sum_{t=1}^{n} |F_t - Y_t|}{n} \qquad (15)$$

where:

F_t = Forecast at time t
Y_t = Actual value at time t
n = number of periods

(Hanke, 1992:112)

The MSE is similar to the MAD, except that each residual is squared. In this way, larger forecast errors are more heavily penalized. It is used in this study so that the forecasts with relatively large errors will be highlighted. Like the MAD, the value yielded by MSE is in the same units as the original series and is also not a relative measure across time series. The MSE is shown in Equation 15.

$$\text{MSE} = \frac{\sum_{t=1}^{n} |F_t - Y_t|^2}{n} \qquad (16)$$

where:

F_t = Forecast at time t
Y_t = Actual value at time t
n = number of periods

(Hanke, 1992:114)

The MAPE compares the error in terms of percentages. The MAPE provides an indication of how large the forecast errors are in comparison to actual forecast errors (Dussault, 1994:3-7). MAPE is a relative measure expressed in percentages, and is applicable across different time series. For this reason it is included in this study. The formula for MAPE is shown in Equation 16.

$$\text{MAPE} = \frac{\sum_{t=1}^{n} |F_t - Y_t| / P_t}{n} \quad (17)$$

where:

F_t = Forecast at time t
Y_t = Actual value at time t
P_t = F_t
n = number of periods

(Hanke, 1994:114)

Should the actual demand equal zero, the numerator is undefined. For this reason, if the actual demand is zero, the demand observation should be ignored (Sherbrooke, 1987:5).

Previous Studies

The medical inventory system involves many decision parameters. These parameters include such factors as safety levels, pipeline times, economic order quantities, daily demand rates, stock control levels, and seasonal influences (Gilloth, 1979:3).

Many of these factors have been addressed in previous studies. Ferguson addressed the Daily Demand Rate (DDR) computation and provided a formula for determining a new DDR factor which could ultimately affect the stock control level, the reorder point, and the safety stock (Ferguson and Gibson, 1977:22). Peacock and Seale attempted to apply a variable safety level to the system in order to improve the service level (Peacock and Seale, 1989:6). Bloss, Moccia, and Rowland designed a computerized inventory control system for the pharmacy at the Wright-Patterson Medical Center (Bloss and others, 1974:1). Each of these studies make specific recommendations for continued research regarding seasonal effects on the medical supply inventory system. Peacock and Seale proposes the development of a model to evaluate trends and seasonal factors upon the USAF Medical Material Management System (Peacock and Seale, 1989:63). Each of these previous works suggested future study in this area for system improvement was recommended.

The management of seasonal items has received much attention in textbooks (Blazer, Brown, Coyle, Wilson and Keating, Wheelwright and Makridakis, Tersine), but it has also been the topic of numerous military studies. Gilloth, Ohl, and Wells addressed the topic in their 1979 thesis entitled "An Evaluation of Seasonality in the United States Air Force Medical Material Management System" (Gilloth and others, 1979). After examining the demand patterns of over 1800 medical items, they determined that seasonality was evident in 25 - 35% of the supplies examined, while only about 8 - 9% of the items were seasonal during both years tested. They concluded that double exponential smoothing was the best forecasting method tested, using mean squared error as the selection criteria (Gilloth and others, 1979:58).

Other forecasting methods examined were the current Medical Material Management system (12 month moving average), and adaptive response rate exponential smoothing. This method utilizes a smoothing constant which automatically adapts to the demand pattern changes. Due to limited data available, they recommended increased date retention.

A thesis titled "The Application of Exponential Smoothing to Forecasting Demand for Economic Order Quantity Items" examined simple, trend and triple (with a quadratic component) exponential smoothing, plus a 12 month moving average (Fischer and Gibson, 1972). Their sample consisted of 34 EOQ items from the Wright-Patterson Base Supply. Though this study did not address medical prescription items, it provides insight into the use of forecasting methods. They concluded that an inadequate database, with only 22 months of data available, prevented the determination of acceptable smoothing constants (Fischer and Gibson, 1972:71). The smoothing constants were chosen by testing several values for the minimum sum of squared errors. Their work showed that, statistically, the four models produced the same mean square error.

Bittel and Gartner examined demand for consumable items at the depot level. They analyzed over 800 line items using the following methods:

1) Simple moving average;
2) Double moving average;
3) Single exponential smoothing;

4) Simple regression (fitting the least squared line);
5) Exponential growth.

(Bittel and Gartner, 1982:5)

Bittel and Gardner noted that simple exponential smoothing gives the lowest mean average variation and deviation of all methods tested. However, they noted that the method was statistically equivalent to the single moving average with four and eight month periods (Bittel and Gartner, 1982:79). Bittel and Gardner recognized that the forecasting model chosen is dependent on the characteristics of the problem - that each forecasting technique has advantages and disadvantages as applied to a given problem.

All previous works noted that research was hampered by a lack of data. This is summed up by Blazer, who noted that a lack of sufficient demand data makes is difficult to analyze different forecasting methods (Blazer, 1984:3). He recommends that 10 years of data is sufficient.

The consensus that can be formed from previous research is that the selection of a forecasting method is case specific. There are many characteristics of a forecasting situation that might be considered in selecting an appropriate model. Wilson and Keating suggest the following should be included in making the selection:

1) The type and quantity of data available;
2) The pattern that the data have exhibited in the past;
3) The length of the forecasting horizon;
4) The technical background of the people preparing and using the forecast.

(Wilson and Keating: 1994:418)

The first two factors have been previously discussed. For the purpose of this research study, the forecasting horizon is approximately one year. The seasonality of demand at the pharmacy at the WPMC is expected to repeat on a yearly basis. The technical background of the author is moderate. Based on these factors, the forecasting techniques used in the course of this research study are seasonal multiple regression and the WES. Multiple regression models can be used to forecast future values of a time series with strong seasonal components (McClave and Benson, 1994:828). The WES is chosen because of its consideration of seasonality in the form of an added seasonal component.

Summary

This chapter discusses the forecasting and iventory models applicable to the Wright-Patterson Medical Center. Inventory management, forecasting models, and forecast error measures were discussed. Previous related research was identified and discussed within the context of this study. Having reviewed this material, the remainder of the thesis is devoted to analysis of the data, developing forecasts, obtaining results, and developing conclusions and recommendations for future study.

III. Methodology

Introduction

The purpose of this study is to forecast the demand pattern for pharmaceutical items at the Wright-Patterson Medical Facility. This chapter presents the demand data at the OutPatient Pharmacy (OP) at the WPMC, and its manipulation, used to conduct this study. The data population of over-the-counter subscription items and the specific data sample are described. The study instruments (MEDLOG), data collection plan, research questions, null hypothesis and analysis methods are pursued to accomplish the forecast analysis. Finally, the chapter is summarized.

The previous chapter discussed the role of forecasting and its application. In this chapter, the specific forecasting techniques are accepted or rejected on their usefulness as applied to the purposes of this study.

Research Design

Research design is the plan and structure of investigation so conceived as to obtain answers to research questions (Kerlinger, 1986:279). It is a plan for selecting the sources and types of information used to answer questions, a framework for specifying the relationship among the study's variables, and a blueprint that outlines each procedure from the hypothesis to the analysis of data (Cooper and Emory, 1994:114). The type of research design can be viewed from several perspectives, such as purpose, time dimension, method of data collection, topical scope, and the researcher's control of variables.

The purpose of the study can be described as either descriptive or causal. The descriptive study is concerned with finding out who, what, when, where, or how much. The causal study attempts to explain relationships among variables (Cooper and Emory, 1994:116). The purpose of this study is causal, as it attempts to explain the relationship between demand and specified time periods. Specifically, by identifying and quantifying such a relationship, the demand history can be modeled to produce a forecasting tool for WPMC managers.

The time dimension of a study is either cross-sectional or longitudinal. Cross-sectional studies are carried out once and represent a "snapshot" of one point in time. Longitudinal studies are repeated over an extended period of time and, thus, can track changes over time (Cooper and Emory, 1994:116). This study is cross-sectional as demand data is collected from historical records, and the collection process in not repeated over time.

Data may be collected by applying either a monitoring or interrogative process. The observational study is conducted by a researcher who inspects the activities of a subject or the nature of some material without attempting to elicit responses from anyone (Cooper and Emory, 1994:114). The interrogative study is conducted using some form of survey, in which the researcher gathers data through the questioning of subjects. The questioning may take the form of interviews, questionnaires, or instruments presented before and/or after a treatment or stimulus condition in an experiment (Cooper and Emory, 1994:114). This study is classified as observational, as the author merely gathers data from past events. The interrogative approach is not applicable to this study. Opinions and subjective thoughts are not required for the data analysis.

The topical scope generally applies to the method in which hypotheses are tested - quantitatively or quantitatively. The statistical study attempts to capture a population's characteristics by making inferences from a sample's characteristics. Generalizations about findings are presented based on the representatives of the sample and the validity of the design (Cooper and Emory, 1994:116). Case studies are tested qualitatively, making support or rejection of hypotheses more difficult. This research study is a statistical study and uses quantitative data with which to test hypotheses. No qualitative data concerning demand history is necessary to perform the data analysis used in this study.

The researcher's control of variables is differentiated between experimental and ex post facto designs. With experimental design, the researcher attempts to control and/or manipulate the variables in the study (Cooper and Emory, 1994:115). It is more appropriate when the researcher wishes to analyze whether specified variables produce effects in other variables. The ex post facto design is conducted with no researcher control over the variables. The researcher only reports on the activities of the variables. This research study is an ex post facto study so that no data bias is present.

To summarize the research design of this study: the study is causal, takes a cross-sectional view, relies on observation, is based on statistical or quantitative data, and illustrates an ex post facto design.

<u>Data Population</u> The WPMC Director of Logistics expressed the need to study the demand data for subscription items at the OutPatient Pharmacy. Demand data from the WPMC is used to determine if the data reveals patterns of demand which may be modeled and forecast.

The data population for this study is the demand history for pharmacy items at the WPMC. Demand histories are the monthly demand values for the prescription items of the OP. The histories are available from varying starting dates, but the data used in this study extends back to May 1995. The WPMC facility stocks an inventory of over 1000 over-the-counter pharmacy items. The pharmacy at the WPMC issues approximately 4000 prescriptions each day. Roughly 20% of prescriptions are referrals from civilian doctors, with military prescriptions comprising the remainder (Spilker, 1994).

The WPMC maintains records on demand history dating back over four years, using the MEDLOG supply account computer program. MEDLOG is the United States Air Force program standard in all USAF medical facilities.

Data Sample The data sample used in this study was made available by the staff of OutPatient Pharmacy. The data was obtained by accessing the demand history shown in the MEDLOG computer system.

The demand history for ten items was chosen at random by the author. A demand history of four years is available for items using the MEDLOG system. Those items which had at least one month of zero demand were withdrawn from the sample. For each item that was withdrawn, another prescription item was substituted, leaving the total number at ten.

A second set of subscription items is analyzed. This set consists of items pre-identified by WPMC personnel as exhibiting seasonal demand behavior. A total of twenty pre-identified were chosen, but demand histories were not available for five of the items, so the number analyzed is fifteen.

Instruments The demand history for these items was compiled by accessing a stock status report, compiled by MEDLOG. To access the data for this research, MEDLOG was programmed to retrieve the monthly demand history for the randomly chosen items.

Forecasting Method Selection

The research problem addressed in this work is based on past demand and explained by quantitative methods. To determine the desired forecasting methods, each method is evaluated on its ease of use, ease of interpretation, and reaction to change. Increasing complexity or statistical sophistication does not automatically mean an improvement in forecasting analysis (Wheelwright, 1984:4). For these reasons, the forecasting methods chosen for this study are the simple moving average, simple exponential smoothing, and Winter's Exponential Smoothing.

The simple moving average technique is chosen for its simplicity of use. It is easy to understand and implement. The simple exponential smoothing technique applies the weighting factor inherent to exponential techniques, and is the simplest of the exponential techniques. The use of a trend component and the addition of a seasonal component makes the Winter's Exponential Smoothing model useful for the forecast of this research study.

The Box-Jenkins Model is not chosen due to its complexity. The procedure is difficult to understand and master, and the data must often be transformed to make it suitable for use (Hill, 1988:31). Regression analysis is not used because the assumption of a linear relationship between demand and time may not be appropriate.

The forecasting techniques are evaluated on their accuracy in forecasting actual demand data. To accomplish this, the forecast error measures mean absolute deviation (MAD), mean squared error (MSE), and mean absolute percentage error (MAPE) are used. Because MAPE is a percentage, it is a relative measure, and is thus sometimes preferred to the MAD. The MSE is applied because the error is a squared measure, and it penalizes large errors more heavily. Thus, adopting the criterion of minimizing mean squared error implies that we would rather have several small deviations from the forecast value than on large deviation (Wheelwright and Makridakis, 1985:46).

Research Questions

To assess the adequacy of the WPMC inventory management system in forecasting demand patterns, the following research questions are developed:

Research Question 1: The first research question is: Will a forecasting model applied the inventory management system at the WPMC detect any trends of demand? To answer this question, the following question is developed:

To what degree is autocorrelation present in the demand history?

The answers to this question will quantitatively show the presence, or lack thereof, of seasonality in the demand data of the both the prescription items selected by the staff of the OP and the items selected by the author. In this way it will be shown if either of the selection techniques exhibits any strength over the other in its ability to select seasonal items.

Research Question 2: The second research question is: Which forecasting technique - simple moving average, simple exponential smoothing, Winter's exponential smoothing model - produces the forecast with the least MAD? This question seeks to determine which forecasting method produces the lowest MAD. The answer to this question provides a measure of the variability of the forecast This measure provides an objective function with which to determine the best technique (Tersine, 1982: 37). This measure is expressed in the unit of the original data, and should not be interpreted across series.

Research Question 3: The third research question is: Which forecasting technique - simple moving average, simple exponential smoothing, Winter's exponential smoothing model - produces the forecast with the least MSE? This question seeks to determine which forecasting technique produces the lowest MSE. Because the MSE squares the measurement error, it penalizes those forecasts with high error. Like the MAD, the MSE should not be interpreted across series.

Research Question 4: The fourth research question is: Which forecasting technique - simple moving average, simple exponential smoothing, Winter's exponential smoothing model - produces the forecast with the least MAPE? This question seeks to determine which forecasting technique produces the lowest MAPE. This results of this question are expressed as a percentage, and the results can be interpreted across series. Accordingly, this measure will provide meaningful analysis when examining data from different prescription items.

Research Design

The design of the research can be divided into three phases - data collection, data manipulation, and data analysis. The data collection phase is comprised of two sets of data. The first set is that data which is selected by the staff of the OP at the WPMC. This set contains those items thought to exhibit seasonal demand data by staff personnel. A second set of data is chosen at random by the author. This set of data is chosen so that a comparison may be made with the data selected by the OP staff.

The second phase of the research involves applying the forecasting techniques to the actual demand data. Because data in only available dating back to May 1995, four years of data are used. The first three years of data are used to generate the forecasts used in computing the forecasts for the fourth year. The forecasted values are then compared to the actual data. The forecasts are generated using two statistical forecasting software packages - Gardner's The Spreadsheet Forecast Manager and Statistix 4.0 (student version), which is supplement to the text Statistics for Business and Economics by Benson and McClave. Likewise, these packages are used to compute the MAD and MSE error measures, while the MAPE is computed by the author. Statistix 4.0 is using in the computation of the autocorreleation coefficient.

Data analysis is conducted when the research objectives and questions are addressed in Chapter Five. The data is compared and conclusions are drawn.

Summary

This chapter gives a description of the types of research design. This research design is causal, takes a cross-sectional view, relies on observation, is based on statistical or quantitative data, and illustrates an ex post facto design. The data sample, the data population and the instruments used in data collection are discussed. Forecasting techniques are selected, and the reasons for their selection are given. Similarly, discarded techniques are discussed. The research questions and respective research hypotheses (if applicable) are discussed. The next chapter presents the results and analysis of implementing the research methodology.

IV. Results

Introduction

This chapter presents the data obtained in the conduct of the research. The first section of the chapter presents both those prescription items selected by the staff of the OP at the WPMC, and those chosen randomly by the author. In the following section, the four research questions are addressed and the resultant data is presented.

Discussion of Prescription Items

Staff members of the OP at the WPMC were asked to present a list of twenty prescription drugs which they believed had demand histories which exhibited seasonality. Staff members were not asked to screen their list for prescription items which may have exhibited seasonality in any particular season of the year. Rather, they were asked to pick those items which they felt exhibited any seasonality. Additionally, the staff was not asked to employ any quantitative methods in their respective selections. The selections were based on the individuals' personal experience in working with prescription drugs. Twenty prescription items were selected, of which five had insufficient demand data. The remaining fifteen are presented in Table 3.

Table 3. Prescription Items Selected by OP Staff

Prescription Item	Ref. #	Description
Amantadine	1	Antiviral. Used to prevent or treat certain flu infections. Not to be used for colds.
Lachydrine	2	Antiviral used to relieve symptoms commonly induced by flu infections.
Ana-Kit	3	Used to relieve effects of insect stings.
Beconage AQ	4	Nasal corticosteroids. Sprayed or inhaled into the nose to help relieve the stuffy nose, irritation, and discomfort of hay fever, other allergies, and other nasal problems.
Benzonatate	5	Used to relieve coughs due to colds or the flu. Not to be used with coughs that occur with smoking or asthma.
CTM 8	6	Cough/cold combinations used to relieve the cough due to colds, the flu, or hay fever.
Dimetapp	7	Antihistamine and decongestant combination used to treat the nasal congestion, sneezing and runny nose caused by colds and hay fever.
Diphenhydramine	8	Used to relieve or prevent nausea, vomiting, and dizziness caused by certain medical problems.
Humibid LA	9	Guafenesin used to relieve coughs due to colds or the flu. Loosens the mucus or phlegm in the lungs.
Atarax	10	Antihistamine used to relieve or prevent the symptoms of any of a number of allergies.
Afrin	11	Oxymetazoline used for the temporary relief of nasal congestion or stuffiness caused by hay fever or other allergies, colds, or sinus trouble.
RID	12	Used to treat head, body, and pubic lice infections.
Robitussin DM	13	Cough/cold combinations used to relieve the cough due to colds, the flu, or hay fever.
Sunscreen	14	Used to protect skin from ultraviolet rays of the sun. SPF 15.
Seldane	15	Antihistamine and decongestant combination used to treat the nasal congestion, sneezing and runny nose caused by colds and hay fever.

(Consumers Union, 1995)

Not surprisingly, the majority of the items on the list are associated with cold weather illnesses. It is anticipated that many seasonal prescription items would be prevalent on the list. The weather in the area surrounding Wright-Patterson AFB can be divided in four distinct seasons, with wintertime temperatures averaging 24 degrees Fahrenheit during the month of January. Winter time lows typically reach sub-zero (M. Reymann, 1995).

Ten of the fifteen items are associated with symptoms such as nasal congestion, coughing, flu infections and sneezing. Two of the items are identified with summertime activities - Ana-Kit, an insect sting relief medicine, and sunscreen. Two other items would not appear to show any seasonality, but were so identified by the staff of the OP because of their experience working which such items. Those items are RID, used to relieve lice infections, and Diphenhydramine, used to prevent nausea and vomiting caused by other medical problems.

Ten items were chosen at random by the author and tested for the presence of seasonality. The items where chosen by the author using a random number generator. When the generator led to a selection of items with unusually low demand history (more than one month of zero demand) the item was discarded and another item was selected.

The items selected by the author are presented next. These items were chosen at random with no regard to function and/or any seasonal demand behavior. The items are presented in Table 4.

Table 4. Randomly Chosen Prescription Items

Prescription Item	Ref. #	Description
Acetaminophen	16	Used to relieve pain and reduce fever. May relieve the pain caused by mild forms of arthritis.
Acyclovir	17	Antiviral used to treat infections caused by viruses. Topical acyclovir used to treat the symptoms of herpes simplex virus infections of the skin and genitals.
Amoxicillan	18	Penicillin used to treat infections caused by bacteria.
Estrogens	19	Female hormones prescribed for one of several reasons, including selected cases of breast cancer, to supplement the body's own estrogen production, and help prevent weakening of bones.
Fluocinolone	20	Used to help relieve redness, swelling, itching, and discomfort caused by many skin problems.
Hydrocortisone	21	Used to help relieve redness, swelling, itching, and discomfort caused by many skin problems.
Mylanta II	22	Antacid taken by mouth to relieve heartburn, sour stomach, or acid indigestion. Neutralize stomach acid.
Nystatin	23	Antifungal used to treat some types of fungus infections.
Selenium Sulfide	24	Used on the scalp to help control the symptoms of dandruff and seborrheic dermatitis.
Spironolactone	25	Potassium-sparing diuretic used to help reduce the amount of water in the body. Cause no lose of potassium.

(Consumers Union, 1995)

This list of prescription items is primarily composed of items which would not be generally considered seasonal. Only one of the items, acetaminophen, would normally be considered a seasonal prescription drug, as it is used to reduce fever. The remainder of the items include topical skin medications, antifungals, antiviruses, antacids, and diuretics. It appears as though the random selection produced a list of items without the seasonal characteristics of the list of items picked by the staff of the OP.

Research Question One

The first research question is: Will a forecasting model applied to the inventory management system at the WPMC detect any trends of demand? The following question is developed: To what degree is autocorrelation present in the demand history?

The autocorrelation coefficient was computed for the demand histories of the prescription items used in this research. The following graph presents the degree of autocorrelation for each item chosen by the staff of the OP.

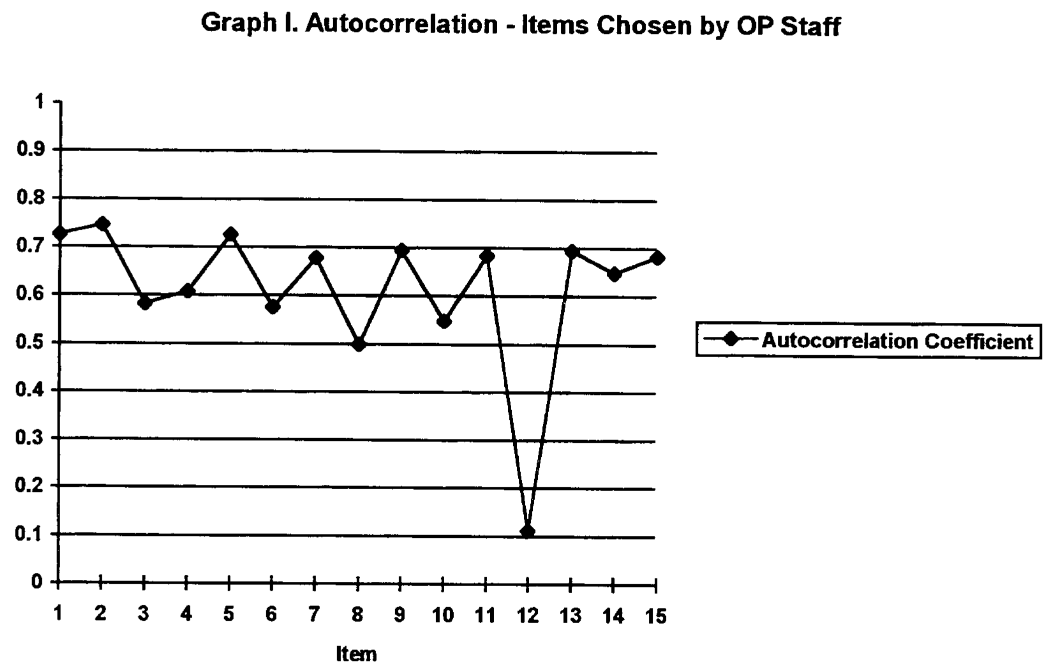

Figure 3. Autocorrelation

Similarly, the following graph shows the autocorrelation coefficients of the set of items chosen randomly.

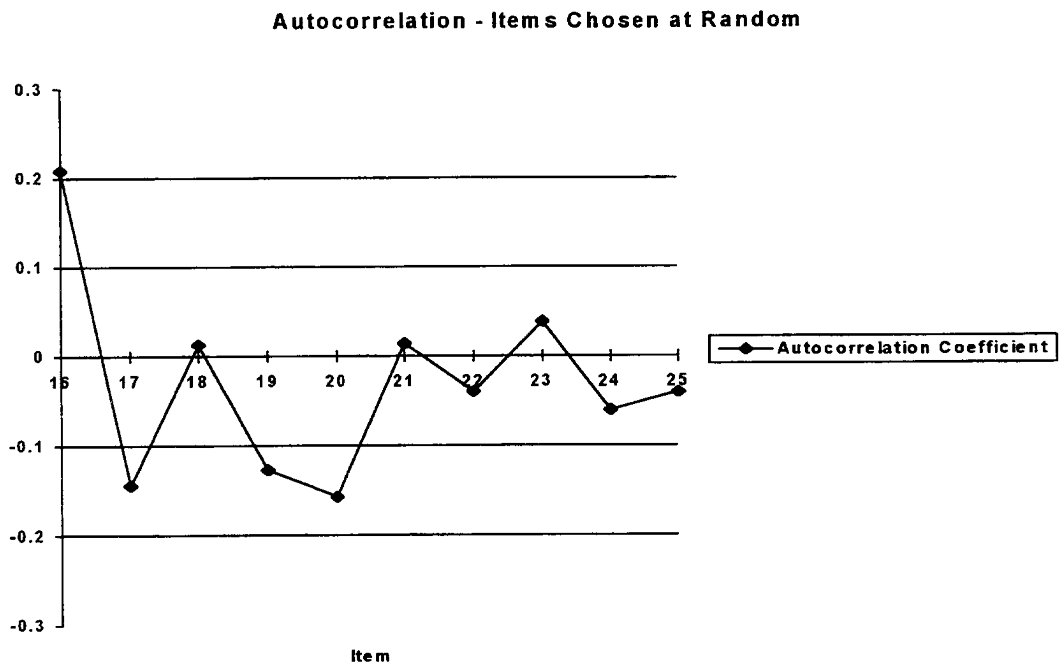

Figure 4. Autocorrelation

Because the items chosen by the OP staff are believed to exhibit seasonal demand behavior, it is expected that the autocorrelation of the these items would be greater than those items randomly chosen. The following table shows the average autocorrelation for each set of items. The values represent absolute values, as the autocorrelation may be both positive and negative, and the effect of the negative and positive values would cancel each other. The closer the value is to one (or negative one), the greater the degree of autocorrelation.

Table 5. Average Autocorrelation

Item Set	Average Autocorrelation
Selected by OP Staff	.614
Randomly Chosen	.084

Research Question Two

The second research question is: Which forecasting technique - 36 month simple moving average, 6 month moving average, simple exponential smoothing, or Winter's exponential smoothing - produces the forecast with the least MAD? This question seeks to determine which forecasting method produces the lowest MAD. The following tables present the MAD for the two sets of prescription items. The MAD for each of these forecasting techniques for those items thought to be seasonal by the staff of the OP is presented in Table 6.

Table 6. Mean Absolute Deviation

Item	Exponential Smoothing (Rank)		Simple Moving Average 1 (Rank)		Simple Moving Average 2 (Rank)		WES (Rank)	
1	4.1	2	4.4	3	4.6	4	.57	1
2	53.7	2	61.2	3	71.3	4	4.3	1
3	5.1	3	4.5	2	5.6	4	1.95	1
4	97.0	3	83.4	2	97.4	4	31.4	1
5	53.2	3	51.6	2	66.4	4	11.2	1
6	61.9	3	60.6	2	68.2	4	24.9	1
7	54.8	2	55.3	3	68.2	4	9.6	1
8	25.4	2	29.2	3	35.3	4	6.8	1
9	67.3	3	61.4	2	80.9	4	8.3	1
10	22.7	2	25.7	4	24.3	3	9.3	1
11	55.5	3	51.0	2	66.6	4	12.3	1
12	6.2	4	4.6	2	4.9	3	4.4	1
13	67.2	3	66.6	2	82.8	4	12.3	1
14	7.1	3	7.0	2	9.2	4	2.9	1
15	128.6	3	115.9	2	132.3	4	43.1	1
Ave. Rank	2.733		2.400		3.867		1.00	

Similarly, the MAD for those items randomly chosen by the author is presented in Table 7.

Table 7. Mean Absolute Deviation, Items Chosen by Author

Item	Exponential Smoothing (Rank)	Simple Moving Average 1 (Rank)	Simple Moving Average 2 (Rank)	WES (Rank)
16	28.7 4	21.8 1	22.8 2	28.5 3
17	14.6 3	15.8 4	14.5 2	12.6 1
18	55.3 4	48.5 3	40.7 1	48.4 2
19	20.5 3	20.6 4	16.2 2	16.1 1
20	8.3 3	7.6 2	7.1 1	8.8 4
21	6.2 2	8.0 3	8.5 4	4.7 1
22	18.1 1	22.4 3	21.6 2	23.2 4
23	8.5 3	7.8 1	7.9 2	9.3 4
24	17.8 2	19.4 3	16.6 1	22.3 4
25	13.9 1	14.6 2	14.8 3	15.7 4
Ave. Rank	2.60	2.60	2.00	2.80

Research Question Three

The third research question is: Which forecasting technique - 36 month simple moving average, 6 month moving average, simple exponential smoothing, or Winter's exponential smoothing - produces the forecast with the least MSE? This question seeks to determine which forecasting technique produces the lowest MSE. The following tables present the MSE for the two sets of prescription items. The MSE for these techniques for those items thought to be seasonal by the staff of the OP is presented in Table 8.

Table 8. Mean Squared Error, Items Chosen by OP Staff

Item	Exponential Smoothing (Rank)		Simple Moving Average 1 (Rank)		Simple Moving Average 2 (Rank)		WES (Rank)	
1	30.2	3	28.5	2	35.5	4	0.54	1
2	4771.0	2	4800	3	6858	4	537.0	1
3	36.2	3	26.4	2	42.4	4	9.8	1
4	14943	4	9981	2	12991	3	1962	1
5	3776.4	3	3564	2	5542	4	209.7	1
6	5780.0	3	5046	2	6562	4	970.1	1
7	4018.1	3	3858	2	5901	4	147.5	1
8	912.1	2	1175	3	1675	4	59.3	1
9	6102.0	3	4827	2	8169	4	114.3	1
10	831.4	2	1086	4	872.1	3	131.3	1
11	4290.8	3	3574	2	5569	4	226.2	1
12	63.2	4	37.2	2	40.2	3	30.1	1
13	5626.6	2	5755	3	8714	4	208.8	1
14	63.5	2	65.9	3	106.9	4	14.9	1
15	25099.8	3	20425	3	25593	4	2981	1
Ave. Rank	2.733		2.467		3.800		1.00	

Similarly, the MSE for those items chosen randomly by the author are presented in Table 9.

Table 9. Mean Squared Error, Items Chosen by Author

Item	Exponential Smoothing (Rank)		Simple Moving Average 1 (Rank)		Simple Moving Average 2 (Rank)		WES (Rank)	
16	1248.0	4	828.8	2	821.0	1	1222	3
17	315.7	2	403.0	4	322.5	3	208.6	1
18	4413.6	4	3484.3	3	2842.4	1	3129	2
19	628.1	4	601.3	3	420.8	2	323.8	1
20	95.1	3	89.1	2	74.2	1	104.1	4
21	69.0	2	100.1	3	124.9	4	45.7	1
22	415.6	1	677.7	3	659.9	2	692.5	4
23	115.3	3	98.6	1	99.2	2	133.9	4
24	553.7	2	561.3	3	460.8	1	703.1	4
25	330.58	3	325.7	2	323.3	1	380.9	4
Ave. Rank	2.80		2.60		1.80		2.80	

Research Question Four

The fourth research question is: Which forecasting technique - 36 month simple moving average, 6 month moving average, simple exponential smoothing, or Winter's exponential smoothing - produces the forecast with the least MAPE? This question seeks to determine which forecasting technique produces the lowest MAPE. The following tables present the MAPE for the two sets of prescription items. The MAPE for each of these forecasting techniques for those items thought to be seasonal by the staff of the OP is presented in

Table 10.

Table 10. MAPE, Items Chosen by OP Staff

Item	Exponential Smoothing (Rank)		Simple Moving Average 1 (Rank)		Simple Moving Average 2 (Rank)		WES (Rank)	
1	40.6	2	41.7	3	43.7	4	5.0	1
2	45.1	2	47.4	3	56.9	4	15.4	1
3	58.7	2	64.8	3	76.7	4	20.0	1
4	18.3	3	16.1	2	18.7	4	5.4	1
5	35.2	3	34.7	2	44.2	4	6.6	1
6	83.3	4	65.1	2	71.6	3	21.4	1
7	47.7	2	49.5	3	58.3	4	6.7	1
8	15.5	2	18.1	3	24.0	4	4.2	1
9	34.5	3	29.4	2	38.8	4	4.0	1
10	14.4	2	18.3	4	15.2	3	5.4	1
11	72.9	3	64.4	2	80.5	4	10.3	1
12	293.9	4	97.2	1	97.7	2	121.7	3
13	44.0	4	41.7	2	52.3	3	6.3	1
14	29.6	2	37.8	3	49.4	4	11.1	1
15	16.7	3	15.7	2	17.7	4	6.0	1
Ave. MAPE	56.6		42.7		49.8		16.23	
Ave. Rank	2.736		2.467		3.667		1.133	

Similarly, the MAPE is shown for those items chosen randomly by the author in Table 11.

Table 11. MAPE, Items Chosen by Author

Item	Exponential Smoothing (Rank)	Simple Moving Average 1 (Rank)	Simple Moving Average 2 (Rank)	WES (Rank)
16	28.6 4	21.4 1	22.2 2	27.2 3
17	13.3 3	13.7 4	12.9 2	11.6 1
18	14.6 4	12.3 2	10.5 1	12.8 3
19	19.1 3	19.2 4	15.6 2	15.5 1
20	31.5 2	32.4 3	28.4 1	43.1 4
21	5.4 1	7.0 3	7.6 4	6.5 2
22	16.7 1	20.9 4	20.1 3	19.4 2
23	18.8 3	17.7 1	17.8 2	22.2 4
24	31.0 4	28.9 2	25.9 1	29.0 3
25	22.0 1	27.8 2	27.9 4	25.2 3
Ave. MAPE	20.1	20.1	18.9	21.3
Ave. Rank	2.60	2.60	2.20	2.60

<u>Summary</u>

This chapter has presented the data gathered in the course of conducting this research. The actual demand data and the associated forecasts are found in the appendixes. The prescription items used to conduct this research were presented. The first set of items were those items which the staff of the OP designated as those which they felt exhibited seasonal demand behavior. The second set of items consists of those items which author selected in a random manner. The remainder of the chapter presented the research questions and the answers to those questions. The data, in this case, the autocorrelation factors and the actual forecasting measurement errors, were presented.

The next chapter ties the research together as it interprets the data obtained in the course of this research. Conclusions are drawn from the result of the research. The author presents implications for the WPMC of this research, and presents an overview of how the research may be implemented in that organization. Lastly, suggestions for further research are given, and the thesis is summarized.

V. Conclusions

Introduction

This chapter presents conclusions drawn as a result of the conduct of the research. Interpretations of the research data are drawn. The research questions and research objectives are assessed in the context of the research accomplished. The implications of this research for the WPMC are presented. In the course of conducting the research, possibilities for further research became evident, and those possibilities are discussed. Lastly, the thesis is summarized.

Summary of Results

Briefly, this study determined that the demand for those prescription items which exhibit seasonality can be forecast more accurately than the simple moving average technique currently employed by MEDLOG. The items determined to be seasonal by the OP staff did exhibit seasonality in nearly all cases, while the items randomly chosen did not. The WES technique proved to be the most accurate method of forecasting for seasonal items, providing significantly more accurate forecasts than the other examined techniques. For those items chosen randomly, the simple moving average technique is the most accurate, though the results show that its accuracy is not significantly better than the other techniques.

Specific Problem

It is the purpose of this study to forecast the demand of seasonal items at the WPMC. An accurate forecasting system can relieve the subjective approach to seasonal predictions and help to anticipate potential stockout conditions brought on by significant variations in demand. A forecasting system may also prevent potential problems brought about by personnel turnover at the OP, and the subsequent loss of expertise and experience. An accurate forecasting model can alleviate the arduous task of determine stock levels for seasonal items and recommend stock levels based on statistically proven methods.

The objective of the MEDLOG used at the Wright-Patterson Medical Center is to provide optimal logistics support. Optimal logistics support provides for both minimum stockout of prescription items and minimum inventory levels. The inventory control procedures outlined in AFM 67-1, Volume V. require a minimum of 95 percent fill-rate on customer demands, while maintaining an economic level of inventory (AFM 67-1: 1-1). While the requirements are being satisfied, staff personnel also believe more optimal logistics support could be achieved with a lower level of inventory (Romeyn, 1994). Specifically, the use of forecasting techniques in determining stockage levels for seasonal demand items may reduce the required inventory while reducing stockout conditions.

When statistical forecasting techniques are applied to the demand data, it will be found that some of the techniques perform better than others. Those techniques which yield the lowest forecasting error measures can then be applied to the demand in order to better anticipate required inventory. In this way inventory levels can be altered to both reduce stockout conditions and required inventory levels.

Research Objectives

The following areas are addressed to determine if statistical forecasting techniques for prescription seasonal demand items (what items to treat as seasonable and how many of those items to stock) can be developed for the WPMC. The result of these objectives will determine if statistical forecasting techniques can be used to increase the accuracy of the OP in determining inventory levels for seasonal demand prescription items. To assess the adequacy of the WPMC inventory management system in addressing seasonal trends, the following research questions are developed:

1. To determine if the items, as identified as exhibiting seasonal trends by the staff of OP, actually display seasonality. The use of the autocorrelation coefficient with a lag of 12 time periods is used to show the degree to which

the data tends to move in the same direction over specified time periods. Autocorrelation occurs where one observation tends to be correlated with the next. The autocorrelation coefficient is calculated for all prescription items, and the results are reviewed for respective significance.

2. To determine if a forecasting model applied the inventory management system at the WPMC will detect the seasonality of demand. To accomplish this objective, it is determined whether those forecasting techniques which incorporate a seasonal component outperform those which do not, in terms of forecasting error measures.

3. To determine which forecasting techniques tested produce the forecast with the least forecast error. The research design is established so that each prescription item analyzed in this study is subjected to the forecasting techniques used in this study. The resultant error measures are then calculated.

Research Questions

The first research question is: To what degree is autocorrelation present in the demand history? The degree of autocorrelation in the demand patterns of the prescription items tested shows to what degree the data coincides with demand data for the same items separated by twelve month intervals.

The autocorrelation coefficient for those items chosen by the OP staff yielded in an average autocorrelation coefficient of 0.614. When the prescription item RID is eliminated, the average of the fourteen remaining items increases to 0.650. The autocorrelation coefficient of RID, which is used to treat head, body, and pubic lice infections, was 0.111 (Consumers Union, 1995:1417). Only one other item chosen by the OP staff, Diphenhydramine, which is used to relieve or prevent nausea and vomiting, yielded an autocorrelation coefficient of less than 0.5 (Consumers Union, 1995:723). These results indicate that those items thought to exhibit seasonal demand patterns by the OP staff did actually show seasonality.

Three items yielded coefficients greater than 0.7. These items are shown in Table 12.

Table 12. Items with High Autocorrelation Coefficients

Prescription Item	Autocorrelation Coefficient
Amantadine	0.726
Lachydrine	0.747
Benzonatate	0.727

These items are all used to treat symptoms associated with flu infections. The strong degree of autocorrelation indicates that cold weather illnesses may hold the most promise for the use of seasonal forecasting techniques.

All autocorrelation coefficients for the items chosen by the OP staff yielded positive coefficients. This indicates that the demand for these items is directly related to the demand for the same item in the same season of previous years. Put another way, when the demand for one of these items increases/decreases during one period, the same period twelve months separated will show an increase/decrease as well. The demand for these items follow similar seasonal cycles.

The autocorrelation coefficient for those items chosen at random by the author yielded an absolute average coefficient of .084. A coefficient of zero would indicate the absence of any correlation. The values for the items chosen randomly ranges from -0.16 to 0.2. The negative values indicate that the demand for that item compared with the same period at twelve month intervals tends to be inversely related.

The item with the most positive autocorrelation was Acetaminophen, which is used to reduce pain associated with fever or arthritis (Consumers Union, 1995:161). This high degree of autocorrelation (relative to the other items in this set) may be related to this drugs use for pains associated with a fever. The most negatively autocorrelated item is Fluocinolone. This drug is used to relieve redness, swelling, itching, and discomfort caused by skin problems (Consumers Union, 1995:624). This result indicates that the demand for this item exhibits a demand pattern which is slightly inverse with respect to the same month of different years. Because this items is used to treat a condition which is broadly defined only as "skin problems" and not associated with any particular time of the year, this result is expected.

The reader is reminded that the items chosen randomly contained only one item, Acetaminophen, which is associated with seasonal (in this case, cold weather) illnesses. The remainder of the items included topical skin medications, antifungals, antiviruses, antacids, and a diuretic. The low autocorrelation coefficients associated with this group of items is an indication that the random selection method was effective in selecting items which do not exhibit seasonal demand patterns.

The results obtained in answering research question one lead the author to conclude that the expertise and experience of the staff of the OP allowed those individuals to accurately select those items which exhibit seasonal demand behavior. Accordingly, the skill of such individuals should be utilized when applying forecasting techniques to prescription item demand data. It is concluded that it is possible to subjectively select seasonal items. Further, selected items prescribed in association with traditionally seasonal illnesses, such as the flu or the fever, show strong seasonality of demand, while items not typically associated with traditionally seasonal illnesses, such as topical skin medications, do not. Thus it appears that the autocorrelation coefficient is an accurate determinant of seasonality.

The second research question is: Which forecasting technique produces the forecast with the least Mean Absolute Deviation? The MAD is a measure between the mean absolute difference between the forecast and the original value. It is most useful when analyst want to measure the forecast error in the same units (as oppose to percentages, for example) as the original series (Hanke, 1992:113).

The WES forecasting technique yielded the lowest MAD for those items chosen by the OP staff. Not only did the WES produce the lowest MAD in every case, but the MAD for the fifteen items yielded by the WES is, on average, only 22% of the respective MAD's of the second ranked forecasting technique. The three items with the greatest differential are shown below in Table 13. The MAD is expressed as a percentage of the second-ranked forecasting technique.

Table 13. MAD Differentials, Items Chosen by OP Staff

Item	MAD Differential
Amantadine	13.5
Lachydrine	8.0
Humibid LA	13.7

The first two items are antivirals used to treat symptoms related to flu infections, while the third item is used to relieve coughs due to colds or the flu (Consumers Union, 1995). Not surprisingly, the item with the lowest MAD differential is RID, at 83%, which also exhibited the least degree of autocorrelation.

The remainder of the items' MAD expressed as in the table range from 20%-83%. Clearly, in terms of MAD, the WES forecasting technique for these fifteen seasonal items is superior to other techniques. The technique employed by MEDLOG, the 12 month moving average, yielded an average ranking of 2.4, which placed this method as the second most optimal. Close behind is the exponential smoothing technique, at 2.733. Solidly in last place with an average ranking of 3.867 is the 6 month moving average. Because the pattern of seasonality for these items follows a twelve month cycle, this result is not surprising. It would be expected that the 12 month moving average for items which follow a 12 month cycle would be superior to the 6 month, which is not in phase with the seasonality. This is the case here.

No forecasting technique was clearly superior with regards to the prescription items chosen by the author. The average rank for each of these items is presented below in Table 14.

Table 14. Average MAD Rank, Items Chosen by Author

Technique	Average Rank
Exponential Smoothing	2.60
Simple Moving Average - 12 Month	2.60
Simple Moving Average - 6 Month	2.00
Winter's Exponential Smoothing	2.80

While the autocorrelation coefficient for these items is low when a 12 month lag is used, it is interesting to note that the autocorrelation coefficient with a one month lag is relatively high, at 0.498. This accounts for the relative accuracy of the 6 month moving average. While these items do not show seasonality, the demand is closely correlated with the demand in successive months. Because the six month moving average uses the shortest time horizon of the techniques in computing forecasts, we would expect that it would produce the least average MAD, as is the case. The relative poor showing by the WES indicates that this method may not perform well when seasonality is not present.

The third research question is: Which forecasting technique produces the forecast with the least Mean Squared Error (MSE)? The MSE squares the forecast error, and thus penalizes those forecasts with larger errors. It is expected that those items with greater demand would yield the highest MSE.

The average rank for each forecasting technique for the items chosen by the OP staff is shown in Table 15.

Table 15. Average MSE Rank, Items Chosen by OP Staff

Technique	Average Rank
Exponential Smoothing	2.733
Simple Moving Average - 12 Month	2.467
Simple Moving Average - 6 Month	3.80
Winter's Exponential Smoothing	1.00

The WES is clearly the most accurate technique in terms of MSE rank. The MSE produced by the WES in on average only 7.0% of the second lowest MSE in each respective case. Because the MSE produces large errors for items with high demand, the MSE differential for such items is large. For example, items 7-9 all average a monthly demand of over 100, and their respective MSE differential between the second-ranked technique and the first-ranked technique (expressed as a percentage) is 3.8, 6.4, and 2.4. The item with the greatest differential is item 1, Amantadine, which also has one of the strongest autocorrelation coefficients, at 0.726. The differential for this item is 1.9%. Though Amantadine is a relatively low use item (with an average monthly demand of 11.4), its strong autocorrelation leads to a very low MSE (relative to the other techniques) when using WES. The MSE differential of the five items with the greatest autocorrelation are shown in Table 16.

Table 16. MSE Differential - Strong Autocorrelation

Item	MSE Differential (%)
Amantadine	1.9
Lachydrine	11.2
Benzonatate	5.9
Robitussin DM	3.7
Humibid LA	2.4
Average	5.0

Similarly, the five items with the weakest autocorrelation are shown in Table 17.

Table 17. MSE Differential - Weak Autocorrelation

Item	MSE Differential (%)
RID	80.9
Diphenhydramine	6.4
Atarax	15.7
CTM 8	19.4
Ana-Kit	37.7
Average	32.0

These results indicate that the WES performs more accurately in terms of MSE when there is evidence of strong autocorrelation, or seasonality.

The 6 month simple moving average again yielded the lowest rank. This was to be expected, as the technique turned in a similar performance when the MAD was computed.

A similar pattern is seen with the items chosen by the author. The 6 month simple moving average again yields the most accurate results, while the remaining techniques all post nearly equal results. The average ranks are shown in Table 18.

Table 18. Average MSE Rank, Items Chosen by Author

Technique	Average Rank
Exponential Smoothing	2.80
Simple Moving Average - 12 Month	2.60
Simple Moving Average - 6 Month	1.80
Winter's Exponential Smoothing	2.80

Though the 6 month simple moving average yields the highest average rank, the associated absolute autocorrelation coefficient with a six month lag is a weak 0.133. In this case, the rank does not appear to be an accurate measure. Indeed, while the 6 month simple moving average ranks well with this measure, when examining the actual values of the MSE compared to those of the set of items selected by the OP staff, it is seen that no technique clearly stands out as the most accurate. The average MSE differential for these items is 80.4%, compared to 7.0% for the items selected by the OP staff. The illustrates that the use of rank is a relative measure, and is not to be solely relied on as a measure of a technique's accuracy.

Research question four is: Which forecasting technique produces the forecast with the least Mean Absolute Percentage Error (MAPE)? The MAPE compares the error in terms of percentages. The MAPE provides an indication of how large the forecast errors are in comparison to the actual forecast values (Dusseault, 1994:3-7).

The average MAPE rank for the forecasting techniques tested on the items chosen by the OP staff are shown in Table 19.

Table 19. Average Rank / MAPE, Items Chosen by OP Staff

Technique	Average Rank / MAPE
Exponential Smoothing	2.74 / 56.6
Simple Moving Average - 12 Month	2.47 / 42.7
Simple Moving Average - 6 Month	3.67 / 49.8
Winter's Exponential Smoothing	1.13 / 16.2

With the exception of item 12 (RID), WES yielded the lowest MAPE for each prescription item. Excluding RID, the average MAPE is 8.7%, meaning that the average forecast error using

WES deviates by only 8.7% from the actual value. The reader will remember that RID has weak autocorrelation and does not exhibit seasonal demand behavior. These results show the superiority of WES when used to forecast items with seasonal demand patterns. As expected, the 12 month moving average performs better than the 6 month, as the seasonality of demand for these items follows a twelve month cycle, and the 12 month moving average is more synchronized with this natural cycle.

Ten items yielded a MAPE of below 10%. The average autocorrelation coefficient of those items is 0.647. As comparison, the remainder of the items (excluding RID) have an average autocorrelation coefficient of 0.647 also. If RID is included, the average coefficient falls to 0.540.

The average MAPE rank for the forecasting techniques tested on the items chosen at random are shown in Table 20.

Table 20. Average Rank / MAPE, Items Chosen at Random

Technique	Average Rank / MAPE
Exponential Smoothing	2.60 / 20.1
Simple Moving Average - 12 Month	2.60 / 20.1
Simple Moving Average - 6 Month	2.20 / 18.9
Winter's Exponential Smoothing	2.60 / 21.3

As can be seen in the table, the results for each of the forecasting techniques are very similar. No technique is clearly more accurate than any other. When the results are analyzed in relation to each item's autocorrelation coefficient, no matching patterns or trends are found. Those items with relative strong autocorrelation are not more accurately forecast by any particular technique, and the same holds for those items with relatively weak autocorrelation. The six month moving average does perform slightly better, and this may be explained by the six month absolute autocorrelation coefficient of 0.133, which is stronger than the 0.050 for the absolute autocorrelation with a 12 month lag. Still, both coefficients show weak autocorrelation.

As a group, the average MAPE for these techniques with the randomly chosen items is 20.1, compared to an average MAPE of 41.3 for the items chosen by the OP staff. This result shows the weakness of applying forecasting techniques which do not incorporate seasonal considerations to seasonal demand items. Likewise, where no seasonality of demand exists, those forecasting techniques which do not allow for seasonal changes do not fare appreciably better or worse than those that do.

The results obtained in answering research questions two, three, and four lead the author to conclude that the WES is superior to exponential smoothing, the twelve month moving average, and the six month moving average. Additionally, the stronger the evidence of seasonality, the more advantageous is the WES, in terms on forecasting error measures. For those items which do not exhibit seasonality, the six month moving average provides forecast with the least error measures, though its advantages are not as pronounced as the WES for items with strong seasonality. For items which show weak evidence of seasonality, the six month moving average is recommended. Such items show relatively strong autocorrelation when the time lag is reduced to one period, indicating that the data for such items is more closely correlated with immediate time periods.

The WES and six month moving average are not recommended for, respectively, items which show weak and strong autocorrelation. Though these techniques show promise when used with, respectively, strongly and weakly autocorrelated demand items, their use with the demand data of items which do not exhibit the proper seasonality yields results which are easily bested by other techniques.

Managerial Implications

This research has shown that statistical forecasting techniques can be used to increase the accuracy of inventory forecasting at the WPMC. The challenge remains to take the findings of this study and implement them in a working environment. The following discussion suggests a way in which the findings of this study may be incorporated in the OP at the WPMC.

Ease of use is an important consideration for any such implementation. The forecasting techniques analyzed in this research were selected, among other reasons, for their relative simplicity. In order to apply any technique to an operating environment, it must be understood.

Before implementing any forecasting techniques, affected personnel must first determine which items they consider to be seasonal. As was found in this study, the personnel of the OP staff relied on personal experience to very accurately identified those items which exhibited seasonal demand behavior. Their experience in working with the items mitigated the need for any quantitative analysis. Such a list would make an excellent starting point. Once the list is generated, the prescriptions can be tested to determine whether they make good seasonal candidates.

The first step to take is to graph the demand data for the applicable prescription items. Does the demand graph appear to repeat itself from one season to the next? Is one season's demand significantly greater or less than another season's? Answers of "yes" to questions such as these provide further evidence that the items may experience seasonal demand.

In chapter two, Peckham provided three criteria for manually determining is seasonal trends exist. The criteria are repeated below:

1) The peak demand should be substantially higher than the random fluctuations or "noise" in the demand;
2) The peak demand must occur during the same time period each year;

3) The reason for the peak must be known.
(Peterson and Silver, 1979:40)

Lastly, the autocorrelation coefficient can be calculated. The computation of this factor is a relatively simple process with the aid a statistical forecasting package, such as Statistix 4.0, which was used by the author.

After a collection of items thought to be seasonal is assembled, the forecasting technique is applied. The use of a spreadsheet forecasting program, such as Gardner's The Spreadsheet Forecast Manager, (used by the author in conducting this research), is a simple and convenient way to apply forecasting techniques. Historical data is loaded, and the spreadsheet generates forecasts based on the input data. The program used by the author also generates trend and seasonal weighted factors which result in the lowest MSE. Using this program, the user can determine which weighted factors produce the best results for each specific prescription item.

With the resultant forecasted demand data, inventory levels can be set. The results obtained using the WES with seasonal prescription items suggest that inventory level reductions and reduced stockouts may be achieved. For example, the twelve month moving average, the technique utilized by MEDLOG, yielded an average MAPE for those items thought to be seasonal of 42.7%. For the same items, the WES yielded an average of 16.2%. In other words, for this measure, the WES yielded a forecast which deviated from the actual only 38% as much as the moving average. This increased accuracy would allow OP managers to maintain lesser inventory levels and reduce the possibility of stockouts. On a monthly basis, the results of the forecasts can be compared to the actual demand data. Adjustments may be made as necessary.

Suggestions for Further Research

In the course of conducting this research, possible topics for further research in this topic area have come to light. Those suggestions are listed below.

1. The use of the Winter's Exponential Smoothing (WES) forecasting technique in an outpatient pharmacy setting would provide data to support or contradict the findings of this research. The WES could be applied to seasonal prescription items to forecast demand over a specified time period. The seasonal items would be obtained by utilizing the experience

and expertise of the OP personnel. Quantitative techniques, such as the use of the autocorrelation coefficient, would then be applied to eliminate those items which are not found to be seasonal. Following the completion of the specific time period, the forecasted results could be compared to the actual results.

Rather than forecast for a time period which has already occurred, as was done in this study, the forecast would be for a future time period. A more detailed examination of the factors which affect the demand levels for the specified items would be provided to explain the deviation of the forecasted data versus the actual data. Such factors to examine would include physician turnover, weather patterns, and customer population shifts.

2. The economic impact on inventory management of the use of forecasting techniques in a hospital setting provides the opportunity to show the advantages or disadvantages of such techniques. The actual inventory costs would be obtained and compared with the expected costs which occur as a result of applying a statistical forecasting technique. Costs to examine would include those discussed in chapter two -

order/setup costs, holding costs, setup costs, and purchase costs.

3. This study tested four forecasting techniques. Other techniques were not examined for reasons of complexity, the lack of user friendliness, and perceived inaccuracy. A study of the more complex models may provide a useful tool for determining the optimal technique to use in various inventory environments. Such techniques to examine would include the Box-Jenkins, ARIMA, and multiple regression.

Summary

This study was initiated because the WPMC Director of Logistics, Lt Col William Romeyn, believed that it may prove beneficial to examine the use of statistical forecasting techniques in conjunction with seasonal prescription items at the WPMC OP. Essentially, this study was conducted to determine if statistical forecasting techniques applied to the demand data of prescription items at the WPMC OP could yield forecasts which produced lower forecasting measurement errors than the technique currently in use. The system currently in use employs the twelve month moving average to forecast demand data.

To provide the reader with the necessary background to understand the concepts and background into the problem, the author provided a review of the basic concepts associated with both inventory management and forecasting techniques. Time series forecasts, which essentially predict the future from past events, were explored.

The research was conducted by first asking the members of the OP staff to select those items which they felt exhibited seasonal demand characteristics. In order to determine if these items produced meaningful results, a group of prescription items was selected at random by the author. The autocorrelation coefficients for each of these items was calculated. Next, four forecasting techniques was applied to the data - the Winter's Exponential Smoothing model, simple exponential smoothing, the twelve month moving average, and the six month moving average. Forecasting error measures were determined for each of these techniques. Lastly, the results were compared and analyzed.

This study has determined that the demand for those prescription items which exhibit seasonality can be forecast more accurately than the simple moving average technique currently employed by MEDLOG. The items determined to be seasonal by the OP staff were found to exhibit seasonal behavior using quantitative analysis methods. Additionally, those items chosen randomly did not show seasonal behavior. The WES technique was shown to be the most accurate method of forecasting for seasonal items, providing significantly more accurate forecasts than the other examined techniques. For those items chosen randomly, the simple moving average technique is the most accurate, though the results show that its accuracy is not significantly better than the other techniques. These results indicate that the WES is the best choice of forecasting methods for those items which exhibit seasonality, while the simple moving average technique is marginally better to use for those items which do not exhibit seasonality.

Appendix A: Autocorrelation - Items 1-15

AUTOCORRELATION PLOT FOR X

```
            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
   1   0.409                    >      *******>***
   2   0.137                   >       ****    <
   3  -0.176                   >   *****       <
   4  -0.405                 **<********       <
   5  -0.250                  >  *******        <
   6  -0.196                 >    ******         <
   7  -0.161                 >     *****         <
   8  -0.306                 > *********         <
   9  -0.097                 >       ***         <
  10   0.053                >          **         <
  11   0.299                >          ********   <
  12   0.682                >          ***********>******

MEAN OF THE SERIES     774.979
STD. DEV. OF SERIES    137.620
NUMBER OF CASES             48
```

STATISTIX 4.0 FOURTEEN, 06/20/95, 13:12

AUTOCORRELATION PLOT FOR X

```
            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
   1   0.735                    >      *******>***********
   2   0.333                 >         ********* <
   3  -0.094                >        ***          <
   4  -0.432                <***********          <
   5  -0.620            ***<************           <
   6  -0.632           ***<*************            <
   7  -0.534            > **************              <
   8  -0.314           >       *********               <
   9   0.013           >               *               <
  10   0.339           >               *********       <
  11   0.587           >               ****************<
  12   0.648          >                *****************<

MEAN OF THE SERIES     25.1250
STD. DEV. OF SERIES    7.84916
NUMBER OF CASES             48
```

STATISTIX 4.0 THIRTEEN, 06/20/95, 13:12

AUTOCORRELATION PLOT FOR X

```
            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
   1   0.830                    >      *******>**************
   2   0.473                >          ***********>*
   3   0.026               >           **          <
   4  -0.369               >  **********           <
   5  -0.633           ****<************           <
   6  -0.727         ****<**************             <
   7  -0.661          *<****************               <
   8  -0.440          >     ************                <
   9  -0.097         >               ***                 <
  10   0.268         >                 ********          <
  11   0.564         >                 ***************   <
  12   0.694        >                  ****************** <

MEAN OF THE SERIES     198.104
STD. DEV. OF SERIES    74.4306
NUMBER OF CASES             48
```

AUTOCORRELATION PLOT FOR X

```
              -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.   +----+----+----+----+----+----+----+----+----+----+
   1   0.100                       >       ***    <
   2   0.095                       >       ***    <
   3   0.160                       >       *****  <
   4  -0.155                       >   *****      <
   5  -0.200                      >   ******       <
   6  -0.194                      >   ******       <
   7  -0.208                      >   ******       <
   8  -0.083                      >      ***       <
   9   0.034                      >        **      <
  10   0.117                      >        ****    <
  11   0.329                      >        ********<
  12   0.111                     >         ****     <

MEAN OF THE SERIES      4.75000
STD. DEV. OF SERIES     5.33658
NUMBER OF CASES              48
```

STATISTIX 4.0 ELEVEN, 06/20/95, 13:11

AUTOCORRELATION PLOT FOR X

```
           -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
  1   0.723                    >      *******>***********
  2   0.335                 >         ********* <
  3   0.009                >          *          <
  4  -0.324                >  *********          <
  5  -0.450                <***********          <
  6  -0.467               >************           <
  7  -0.535              <*************            <
  8  -0.469             > *************             <
  9  -0.191            >         ******              <
 10   0.106            >              ****           <
 11   0.457            >              ************   <
 12   0.684           >               ****************>*
```

MEAN OF THE SERIES 123.791
STD. DEV. OF SERIES 62.0614
NUMBER OF CASES 48

STATISTIX 4.0 TEN, 06/20/95, 13:11

AUTOCORRELATION PLOT FOR X

```
            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
   1   0.306                   >      *******>*
   2   0.040                  >       **      <
   3  -0.122                  >    ****       <
   4  -0.177                  >   *****       <
   5   0.181                  >       ******  <
   6   0.288                  >       ********<
   7   0.184                 >        ******   <
   8  -0.240                 >  *******        <
   9  -0.187                 >   ******        <
  10  -0.117                 >     ****        <
  11   0.136                 >        ****     <
  12   0.549                >         **********>****

MEAN OF THE SERIES      162.666
STD. DEV. OF SERIES     30.9309
NUMBER OF CASES              48
```

```
STATISTIX 4.0                                                   NINE, 06/20/95, 13:10

AUTOCORRELATION PLOT FOR X

            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
  1    0.765                    >      *******>************
  2    0.436                 >         **********>*
  3    0.049                >          **         <
  4   -0.294                >   ********          <
  5   -0.492               <************           <
  6   -0.590            **<*************            <
  7   -0.539             >**************             <
  8   -0.402            >    ***********              <
  9   -0.095           >             ***               <
 10    0.218           >               ******          <
 11    0.531           >               **************  <
 12    0.694          >                *****************>

MEAN OF THE SERIES     227.895
STD. DEV. OF SERIES    74.0270
NUMBER OF CASES             48
```

STATISTIX 4.0 EIGHT, 06/20/95, 13:09

AUTOCORRELATION PLOT FOR X

```
            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
   1   0.633                    >      *******>*********
   2   0.476                  >        *********>***
   3   0.094                >          ***        <
   4  -0.278                >   ********          <
   5  -0.441                <***********          <
   6  -0.634           ****<************           <
   7  -0.443              > ************            <
   8  -0.344             >    **********             <
   9  -0.030            >             **              <
  10   0.221            >              *******        <
  11   0.303            >              *********      <
  12   0.499            >              *************  <

MEAN OF THE SERIES     155.541
STD. DEV. OF SERIES    33.0970
NUMBER OF CASES             48
```

AUTOCORRELATION PLOT FOR X

```
            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
   1   0.796                    >      *******>*************
   2   0.488                >          ***********>*
   3   0.069               >           ***         <
   4  -0.314               >  *********            <
   5  -0.574            **<************            <
   6  -0.727        *****<*************             <
   7  -0.641          *<***************              <
   8  -0.419          >     ***********                <
   9  -0.102          >            ****                <
  10   0.281          >                ********        <
  11   0.533          >                **************  <
  12   0.678         >                 *****************<
```

```
MEAN OF THE SERIES      147.583
STD. DEV. OF SERIES     61.5399
NUMBER OF CASES              48
```

```
STATISTIX 4.0                                               SIX, 06/20/95, 13:09

AUTOCORRELATION PLOT FOR X

            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
   1   0.782                    >      *******>*************
   2   0.428                >          ***********>
   3   0.041                >          **         <
   4  -0.248                >    *******          <
   5  -0.449               >************           <
   6  -0.601            ***<************           <
   7  -0.580             <**************             <
   8  -0.413            >    ***********              <
   9  -0.122           >            ****               <
  10   0.219           >               ******          <
  11   0.460           >               ************    <
  12   0.577           >               *************** <

MEAN OF THE SERIES      140.708
STD. DEV. OF SERIES     66.6445
NUMBER OF CASES              48
```

STATISTIX 4.0

FIVE, 06/20/95, 13:07

AUTOCORRELATION PLOT FOR X

```
             -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
LAG   CORR.   +----+----+----+----+----+----+----+----+----+----+
  1   0.838                     >      *******>**************
  2   0.491                 >          ***********>*
  3   0.086                >           ***         <
  4  -0.310                >   *********           <
  5  -0.591             ***<************           <
  6  -0.689           ***<**************             <
  7  -0.611             >***************              <
  8  -0.360           >       **********                <
  9   0.010           >                *                <
 10   0.376           >                **********       <
 11   0.640           >                *****************<
 12   0.727         >                  *******************<
```

```
MEAN OF THE SERIES       170.166
STD. DEV. OF SERIES      59.5099
NUMBER OF CASES               48
```

```
STATISTIX 4.0                                        FOUR, 06/20/95, 13:06

AUTOCORRELATION PLOT FOR X

              -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
LAG    CORR.    +----+----+----+----+----+----+----+----+----+----+
  1    0.471                      >      *******>*****
  2    0.145                    >        *****    <
  3   -0.140                    >     ****        <
  4   -0.205                    >   ******        <
  5   -0.133                    >     ****        <
  6   -0.138                    >     ****        <
  7   -0.116                    >     ****        <
  8   -0.275                    > ********        <
  9   -0.227                   >   *******         <
 10   -0.075                   >       ***         <
 11    0.241                   >         *******   <
 12    0.608                   >         **********>*****

MEAN OF THE SERIES      565.895
STD. DEV. OF SERIES     105.576
NUMBER OF CASES              48
```

AUTOCORRELATION PLOT FOR X

```
            -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
 LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
   1   0.610                    >      *******>********
   2   0.185                  >        ******   <
   3  -0.111                 >      ****         <
   4  -0.327                 > *********         <
   5  -0.452                *<**********         <
   6  -0.500              **<***********          <
   7  -0.347               >  **********           <
   8  -0.185              >       ******            <
   9  -0.037              >           **            <
  10   0.262              >            ********     <
  11   0.506              >            *************<
  12   0.583             >             **************>*
```

MEAN OF THE SERIES 11.3125
STD. DEV. OF SERIES 5.11597
NUMBER OF CASES 48

STATISTIX 4.0

AUTOCORRELATION PLOT FOR X

```
           -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
LAG   CORR.  +----+----+----+----+----+----+----+----+----+----+
  1   0.739                    >      *******>***********
  2   0.401                 >         **********<
  3   0.028                >          **         <
  4  -0.267                >   ********          <
  5  -0.462               *<***********          <
  6  -0.558             **<************           <
  7  -0.518              >*************            <
  8  -0.369             >    **********             <
  9  -0.094            >            ***              <
 10   0.234            >              *******        <
 11   0.545            >              ***************<
 12   0.747           >               ****************>***

MEAN OF THE SERIES       171.750
STD. DEV. OF SERIES      67.5929
NUMBER OF CASES               48
```

AUTOCORRELATION PLOT FOR X

```
             -1.0 -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8  1.0
LAG   CORR.   +----+----+----+----+----+----+----+----+----+----+
  1   0.638                     >      *******>*********
  2   0.091                  >         ***       <
  3  -0.157                  >     *****         <
  4  -0.215                  >    ******         <
  5  -0.300                  > *********         <
  6  -0.343                  >**********         <
  7  -0.278                 >   ********          <
  8  -0.257                 >    *******          <
  9  -0.251                >     *******           <
 10  -0.018                >           *           <
 11   0.438                >           ************<
 12   0.726               >            *************>*****
```

```
MEAN OF THE SERIES       15.0000
STD. DEV. OF SERIES      5.03322
NUMBER OF CASES               48
```

Appendix B: Simple Exponential Smoothing - Items 1-15

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

\R	Reset wor
\L	Load data
\E	Extract d
\G	Run
\F	Graph for
\Z	Graph err
\M	Compute M

Title1: AMANTADINE
Title2:
X-axis: Month
Y-axis: Demand

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1
1 = Average of warm-up data	
2 = First data value	

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			AMANTADINE				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	7		15.08	-8.08	#N/A
	6	2	8		12.66	-4.66	#N/A
	7	3	10		11.26	-1.26	#N/A
	8	4	11		10.88	0.12	#N/A
	9	5	15		10.92	4.08	#N/A
	10	6	19		12.14	6.86	#N/A
	11	7	18		14.20	3.80	#N/A
	12	8	16		15.34	0.66	#N/A
1992	1	9	16		15.54	0.46	#N/A
	2	10	17		15.68	1.32	#N/A
	3	11	18		16.07	1.93	#N/A
	4	12	16		16.65	-0.65	#N/A
	5	13	8		16.46	-8.46	#N/A
	6	14	4		13.92	-9.92	#N/A
	7	15	9		10.94	-1.94	#N/A
	8	16	15		10.36	4.64	#N/A
	9	17	14		11.75	2.25	#N/A
	10	18	17		12.43	4.57	#N/A
	11	19	20		13.80	6.20	#N/A

	12	20	15	15.66	-0.66	#N/A
1993	1	21	14	15.46	-1.46	#N/A
	2	22	19	15.02	3.98	#N/A
	3	23	22	16.22	5.78	#N/A
	4	24	20	17.95	2.05	#N/A
	5	25	8	18.57	-10.57	#N/A
	6	26	6	15.40	-9.40	#N/A
	7	27	8	12.58	-4.58	#N/A
	8	28	13	11.20	1.80	#N/A
	9	29	15	11.74	3.26	#N/A
	10	30	18	12.72	5.28	#N/A
	11	31	23	14.30	8.70	#N/A
	12	32	21	16.91	4.09	#N/A
1994	1	33	17	18.14	-1.14	#N/A
	2	34	20	17.80	2.20	#N/A
	3	35	25	18.46	6.54	#N/A
	4	36	21	20.42	0.58	#N/A
	5	37	9	20.59	-11.59	#N/A
	6	38	6	17.12	-11.12	#N/A
	7	39	9	13.78	-4.78	#N/A
	8	40	14	12.35	1.65	#N/A
	9	41	14	12.84	1.16	#N/A
	10	42	17	13.19	3.81	#N/A
	11	43	21	14.33	6.67	#N/A
	12	44	17	16.33	0.67	#N/A
1995	1	45	15	16.53	-1.53	#N/A
	2	46	18	16.07	1.93	#N/A
	3	47	20	16.65	3.35	#N/A
	4	48	17	17.66	-0.66	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

SMOOTH	Simple exponential smoothing Annual, quarterly, or monthly data Minimum of 2 data		\R	Reset wor
			\L	Load data
			\E	Extract d
			\G	Run
Title1:	LAC-HYDRIN		\F	Graph for
Title2:			\Z	Graph err
X-axis:	Month		\M	Compute M
Y-axis:	Demand			

INPUT:		OUTPUT:
Smoothing weight	0.30	Data type
Number of warm-up data	36	Number of data
Last period to forecast	48	Nbr. of outliers
Method for setting initial forecast:	1	Warm-up MSE
1 = Average of warm-up data		Forecasting MSE
2 = First data value		Warm-up MAD
		Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE		LAC-HYDRIN					
BEG. YEAR		####					
BEG. PERIOD		5					
DATA TYPE		12					
0	0	1	90		168.81	-78.81	#N/A
1	1	2	97		145.16	-48.16	#N/A
	2	3	91		130.71	-39.71	#N/A
	3	4	107		118.80	-11.80	#N/A
	4	5	133		115.26	17.74	#N/A
	5	6	150		120.58	29.42	#N/A
	6	7	175		129.41	45.59	#N/A
	7	8	190		143.09	46.91	#N/A
	8	9	199		157.16	41.84	#N/A
	9	10	222		169.71	52.29	#N/A
	10	11	241		185.40	55.60	#N/A
	11	12	217		202.08	14.92	#N/A
	12	13	62		206.56	-144.56	#N/A
	13	14	81		163.19	-82.19	#N/A
	14	15	62		138.53	-76.53	#N/A
	15	16	118		115.57	2.43	#N/A
	16	17	146		116.30	29.70	#N/A
	17	18	157		125.21	31.79	#N/A
	18	19	173		134.75	38.25	#N/A

19	20	193	146.22	46.78	#N/A
20	21	239	160.26	78.74	#N/A
21	22	238	183.88	54.12	#N/A
22	23	257	200.12	56.88	#N/A
23	24	218	217.18	0.82	#N/A
24	25	63	217.43	-154.43	#N/A
25	26	89	171.10	-82.10	#N/A
26	27	90	146.47	-56.47	#N/A
27	28	133	129.53	3.47	#N/A
28	29	150	130.57	19.43	#N/A
29	30	173	136.40	36.60	#N/A
30	31	222	147.38	74.62	#N/A
31	32	262	169.77	92.23	#N/A
32	33	270	197.44	72.56	#N/A
33	34	277	219.21	57.79	#N/A
34	35	282	236.54	45.46	#N/A
35	36	210	250.18	-40.18	#N/A
36	37	76	238.13	-162.13	#N/A
37	38	105	189.49	-84.49	#N/A
38	39	79	164.14	-85.14	#N/A
39	40	144	138.60	5.40	#N/A
40	41	146	140.22	5.78	#N/A
41	42	163	141.95	21.05	#N/A
42	43	202	148.27	53.73	#N/A
43	44	205	164.39	40.61	#N/A
44	45	246	176.57	69.43	#N/A
45	46	250	197.40	52.60	#N/A
46	47	276	213.18	62.82	#N/A
47	48	230	232.03	-2.03	#N/A
48	#N/A		#N/A	#N/A	#N/A
49	#N/A		#N/A	#N/A	#N/A
50	#N/A		#N/A	#N/A	#N/A
51	#N/A		#N/A	#N/A	#N/A
52	#N/A		#N/A	#N/A	#N/A
53	#N/A		#N/A	#N/A	#N/A
54	#N/A		#N/A	#N/A	#N/A
55	#N/A		#N/A	#N/A	#N/A
56	#N/A		#N/A	#N/A	#N/A
57	#N/A		#N/A	#N/A	#N/A
58	#N/A		#N/A	#N/A	#N/A
59	#N/A		#N/A	#N/A	#N/A
60	#N/A		#N/A	#N/A	#N/A
61	#N/A		#N/A	#N/A	#N/A
62	#N/A		#N/A	#N/A	#N/A
63	#N/A		#N/A	#N/A	#N/A
64	#N/A		#N/A	#N/A	#N/A
65	#N/A		#N/A	#N/A	#N/A
66	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

\R Reset wor
\L Load data
\E Extract d
\G Run
\F Graph for
\Z Graph err
\M Compute M

Title1: ANA-KIT
Title2:
X-axis: Month
Y-axis: Demand

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1

1 = Average of warm-up data
2 = First data value

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

			COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			ANA-KIT					
BEG. YEAR			####					
BEG. PERIOD			5					
DATA TYPE			12					
	0	0	1	15		11.22	3.78	#N/A
	1	1	2	16		12.36	3.64	#N/A
		2	3	19		13.45	5.55	#N/A
		3	4	17		15.11	1.89	#N/A
		4	5	17		15.68	1.32	#N/A
		5	6	14		16.08	-2.08	#N/A
		6	7	9		15.45	-6.45	#N/A
		7	8	7		13.52	-6.52	#N/A
		8	9	5		11.56	-6.56	#N/A
		9	10	6		9.59	-3.59	#N/A
		10	11	8		8.52	-0.52	#N/A
		11	12	14		8.36	5.64	#N/A
		12	13	18		10.05	7.95	#N/A
		13	14	14		12.44	1.56	#N/A
		14	15	9		12.91	-3.91	#N/A
		15	16	16		11.73	4.27	#N/A
		16	17	14		13.01	0.99	#N/A
		17	18	13		13.31	-0.31	#N/A
		18	19	8		13.22	-5.22	#N/A

19	20	7	11.65	-4.65	#N/A
20	21	6	10.26	-4.26	#N/A
21	22	3	8.98	-5.98	#N/A
22	23	7	7.19	-0.19	#N/A
23	24	14	7.13	6.87	#N/A
24	25	19	9.19	9.81	#N/A
25	26	20	12.13	7.87	#N/A
26	27	11	14.49	-3.49	#N/A
27	28	16	13.45	2.55	#N/A
28	29	14	14.21	-0.21	#N/A
29	30	10	14.15	-4.15	#N/A
30	31	4	12.90	-8.90	#N/A
31	32	3	10.23	-7.23	#N/A
32	33	3	8.06	-5.06	#N/A
33	34	6	6.54	-0.54	#N/A
34	35	9	6.38	2.62	#N/A
35	36	13	7.17	5.83	#N/A
36	37	18	8.92	9.08	#N/A
37	38	13	11.64	1.36	#N/A
38	39	9	12.05	-3.05	#N/A
39	40	16	11.13	4.87	#N/A
40	41	15	12.59	2.41	#N/A
41	42	12	13.32	-1.32	#N/A
42	43	5	12.92	-7.92	#N/A
43	44	4	10.54	-6.54	#N/A
44	45	7	8.58	-1.58	#N/A
45	46	4	8.11	-4.11	#N/A
46	47	18	6.87	11.13	#N/A
47	48	18	10.21	7.79	#N/A
48	#N/A		#N/A	#N/A	#N/A
49	#N/A		#N/A	#N/A	#N/A
50	#N/A		#N/A	#N/A	#N/A
51	#N/A		#N/A	#N/A	#N/A
52	#N/A		#N/A	#N/A	#N/A
53	#N/A		#N/A	#N/A	#N/A
54	#N/A		#N/A	#N/A	#N/A
55	#N/A		#N/A	#N/A	#N/A
56	#N/A		#N/A	#N/A	#N/A
57	#N/A		#N/A	#N/A	#N/A
58	#N/A		#N/A	#N/A	#N/A
59	#N/A		#N/A	#N/A	#N/A
60	#N/A		#N/A	#N/A	#N/A
61	#N/A		#N/A	#N/A	#N/A
62	#N/A		#N/A	#N/A	#N/A
63	#N/A		#N/A	#N/A	#N/A
64	#N/A		#N/A	#N/A	#N/A
65	#N/A		#N/A	#N/A	#N/A
66	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

Title1: BECONAGE AQ
Title2:
X-axis: Month
Y-axis: Demand

\R Reset wor
\L Load data
\E Extract d
\G Run
\F Graph for
\Z Graph err
\M Compute M

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1

1 = Average of warm-up data
2 = First data value

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE		BECONAGE AQ					
BEG. YEAR		####					
BEG. PERIOD		5					
DATA TYPE		12					
0	0	1	307		564.08	-257.08	#N/A
1	1	2	386		486.96	-100.96	#N/A
	2	3	414		456.67	-42.67	#N/A
	3	4	472		443.87	28.13	#N/A
	4	5	533		452.31	80.69	#N/A
	5	6	602		476.52	125.48	#N/A
	6	7	583		514.16	68.84	#N/A
	7	8	616		534.81	81.19	#N/A
	8	9	617		559.17	57.83	#N/A
	9	10	634		576.52	57.48	#N/A
	10	11	670		593.76	76.24	#N/A
	11	12	654		616.63	37.37	#N/A
	12	13	414		627.84	-213.84	#N/A
	13	14	447		563.69	-116.69	#N/A
	14	15	407		528.68	-121.68	#N/A
	15	16	622		492.18	129.82	#N/A
	16	17	652		531.12	120.88	#N/A
	17	18	581		567.39	13.61	#N/A
	18	19	607		571.47	35.53	#N/A

19	20	637	582.13	54.87	#N/A
20	21	581	598.59	-17.59	#N/A
21	22	532	593.31	-61.31	#N/A
22	23	642	574.92	67.08	#N/A
23	24	637	595.04	41.96	#N/A
24	25	403	607.63	-204.63	#N/A
25	26	488	546.24	-58.24	#N/A
26	27	393	528.77	-135.77	#N/A
27	28	572	488.04	83.96	#N/A
28	29	640	513.23	126.77	#N/A
29	30	622	551.26	70.74	#N/A
30	31	658	572.48	85.52	#N/A
31	32	601	598.14	2.86	#N/A
32	33	622	599.00	23.00	#N/A
33	34	646	605.90	40.10	#N/A
34	35	733	617.93	115.07	#N/A
35	36	682	652.45	29.55	#N/A
36	37	383	661.31	-278.31	#N/A
37	38	486	577.82	-91.82	#N/A
38	39	393	550.27	-157.27	#N/A
39	40	573	503.09	69.91	#N/A
40	41	647	524.06	122.94	#N/A
41	42	621	560.95	60.05	#N/A
42	43	650	578.96	71.04	#N/A
43	44	590	600.27	-10.27	#N/A
44	45	613	597.19	15.81	#N/A
45	46	526	601.93	-75.93	#N/A
46	47	761	579.15	181.85	#N/A
47	48	663	633.71	29.29	#N/A
48	#N/A		#N/A	#N/A	#N/A
49	#N/A		#N/A	#N/A	#N/A
50	#N/A		#N/A	#N/A	#N/A
51	#N/A		#N/A	#N/A	#N/A
52	#N/A		#N/A	#N/A	#N/A
53	#N/A		#N/A	#N/A	#N/A
54	#N/A		#N/A	#N/A	#N/A
55	#N/A		#N/A	#N/A	#N/A
56	#N/A		#N/A	#N/A	#N/A
57	#N/A		#N/A	#N/A	#N/A
58	#N/A		#N/A	#N/A	#N/A
59	#N/A		#N/A	#N/A	#N/A
60	#N/A		#N/A	#N/A	#N/A
61	#N/A		#N/A	#N/A	#N/A
62	#N/A		#N/A	#N/A	#N/A
63	#N/A		#N/A	#N/A	#N/A
64	#N/A		#N/A	#N/A	#N/A
65	#N/A		#N/A	#N/A	#N/A
66	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

\R	Reset wor
\L	Load data
\E	Extract d
\G	Run
\F	Graph for
\Z	Graph err
\M	Compute M

Title1: BENZONATATE
Title2:
X-axis: Month
Y-axis: Demand

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1

1 = Average of warm-up data
2 = First data value

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:
========= =========

			COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
			-----	-------	-------	-------	-------	-------
TEXT LINE			BENZONATATE					
BEG. YEAR			####					
BEG. PERIOD			5					
DATA TYPE			12					
	0	0	1	163		167.92	-4.92	#N/A
	1	1	2	122		166.44	-44.44	#N/A
		2	3	97		153.11	-56.11	#N/A
		3	4	81		136.28	-55.28	#N/A
		4	5	83		119.69	-36.69	#N/A
		5	6	100		108.69	-8.69	#N/A
		6	7	146		106.08	39.92	#N/A
		7	8	173		118.06	54.94	#N/A
		8	9	193		134.54	58.46	#N/A
		9	10	187		152.08	34.92	#N/A
		10	11	211		162.55	48.45	#N/A
		11	12	217		177.09	39.91	#N/A
		12	13	170		189.06	-19.06	#N/A
		13	14	140		183.34	-43.34	#N/A
		14	15	93		170.34	-77.34	#N/A
		15	16	81		147.14	-66.14	#N/A
		16	17	111		127.30	-16.30	#N/A
		17	18	140		122.41	17.59	#N/A
		18	19	163		127.69	35.31	#N/A

19	20	195	138.28	56.72	#N/A
20	21	240	155.30	84.70	#N/A
21	22	253	180.71	72.29	#N/A
22	23	252	202.39	49.61	#N/A
23	24	217	217.28	-0.28	#N/A
24	25	188	217.19	-29.19	#N/A
25	26	143	208.44	-65.44	#N/A
26	27	88	188.80	-100.80	#N/A
27	28	85	158.56	-73.56	#N/A
28	29	123	136.49	-13.49	#N/A
29	30	138	132.45	5.55	#N/A
30	31	192	134.11	57.89	#N/A
31	32	222	151.48	70.52	#N/A
32	33	238	172.63	65.37	#N/A
33	34	260	192.24	67.76	#N/A
34	35	289	212.57	76.43	#N/A
35	36	251	235.50	15.50	#N/A
36	37	185	240.15	-55.15	#N/A
37	38	139	223.60	-84.60	#N/A
38	39	87	198.22	-111.22	#N/A
39	40	88	164.86	-76.86	#N/A
40	41	129	141.80	-12.80	#N/A
41	42	135	137.96	-2.96	#N/A
42	43	187	137.07	49.93	#N/A
43	44	215	152.05	62.95	#N/A
44	45	211	170.94	40.06	#N/A
45	46	240	182.95	57.05	#N/A
46	47	272	200.07	71.93	#N/A
47	48	235	221.65	13.35	#N/A
48	#N/A		#N/A	#N/A	#N/A
49	#N/A		#N/A	#N/A	#N/A
50	#N/A		#N/A	#N/A	#N/A
51	#N/A		#N/A	#N/A	#N/A
52	#N/A		#N/A	#N/A	#N/A
53	#N/A		#N/A	#N/A	#N/A
54	#N/A		#N/A	#N/A	#N/A
55	#N/A		#N/A	#N/A	#N/A
56	#N/A		#N/A	#N/A	#N/A
57	#N/A		#N/A	#N/A	#N/A
58	#N/A		#N/A	#N/A	#N/A
59	#N/A		#N/A	#N/A	#N/A
60	#N/A		#N/A	#N/A	#N/A
61	#N/A		#N/A	#N/A	#N/A
62	#N/A		#N/A	#N/A	#N/A
63	#N/A		#N/A	#N/A	#N/A
64	#N/A		#N/A	#N/A	#N/A
65	#N/A		#N/A	#N/A	#N/A
66	#N/A		#N/A	#N/A	#N/A

SMOOTH	Simple exponential smoothing Annual, quarterly, or monthly data Minimum of 2 data	

\R	Reset wor
\L	Load data
\E	Extract d
\G	Run
\F	Graph for
\Z	Graph err
\M	Compute M

Title1: CTM 8
Title2:
X-axis: Month
Y-axis: Demand

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1
1 = Average of warm-up data	
2 = First data value	

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE		CTM 8					
BEG. YEAR		####					
BEG. PERIOD		5					
DATA TYPE		12					
0	0	1	160		129.42	30.58	#N/A
1	1	2	134		138.59	-4.59	#N/A
	2	3	29		137.21	-108.21	#N/A
	3	4	27		104.75	-77.75	#N/A
	4	5	55		81.42	-26.42	#N/A
	5	6	84		73.50	10.50	#N/A
	6	7	111		76.65	34.35	#N/A
	7	8	115		86.95	28.05	#N/A
	8	9	134		95.37	38.63	#N/A
	9	10	145		106.96	38.04	#N/A
	10	11	180		118.37	61.63	#N/A
	11	12	195		136.86	58.14	#N/A
	12	13	196		154.30	41.70	#N/A
	13	14	120		166.81	-46.81	#N/A
	14	15	63		152.77	-89.77	#N/A
	15	16	39		125.84	-86.84	#N/A
	16	17	60		99.79	-39.79	#N/A
	17	18	79		87.85	-8.85	#N/A
	18	19	109		85.20	23.80	#N/A

19	20	115	92.34	22.66	#N/A
20	21	153	99.14	53.86	#N/A
21	22	172	115.29	56.71	#N/A
22	23	256	132.31	123.69	#N/A
23	24	217	169.41	47.59	#N/A
24	25	174	183.69	-9.69	#N/A
25	26	121	180.78	-59.78	#N/A
26	27	60	162.85	-102.85	#N/A
27	28	38	131.99	-93.99	#N/A
28	29	59	103.80	-44.80	#N/A
29	30	111	90.36	20.64	#N/A
30	31	129	96.55	32.45	#N/A
31	32	133	106.28	26.72	#N/A
32	33	193	114.30	78.70	#N/A
33	34	214	137.91	76.09	#N/A
34	35	258	160.74	97.26	#N/A
35	36	221	189.92	31.08	#N/A
36	37	195	199.24	-4.24	#N/A
37	38	143	197.97	-54.97	#N/A
38	39	42	181.48	-139.48	#N/A
39	40	33	139.63	-106.63	#N/A
40	41	61	107.64	-46.64	#N/A
41	42	99	93.65	5.35	#N/A
42	43	126	95.26	30.74	#N/A
43	44	68	104.48	-36.48	#N/A
44	45	173	93.54	79.46	#N/A
45	46	198	117.37	80.63	#N/A
46	47	274	141.56	132.44	#N/A
47	48	207	181.29	25.71	#N/A
48	#N/A		#N/A	#N/A	#N/A
49	#N/A		#N/A	#N/A	#N/A
50	#N/A		#N/A	#N/A	#N/A
51	#N/A		#N/A	#N/A	#N/A
52	#N/A		#N/A	#N/A	#N/A
53	#N/A		#N/A	#N/A	#N/A
54	#N/A		#N/A	#N/A	#N/A
55	#N/A		#N/A	#N/A	#N/A
56	#N/A		#N/A	#N/A	#N/A
57	#N/A		#N/A	#N/A	#N/A
58	#N/A		#N/A	#N/A	#N/A
59	#N/A		#N/A	#N/A	#N/A
60	#N/A		#N/A	#N/A	#N/A
61	#N/A		#N/A	#N/A	#N/A
62	#N/A		#N/A	#N/A	#N/A
63	#N/A		#N/A	#N/A	#N/A
64	#N/A		#N/A	#N/A	#N/A
65	#N/A		#N/A	#N/A	#N/A
66	#N/A		#N/A	#N/A	#N/A

```
SMOOTH    Simple exponential smoothing                 \R   Reset wor
          Annual, quarterly, or monthly data           \L   Load data
          Minimum of 2 data                            \E   Extract d
                                                       \G   Run
Title1:   DIMETAPP                                     \F   Graph for
Title2:                                                \Z   Graph err
X-axis:   Month                                        \M   Compute M
Y-axis:   Demand

INPUT:                                                 OUTPUT:
Smoothing weight                       0.30            Data type
Number of warm-up data                   36            Number of data
Last period to forecast                  48            Nbr. of outliers
Method for setting initial                1            Warm-up MSE
forecast:                                              Forecasting MSE
  1 = Average of warm-up data                          Warm-up MAD
  2 = First data value                                 Forecasting MAD
```

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			DIMETAPP				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	80		146.81	-66.81	#N/A
	6	2	70		126.76	-56.76	#N/A
	7	3	60		109.73	-49.73	#N/A
	8	4	60		94.81	-34.81	#N/A
	9	5	120		84.37	35.63	#N/A
	10	6	130		95.06	34.94	#N/A
	11	7	153		105.54	47.46	#N/A
	12	8	179		119.78	59.22	#N/A
1992	1	9	180		137.55	42.45	#N/A
	2	10	233		150.28	82.72	#N/A
	3	11	181		175.10	5.90	#N/A
	4	12	151		176.87	-25.87	#N/A
	5	13	90		169.11	-79.11	#N/A
	6	14	92		145.38	-53.38	#N/A
	7	15	63		129.36	-66.36	#N/A
	8	16	67		109.45	-42.45	#N/A
	9	17	99		96.72	2.28	#N/A
	10	18	157		97.40	59.60	#N/A
	11	19	172		115.28	56.72	#N/A

	12	20	190	132.30	57.70	#N/A
1993	1	21	222	149.61	72.39	#N/A
	2	22	232	171.33	60.67	#N/A
	3	23	207	189.53	17.47	#N/A
	4	24	183	194.77	-11.77	#N/A
	5	25	93	191.24	-98.24	#N/A
	6	26	87	161.77	-74.77	#N/A
	7	27	63	139.34	-76.34	#N/A
	8	28	66	116.44	-50.44	#N/A
	9	29	117	101.31	15.69	#N/A
	10	30	148	106.01	41.99	#N/A
	11	31	195	118.61	76.39	#N/A
	12	32	210	141.53	68.47	#N/A
1994	1	33	236	162.07	73.93	#N/A
	2	34	289	184.25	104.75	#N/A
	3	35	217	215.67	1.33	#N/A
	4	36	193	216.07	-23.07	#N/A
	5	37	94	209.15	-115.15	#N/A
	6	38	84	174.61	-90.61	#N/A
	7	39	72	147.42	-75.42	#N/A
	8	40	74	124.80	-50.80	#N/A
	9	41	132	109.56	22.44	#N/A
	10	42	151	116.29	34.71	#N/A
	11	43	187	126.70	60.30	#N/A
	12	44	179	144.79	34.21	#N/A
1995	1	45	203	155.05	47.95	#N/A
	2	46	262	169.44	92.56	#N/A
	3	47	197	197.21	-0.21	#N/A
	4	48	164	197.14	-33.14	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

Title1: DIPHENHYDRAMINE
Title2:
X-axis: Month
Y-axis: Demand

\R Reset wor
\L Load data
\E Extract d
\G Run
\F Graph for
\Z Graph err
\M Compute M

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1

1 = Average of warm-up data
2 = First data value

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			DIPHENHYDRAMINE				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	96		153.11	-57.11	#N/A
	6	2	152		135.98	16.02	#N/A
	7	3	138		140.78	-2.78	#N/A
	8	4	172		139.95	32.05	#N/A
	9	5	179		149.56	29.44	#N/A
	10	6	155		158.40	-3.40	#N/A
	11	7	160		157.38	2.62	#N/A
	12	8	132		158.16	-26.16	#N/A
1992	1	9	127		150.31	-23.31	#N/A
	2	10	101		143.32	-42.32	#N/A
	3	11	93		130.62	-37.62	#N/A
	4	12	107		119.34	-12.34	#N/A
	5	13	110		115.64	-5.64	#N/A
	6	14	172		113.95	58.05	#N/A
	7	15	170		131.36	38.64	#N/A
	8	16	210		142.95	67.05	#N/A
	9	17	230		163.07	66.93	#N/A
	10	18	206		183.15	22.85	#N/A
	11	19	183		190.00	-7.00	#N/A

	12	20	140	187.90	-47.90	#N/A
1993	1	21	171	173.53	-2.53	#N/A
	2	22	135	172.77	-37.77	#N/A
	3	23	140	161.44	-21.44	#N/A
	4	24	134	155.01	-21.01	#N/A
	5	25	123	148.71	-25.71	#N/A
	6	26	186	140.99	45.01	#N/A
	7	27	159	154.50	4.50	#N/A
	8	28	195	155.85	39.15	#N/A
	9	29	201	167.59	33.41	#N/A
	10	30	195	177.62	17.38	#N/A
	11	31	167	182.83	-15.83	#N/A
	12	32	147	178.08	-31.08	#N/A
1994	1	33	160	168.76	-8.76	#N/A
	2	34	119	166.13	-47.13	#N/A
	3	35	125	151.99	-26.99	#N/A
	4	36	122	143.89	-21.89	#N/A
	5	37	126	137.33	-11.33	#N/A
	6	38	192	133.93	58.07	#N/A
	7	39	168	151.35	16.65	#N/A
	8	40	202	156.34	45.66	#N/A
	9	41	209	170.04	38.96	#N/A
	10	42	185	181.73	3.27	#N/A
	11	43	172	182.71	-10.71	#N/A
	12	44	152	179.50	-27.50	#N/A
1995	1	45	157	171.25	-14.25	#N/A
	2	46	124	166.97	-42.97	#N/A
	3	47	133	154.08	-21.08	#N/A
	4	48	134	147.76	-13.76	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

\R Reset wor
\L Load data
\E Extract d
\G Run
\F Graph for
\Z Graph err
\M Compute M

Title1: HUMIBID LA
Title2:
X-axis: Month
Y-axis: Demand

INPUT:	
Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1
1 = Average of warm-up data	
2 = First data value	

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			HUMIBID LA				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	126		226.72	-100.72	#N/A
	6	2	132		196.51	-64.51	#N/A
	7	3	102		177.15	-75.15	#N/A
	8	4	133		154.61	-21.61	#N/A
	9	5	190		148.13	41.87	#N/A
	10	6	157		160.69	-3.69	#N/A
	11	7	233		159.58	73.42	#N/A
	12	8	237		181.61	55.39	#N/A
1992	1	9	298		198.22	99.78	#N/A
	2	10	317		228.16	88.84	#N/A
	3	11	347		254.81	92.19	#N/A
	4	12	250		282.47	-32.47	#N/A
	5	13	153		272.73	-119.73	#N/A
	6	14	143		236.81	-93.81	#N/A
	7	15	127		208.67	-81.67	#N/A
	8	16	149		184.17	-35.17	#N/A
	9	17	190		173.62	16.38	#N/A
	10	18	207		178.53	28.47	#N/A
	11	19	232		187.07	44.93	#N/A

	12	20	269	200.55	68.45	#N/A
1993	1	21	289	221.09	67.91	#N/A
	2	22	308	241.46	66.54	#N/A
	3	23	329	261.42	67.58	#N/A
	4	24	280	281.70	-1.70	#N/A
	5	25	163	281.19	-118.19	#N/A
	6	26	170	245.73	-75.73	#N/A
	7	27	157	223.01	-66.01	#N/A
	8	28	173	203.21	-30.21	#N/A
	9	29	206	194.15	11.85	#N/A
	10	30	232	197.70	34.30	#N/A
	11	31	257	207.99	49.01	#N/A
	12	32	283	222.69	60.31	#N/A
1994	1	33	324	240.79	83.21	#N/A
	2	34	320	265.75	54.25	#N/A
	3	35	377	282.03	94.97	#N/A
	4	36	302	310.52	-8.52	#N/A
	5	37	159	307.96	-148.96	#N/A
	6	38	162	263.27	-101.27	#N/A
	7	39	119	232.89	-113.89	#N/A
	8	40	158	198.72	-40.72	#N/A
	9	41	186	186.51	-0.51	#N/A
	10	42	214	186.35	27.65	#N/A
	11	43	261	194.65	66.35	#N/A
	12	44	269	214.55	54.45	#N/A
1995	1	45	308	230.89	77.11	#N/A
	2	46	314	254.02	59.98	#N/A
	3	47	359	272.01	86.99	#N/A
	4	48	268	298.11	-30.11	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

```
SMOOTH    Simple exponential smoothing                      \R    Reset wor
          Annual, quarterly, or monthly data                \L    Load data
          Minimum of 2 data                                 \E    Extract d
                                                            \G    Run
Title1:   ATARAX                                            \F    Graph for
Title2:                                                     \Z    Graph err
X-axis:   Month                                             \M    Compute M
Y-axis:   Demand
```

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1
1 = Average of warm-up data	
2 = First data value	

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			ATARAX				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	77		160.39	-83.39	#N/A
	6	2	120		135.37	-15.37	#N/A
	7	3	111		130.76	-19.76	#N/A
	8	4	164		124.83	39.17	#N/A
	9	5	148		136.58	11.42	#N/A
	10	6	153		140.01	12.99	#N/A
	11	7	140		143.91	-3.91	#N/A
	12	8	138		142.73	-4.73	#N/A
1992	1	9	172		141.31	30.69	#N/A
	2	10	137		150.52	-13.52	#N/A
	3	11	220		146.46	73.54	#N/A
	4	12	207		168.52	38.48	#N/A
	5	13	101		180.07	-79.07	#N/A
	6	14	137		156.35	-19.35	#N/A
	7	15	140		150.54	-10.54	#N/A
	8	16	144		147.38	-3.38	#N/A
	9	17	193		146.37	46.63	#N/A
	10	18	182		160.36	21.64	#N/A
	11	19	149		166.85	-17.85	#N/A

	12	20	139	161.49	-22.49	#N/A
1993	1	21	181	154.75	26.25	#N/A
	2	22	178	162.62	15.38	#N/A
	3	23	189	167.24	21.76	#N/A
	4	24	183	173.76	9.24	#N/A
	5	25	130	176.54	-46.54	#N/A
	6	26	143	162.57	-19.57	#N/A
	7	27	133	156.70	-23.70	#N/A
	8	28	168	149.59	18.41	#N/A
	9	29	199	155.11	43.89	#N/A
	10	30	201	168.28	32.72	#N/A
	11	31	183	178.10	4.90	#N/A
	12	32	157	179.57	-22.57	#N/A
1994	1	33	194	172.80	21.20	#N/A
	2	34	172	179.16	-7.16	#N/A
	3	35	210	177.01	32.99	#N/A
	4	36	181	186.91	-5.91	#N/A
	5	37	118	185.14	-67.14	#N/A
	6	38	151	164.99	-13.99	#N/A
	7	39	142	160.80	-18.80	#N/A
	8	40	178	155.16	22.84	#N/A
	9	41	193	162.01	30.99	#N/A
	10	42	180	171.31	8.69	#N/A
	11	43	162	173.91	-11.91	#N/A
	12	44	147	170.34	-23.34	#N/A
1995	1	45	194	163.34	30.66	#N/A
	2	46	172	172.54	-0.54	#N/A
	3	47	214	172.38	41.62	#N/A
	4	48	183	184.86	-1.86	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

Title1: AFTIN
Title2:
X-axis: Month
Y-axis: Demand

\R Reset wor
\L Load data
\E Extract d
\G Run
\F Graph for
\Z Graph err
\M Compute M

INPUT:	
Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1
1 = Average of warm-up data	
2 = First data value	

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			AFTIN				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	40		123.28	-83.28	#N/A
	6	2	36		98.29	-62.29	#N/A
	7	3	23		79.61	-56.61	#N/A
	8	4	44		62.62	-18.62	#N/A
	9	5	106		57.04	48.96	#N/A
	10	6	102		71.73	30.27	#N/A
	11	7	143		80.81	62.19	#N/A
	12	8	160		99.47	60.53	#N/A
1992	1	9	163		117.63	45.37	#N/A
	2	10	218		131.24	86.76	#N/A
	3	11	224		157.27	66.73	#N/A
	4	12	167		177.29	-10.29	#N/A
	5	13	75		174.20	-99.20	#N/A
	6	14	61		144.44	-83.44	#N/A
	7	15	43		119.41	-76.41	#N/A
	8	16	78		96.49	-18.49	#N/A
	9	17	116		90.94	25.06	#N/A
	10	18	126		98.46	27.54	#N/A
	11	19	133		106.72	26.28	#N/A

	12	20	155	114.60	40.40	#N/A
1993	1	21	168	126.72	41.28	#N/A
	2	22	157	139.11	17.89	#N/A
	3	23	217	144.47	72.53	#N/A
	4	24	182	166.23	15.77	#N/A
	5	25	73	170.96	-97.96	#N/A
	6	26	49	141.57	-92.57	#N/A
	7	27	29	113.80	-84.80	#N/A
	8	28	44	88.36	-44.36	#N/A
	9	29	99	75.05	23.95	#N/A
	10	30	123	82.24	40.76	#N/A
	11	31	113	94.47	18.53	#N/A
	12	32	162	100.03	61.97	#N/A
1994	1	33	193	118.62	74.38	#N/A
	2	34	180	140.93	39.07	#N/A
	3	35	228	152.65	75.35	#N/A
	4	36	208	175.26	32.74	#N/A
	5	37	67	185.08	-118.08	#N/A
	6	38	51	149.66	-98.66	#N/A
	7	39	34	120.06	-86.06	#N/A
	8	40	58	94.24	-36.24	#N/A
	9	41	135	83.37	51.63	#N/A
	10	42	118	98.86	19.14	#N/A
	11	43	103	104.60	-1.60	#N/A
	12	44	152	104.12	47.88	#N/A
1995	1	45	183	118.48	64.52	#N/A
	2	46	171	137.84	33.16	#N/A
	3	47	238	147.79	90.21	#N/A
	4	48	194	174.85	19.15	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

\R Reset wor
\L Load data
\E Extract d
\G Run
\F Graph for
\Z Graph err
\M Compute M

Title1: RID
Title2:
X-axis: Month
Y-axis: Demand

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1

1 = Average of warm-up data
2 = First data value

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			RID				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	2		4.36	-2.36	#N/A
	6	2	1		3.65	-2.65	#N/A
	7	3	7		2.86	4.14	#N/A
	8	4	3		4.10	-1.10	#N/A
	9	5	0		3.77	-3.77	#N/A
	10	6	5		2.64	2.36	#N/A
	11	7	6		3.35	2.65	#N/A
	12	8	2		4.14	-2.14	#N/A
1992	1	9	0		3.50	-3.50	#N/A
	2	10	4		2.45	1.55	#N/A
	3	11	0		2.92	-2.92	#N/A
	4	12	3		2.04	0.96	#N/A
	5	13	2		2.33	-0.33	#N/A
	6	14	3		2.23	0.77	#N/A
	7	15	0		2.46	-2.46	#N/A
	8	16	7		1.72	5.28	#N/A
	9	17	13		3.31	9.69	#N/A
	10	18	2		6.21	-4.21	#N/A
	11	19	14		4.95	9.05	#N/A

	12	20	0	7.66	-7.66	#N/A
1993	1	21	3	5.37	-2.37	#N/A
	2	22	4	4.66	-0.66	#N/A
	3	23	2	4.46	-2.46	#N/A
	4	24	1	3.72	-2.72	#N/A
	5	25	2	2.90	-0.90	#N/A
	6	26	1	2.63	-1.63	#N/A
	7	27	0	2.14	-2.14	#N/A
	8	28	5	1.50	3.50	#N/A
	9	29	11	2.55	8.45	#N/A
	10	30	17	5.09	11.91	#N/A
	11	31	9	8.66	0.34	#N/A
	12	32	15	8.76	6.24	#N/A
1994	1	33	0	10.63	-10.63	#N/A
	2	34	4	7.44	-3.44	#N/A
	3	35	5	6.41	-1.41	#N/A
	4	36	4	5.99	-1.99	#N/A
	5	37	0	5.39	-5.39	#N/A
	6	38	1	3.77	-2.77	#N/A
	7	39	4	2.94	1.06	#N/A
	8	40	21	3.26	17.74	#N/A
	9	41	6	8.58	-2.58	#N/A
	10	42	3	7.81	-4.81	#N/A
	11	43	22	6.36	15.64	#N/A
	12	44	3	11.06	-8.06	#N/A
1995	1	45	4	8.64	-4.64	#N/A
	2	46	4	7.25	-3.25	#N/A
	3	47	1	6.27	-5.27	#N/A
	4	48	2	4.69	-2.69	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

Title1: ROBITUSSIN
Title2:
X-axis: Month
Y-axis: Demand

\R Reset wor
\L Load data
\E Extract d
\G Run
\F Graph for
\Z Graph err
\M Compute M

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1
1 = Average of warm-up data	
2 = First data value	

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			ROBITUSSIN				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	120		196.47	-76.47	#N/A
	6	2	82		173.53	-91.53	#N/A
	7	3	71		146.07	-75.07	#N/A
	8	4	85		123.55	-38.55	#N/A
	9	5	149		111.98	37.02	#N/A
	10	6	207		123.09	83.91	#N/A
	11	7	253		148.26	104.74	#N/A
	12	8	263		179.68	83.32	#N/A
1992	1	9	252		204.68	47.32	#N/A
	2	10	239		218.88	20.12	#N/A
	3	11	238		224.91	13.09	#N/A
	4	12	201		228.84	-27.84	#N/A
	5	13	151		220.49	-69.49	#N/A
	6	14	101		199.64	-98.64	#N/A
	7	15	90		170.05	-80.05	#N/A
	8	16	100		146.03	-46.03	#N/A
	9	17	173		132.22	40.78	#N/A
	10	18	238		144.46	93.54	#N/A
	11	19	280		172.52	107.48	#N/A

	12	20	293	204.76	88.24	#N/A
1993	1	21	247	231.23	15.77	#N/A
	2	22	268	235.96	32.04	#N/A
	3	23	255	245.57	9.43	#N/A
	4	24	199	248.40	-49.40	#N/A
	5	25	156	233.58	-77.58	#N/A
	6	26	120	210.31	-90.31	#N/A
	7	27	92	183.22	-91.22	#N/A
	8	28	90	155.85	-65.85	#N/A
	9	29	177	136.10	40.90	#N/A
	10	30	205	148.37	56.63	#N/A
	11	31	273	165.36	107.64	#N/A
	12	32	302	197.65	104.35	#N/A
1994	1	33	315	228.95	86.05	#N/A
	2	34	286	254.77	31.23	#N/A
	3	35	287	264.14	22.86	#N/A
	4	36	215	271.00	-56.00	#N/A
	5	37	151	254.20	-103.20	#N/A
	6	38	105	223.24	-118.24	#N/A
	7	39	85	187.77	-102.77	#N/A
	8	40	101	156.94	-55.94	#N/A
	9	41	188	140.16	47.84	#N/A
	10	42	245	154.51	90.49	#N/A
	11	43	266	181.66	84.34	#N/A
	12	44	287	206.96	80.04	#N/A
1995	1	45	252	230.97	21.03	#N/A
	2	46	289	237.28	51.72	#N/A
	3	47	258	252.80	5.20	#N/A
	4	48	209	254.36	-45.36	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

\R Reset wor
\L Load data
\E Extract d
\G Run
\F Graph for
\Z Graph err
\M Compute M

Title1: SUNSCREEN
Title2:
X-axis: Month
Y-axis: Demand

INPUT:	
Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1
1 = Average of warm-up data	
2 = First data value	

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			SUNSCREEN				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	23		24.58	-1.58	#N/A
	6	2	30		24.11	5.89	#N/A
	7	3	34		25.88	8.12	#N/A
	8	4	35		28.31	6.69	#N/A
	9	5	32		30.32	1.68	#N/A
	10	6	30		30.82	-0.82	#N/A
	11	7	19		30.58	-11.58	#N/A
	12	8	19		27.10	-8.10	#N/A
1992	1	9	15		24.67	-9.67	#N/A
	2	10	16		21.77	-5.77	#N/A
	3	11	19		20.04	-1.04	#N/A
	4	12	28		19.73	8.27	#N/A
	5	13	24		22.21	1.79	#N/A
	6	14	33		22.75	10.25	#N/A
	7	15	37		25.82	11.18	#N/A
	8	16	40		29.18	10.82	#N/A
	9	17	35		32.42	2.58	#N/A
	10	18	23		33.20	-10.20	#N/A
	11	19	20		30.14	-10.14	#N/A

	12	20	14	27.10	-13.10	#N/A
1993	1	21	16	23.17	-7.17	#N/A
	2	22	17	21.02	-4.02	#N/A
	3	23	24	19.81	4.19	#N/A
	4	24	26	21.07	4.93	#N/A
	5	25	30	22.55	7.45	#N/A
	6	26	34	24.78	9.22	#N/A
	7	27	26	27.55	-1.55	#N/A
	8	28	30	27.08	2.92	#N/A
	9	29	34	27.96	6.04	#N/A
	10	30	27	29.77	-2.77	#N/A
	11	31	13	28.94	-15.94	#N/A
	12	32	6	24.16	-18.16	#N/A
1994	1	33	11	18.71	-7.71	#N/A
	2	34	14	16.40	-2.40	#N/A
	3	35	21	15.68	5.32	#N/A
	4	36	30	17.27	12.73	#N/A
	5	37	28	21.09	6.91	#N/A
	6	38	31	23.16	7.84	#N/A
	7	39	33	25.52	7.48	#N/A
	8	40	33	27.76	5.24	#N/A
	9	41	33	29.33	3.67	#N/A
	10	42	39	30.43	8.57	#N/A
	11	43	17	33.00	-16.00	#N/A
	12	44	18	28.20	-10.20	#N/A
1995	1	45	18	25.14	-7.14	#N/A
	2	46	22	23.00	-1.00	#N/A
	3	47	30	22.70	7.30	#N/A
	4	48	29	24.89	4.11	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

SMOOTH Simple exponential smoothing
Annual, quarterly, or monthly data
Minimum of 2 data

\R	Reset wor
\L	Load data
\E	Extract d
\G	Run
\F	Graph for
\Z	Graph err
\M	Compute M

Title1: SELDANE
Title2:
X-axis: Month
Y-axis: Demand

INPUT:

Smoothing weight	0.30
Number of warm-up data	36
Last period to forecast	48
Method for setting initial forecast:	1
1 = Average of warm-up data	
2 = First data value	

OUTPUT:
Data type
Number of data
Nbr. of outliers
Warm-up MSE
Forecasting MSE
Warm-up MAD
Forecasting MAD

DATA FILE:

		COUNT	DATA	SEAS. INDEX	FCST.	ERROR	INDEX x FCST.
TEXT LINE			SELDANE				
BEG. YEAR			1991				
BEG. PERIOD			5				
DATA TYPE			12				
1991	5	1	487		776.03	-289.03	#N/A
	6	2	632		689.32	-57.32	#N/A
	7	3	780		672.12	107.88	#N/A
	8	4	888		704.49	183.51	#N/A
	9	5	910		759.54	150.46	#N/A
	10	6	868		804.68	63.32	#N/A
	11	7	823		823.67	-0.67	#N/A
	12	8	784		823.47	-39.47	#N/A
1992	1	9	723		811.63	-88.63	#N/A
	2	10	681		785.04	-104.04	#N/A
	3	11	736		753.83	-17.83	#N/A
	4	12	592		748.48	-156.48	#N/A
	5	13	486		701.54	-215.54	#N/A
	6	14	666		636.88	29.12	#N/A
	7	15	672		645.61	26.39	#N/A
	8	16	984		653.53	330.47	#N/A
	9	17	970		752.67	217.33	#N/A
	10	18	930		817.87	112.13	#N/A
	11	19	830		851.51	-21.51	#N/A

	12	20	777	845.06	-68.06	#N/A
1993	1	21	733	824.64	-91.64	#N/A
	2	22	672	797.15	-125.15	#N/A
	3	23	782	759.60	22.40	#N/A
	4	24	714	766.32	-52.32	#N/A
	5	25	551	750.63	-199.63	#N/A
	6	26	789	690.74	98.26	#N/A
	7	27	622	720.22	-98.22	#N/A
	8	28	936	690.75	245.25	#N/A
	9	29	1055	764.33	290.67	#N/A
	10	30	950	851.53	98.47	#N/A
	11	31	847	881.07	-34.07	#N/A
	12	32	813	870.85	-57.85	#N/A
1994	1	33	812	853.49	-41.49	#N/A
	2	34	709	841.05	-132.05	#N/A
	3	35	950	801.43	148.57	#N/A
	4	36	783	846.00	-63.00	#N/A
	5	37	503	827.10	-324.10	#N/A
	6	38	719	729.87	-10.87	#N/A
	7	39	582	726.61	-144.61	#N/A
	8	40	916	683.23	232.77	#N/A
	9	41	989	753.06	235.94	#N/A
	10	42	900	823.84	76.16	#N/A
	11	43	851	846.69	4.31	#N/A
	12	44	755	847.98	-92.98	#N/A
1995	1	45	756	820.09	-64.09	#N/A
	2	46	655	800.86	-145.86	#N/A
	3	47	902	757.10	144.90	#N/A
	4	48	734	800.57	-66.57	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A
	12	#N/A		#N/A	#N/A	#N/A
1996	1	#N/A		#N/A	#N/A	#N/A
	2	#N/A		#N/A	#N/A	#N/A
	3	#N/A		#N/A	#N/A	#N/A
	4	#N/A		#N/A	#N/A	#N/A
	5	#N/A		#N/A	#N/A	#N/A
	6	#N/A		#N/A	#N/A	#N/A
	7	#N/A		#N/A	#N/A	#N/A
	8	#N/A		#N/A	#N/A	#N/A
	9	#N/A		#N/A	#N/A	#N/A
	10	#N/A		#N/A	#N/A	#N/A
	11	#N/A		#N/A	#N/A	#N/A

Appendix C: WES - Items 1-15

TRENDS	Trend and seasonal smoothing
	Deseas. quarterly or monthly data
	Use SEASQTR/MON to prepare data file

Reset worksheet
Load data file
Extract data file
Run
Graph forecasts
Graph errors
Compute MSE table

Title1:	Trend/Seasonal #1
Title2:	Amantadine
X-axis:	MONTH
Y-axis:	DEMAND

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	60
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	AMANTADINE						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					14.374	0.0423
1991	5	1	12.60	0.5557	7	8.01	-1.01	14.374	0.0423
	6	#N/A	22.76	0.3516	8	5.08	2.92	14.374	0.0423
	7	#N/A	17.38	0.5755	10	8.33	1.67	14.374	0.0423
	8	#N/A	11.78	0.9338	11	13.54	-2.54	14.374	0.0423
	9	#N/A	15.80	0.9496	15	13.80	1.20	14.374	0.0423
	10	#N/A	16.61	1.1436	19	16.64	2.36	14.374	0.0423
	11	#N/A	13.15	1.3690	18	19.95	-1.95	14.374	0.0423
	12	#N/A	13.99	1.1433	16	16.68	-0.68	14.374	0.0423
1992	1	#N/A	15.32	1.0441	16	15.25	0.75	14.374	0.0423
	2	#N/A	13.66	1.2442	17	18.19	-1.19	14.374	0.0423
	3	#N/A	12.58	1.4307	18	20.94	-2.94	14.374	0.0423
	4	#N/A	12.71	1.2589	16	18.44	-2.44	14.374	0.0423
	5	#N/A	14.40	0.5557	8	8.15	-0.15	14.374	0.0423
	6	#N/A	11.38	0.3516	4	5.16	-1.16	14.374	0.0423

	7	#N/A	15.64	0.5755	9	8.45	0.55	14.374	0.0423
	8	#N/A	16.06	0.9338	15	13.71	1.29	14.374	0.0423
	9	#N/A	14.74	0.9496	14	13.95	0.05	14.374	0.0423
	10	#N/A	14.87	1.1436	17	16.81	0.19	14.374	0.0423
	11	#N/A	14.61	1.3690	20	20.13	-0.13	14.374	0.0423
	12	#N/A	13.12	1.1433	15	16.82	-1.82	14.374	0.0423
1993	1	#N/A	13.41	1.0441	14	15.36	-1.36	14.374	0.0423
	2	#N/A	15.27	1.2442	19	18.31	0.69	14.374	0.0423
	3	#N/A	15.38	1.4307	22	21.06	0.94	14.374	0.0423
	4	#N/A	15.89	1.2589	20	18.54	1.46	14.374	0.0423
	5	#N/A	14.40	0.5557	8	8.18	-0.18	14.374	0.0423
	6	#N/A	17.07	0.3516	6	5.18	0.82	14.374	0.0423
	7	#N/A	13.90	0.5755	8	8.48	-0.48	14.374	0.0423
	8	#N/A	13.92	0.9338	13	13.76	-0.76	14.374	0.0423
	9	#N/A	15.80	0.9496	15	13.99	1.01	14.374	0.0423
	10	#N/A	15.74	1.1436	18	16.85	1.15	14.374	0.0423
	11	#N/A	16.80	1.3690	23	20.18	2.82	14.374	0.0423
	12	#N/A	18.37	1.1433	21	16.85	4.15	14.374	0.0423
1994	1	#N/A	16.28	1.0441	17	15.39	1.61	14.374	0.0423
	2	#N/A	16.07	1.2442	20	18.34	1.66	14.374	0.0423
	3	#N/A	17.47	1.4307	25	21.09	3.91	14.374	0.0423
	4	#N/A	16.68	1.2589	21	18.56	2.44	14.374	0.0423
	5	#N/A	16.20	0.5557	9	8.19	0.81	14.374	0.0423
	6	#N/A	17.07	0.3516	6	5.18	0.82	14.374	0.0423
	7	#N/A	15.64	0.5755	9	8.49	0.51	14.374	0.0423
	8	#N/A	14.99	0.9338	14	13.77	0.23	14.374	0.0423
	9	#N/A	14.74	0.9496	14	14.01	-0.01	14.374	0.0423
	10	#N/A	14.87	1.1436	17	16.87	0.13	14.374	0.0423
	11	#N/A	15.34	1.3690	21	20.19	0.81	14.374	0.0423
	12	#N/A	14.87	1.1433	17	16.86	0.14	14.374	0.0423
1995	1	#N/A	14.37	1.0441	15	15.40	-0.40	14.374	0.0423
	2	#N/A	14.47	1.2442	18	18.35	-0.35	14.374	0.0423
	3	#N/A	13.98	1.4307	20	21.10	-1.10	14.374	0.0423
	4	#N/A	13.50	1.2589	17	18.57	-1.57	14.374	0.0423
	5	#N/A		0.5557	#N/A	8.20	#N/A	14.374	0.0423
	6	#N/A		0.3516	#N/A	5.19	#N/A	14.374	0.0423
	7	#N/A		0.5755	#N/A	8.49	#N/A	14.374	0.0423
	8	#N/A		0.9338	#N/A	13.78	#N/A	14.374	0.0423
	9	#N/A		0.9496	#N/A	14.01	#N/A	14.374	0.0423
	10	#N/A		1.1436	#N/A	16.87	#N/A	14.374	0.0423
	11	#N/A		1.3690	#N/A	20.20	#N/A	14.374	0.0423
	12	#N/A		1.1433	#N/A	16.87	#N/A	14.374	0.0423
1996	1	#N/A		1.0441	#N/A	15.40	#N/A	14.374	0.0423
	2	#N/A		1.2442	#N/A	18.36	#N/A	14.374	0.0423
	3	#N/A		1.4307	#N/A	21.11	#N/A	14.374	0.0423
	4	#N/A		1.2589	#N/A	18.57	#N/A	14.374	0.0423
	5	#N/A		0.5557	#N/A	#N/A	#N/A	14.374	0.0423
	6	#N/A		0.3516	#N/A	#N/A	#N/A	14.374	0.0423
	7	#N/A		0.5755	#N/A	#N/A	#N/A	14.374	0.0423
	8	#N/A		0.9338	#N/A	#N/A	#N/A	14.374	0.0423
	9	#N/A		0.9496	#N/A	#N/A	#N/A	14.374	0.0423

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

Reset worksheet
Load data file
Extract data file
Run
Graph forecasts
Graph errors
Compute MSE table

Title1: Trend/Seasonal #2
Title2: Lac-Hydrin
X-axis:
Y-axis:

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	LAC-HYDRIN						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					186.07	-0.2392
1991	5	1	280.26	0.3211	90	59.68	30.315	186.07	-0.2392
	6	#N/A	222.01	0.4369	97	81.12	15.881	186.07	-0.2392
	7	#N/A	246.71	0.3688	91	68.42	22.583	186.07	-0.2392
	8	#N/A	171.72	0.6231	107	115.48	-8.479	186.07	-0.2392
	9	#N/A	188.67	0.7049	133	130.54	2.456	186.07	-0.2392
	10	#N/A	186.52	0.8042	150	148.83	1.171	186.07	-0.2392
	11	#N/A	157.25	1.1129	175	205.82	-30.821	186.07	-0.2392
	12	#N/A	143.07	1.3280	190	245.48	-55.478	186.07	-0.2392
1992	1	#N/A	131.63	1.5118	199	279.31	-80.307	186.07	-0.2392
	2	#N/A	140.11	1.5845	222	292.60	-70.604	186.07	-0.2392
	3	#N/A	139.36	1.7294	241	319.23	-78.232	186.07	-0.2392
	4	#N/A	147.18	1.4744	217	272.06	-55.063	186.07	-0.2392
	5	#N/A	193.07	0.3211	62	59.24	2.762	186.07	-0.2392
	6	#N/A	185.39	0.4369	81	80.57	0.428	186.07	-0.2392

	7	#N/A	168.09	0.3688	62	68.00	-6.002	186.07	-0.2392
	8	#N/A	189.38	0.6231	118	114.85	3.153	186.07	-0.2392
	9	#N/A	207.12	0.7049	146	129.90	16.099	186.07	-0.2392
	10	#N/A	195.22	0.8042	157	148.17	8.831	186.07	-0.2392
	11	#N/A	155.46	1.1129	173	205.00	-31.999	186.07	-0.2392
	12	#N/A	145.33	1.3280	193	244.60	-51.595	186.07	-0.2392
1993	1	#N/A	158.09	1.5118	239	278.40	-39.402	186.07	-0.2392
	2	#N/A	150.21	1.5845	238	291.75	-53.750	186.07	-0.2392
	3	#N/A	148.61	1.7294	257	318.39	-61.393	186.07	-0.2392
	4	#N/A	147.86	1.4744	218	271.42	-53.420	186.07	-0.2392
	5	#N/A	196.18	0.3211	63	59.11	3.888	186.07	-0.2392
	6	#N/A	203.70	0.4369	89	80.42	8.583	186.07	-0.2392
	7	#N/A	244.00	0.3688	90	67.88	22.116	186.07	-0.2392
	8	#N/A	213.45	0.6231	133	114.67	18.331	186.07	-0.2392
	9	#N/A	212.79	0.7049	150	129.72	20.281	186.07	-0.2392
	10	#N/A	215.12	0.8042	173	147.98	25.018	186.07	-0.2392
	11	#N/A	199.49	1.1129	222	204.77	17.233	186.07	-0.2392
	12	#N/A	197.29	1.3280	262	244.35	17.654	186.07	-0.2392
1994	1	#N/A	178.60	1.5118	270	278.15	-8.147	186.07	-0.2392
	2	#N/A	174.82	1.5845	277	291.51	-14.509	186.07	-0.2392
	3	#N/A	163.07	1.7294	282	318.16	-36.157	186.07	-0.2392
	4	#N/A	142.43	1.4744	210	271.24	-61.238	186.07	-0.2392
	5	#N/A	236.66	0.3211	76	59.08	16.924	186.07	-0.2392
	6	#N/A	240.32	0.4369	105	80.37	24.626	186.07	-0.2392
	7	#N/A	214.18	0.3688	79	67.85	11.149	186.07	-0.2392
	8	#N/A	231.11	0.6231	144	114.62	29.382	186.07	-0.2392
	9	#N/A	207.12	0.7049	146	129.67	16.332	186.07	-0.2392
	10	#N/A	202.68	0.8042	163	147.93	15.070	186.07	-0.2392
	11	#N/A	181.51	1.1129	202	204.70	-2.701	186.07	-0.2392
	12	#N/A	154.37	1.3280	205	244.28	-39.275	186.07	-0.2392
1995	1	#N/A	162.72	1.5118	246	278.07	-32.075	186.07	-0.2392
	2	#N/A	157.78	1.5845	250	291.44	-41.441	186.07	-0.2392
	3	#N/A	159.60	1.7294	276	318.09	-42.090	186.07	-0.2392
	4	#N/A	156.00	1.4744	230	271.19	-41.187	186.07	-0.2392
	5	#N/A	#N/A	0.3211	#N/A	#N/A	#N/A	186.07	-0.2392
	6	#N/A	#N/A	0.4369	#N/A	#N/A	#N/A	186.07	-0.2392
	7	#N/A	#N/A	0.3688	#N/A	#N/A	#N/A	186.07	-0.2392
	8	#N/A	#N/A	0.6231	#N/A	#N/A	#N/A	186.07	-0.2392
	9	#N/A	#N/A	0.7049	#N/A	#N/A	#N/A	186.07	-0.2392
	10	#N/A	#N/A	0.8042	#N/A	#N/A	#N/A	186.07	-0.2392
	11	#N/A	#N/A	1.1129	#N/A	#N/A	#N/A	186.07	-0.2392
	12	#N/A	#N/A	1.3280	#N/A	#N/A	#N/A	186.07	-0.2392
1996	1	#N/A	#N/A	1.5118	#N/A	#N/A	#N/A	186.07	-0.2392
	2	#N/A	#N/A	1.5845	#N/A	#N/A	#N/A	186.07	-0.2392
	3	#N/A	#N/A	1.7294	#N/A	#N/A	#N/A	186.07	-0.2392
	4	#N/A	#N/A	1.4744	#N/A	#N/A	#N/A	186.07	-0.2392
	5	#N/A		0.3211	#N/A	#N/A	#N/A	186.07	-0.2392
	6	#N/A		0.4369	#N/A	#N/A	#N/A	186.07	-0.2392
	7	#N/A		0.3688	#N/A	#N/A	#N/A	186.07	-0.2392
	8	#N/A		0.6231	#N/A	#N/A	#N/A	186.07	-0.2392
	9	#N/A		0.7049	#N/A	#N/A	#N/A	186.07	-0.2392

TRENDS	Trend and seasonal smoothing Deseas. quarterly or monthly data Use SEASQTR/MON to prepare data file	Reset worksheet Load data file Extract data file Run Graph forecasts Graph errors Compute MSE table

Title1: Trend/Seasonal #3
Title2: Ana-Kit
X-axis: MONTH
Y-axis: DEMAND

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	ANA-KIT						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					13.263	-0.1038
1991	5	1	8.78	1.7075	15	22.4863	-7.486	13.263	-0.1038
	6	#N/A	10.90	1.4682	16	19.2109	-3.211	13.263	-0.1038
	7	#N/A	20.74	0.9162	19	11.9196	7.080	13.263	-0.1038
	8	#N/A	11.27	1.5085	17	19.5213	-2.521	13.263	-0.1038
	9	#N/A	12.52	1.3582	17	17.4933	-0.493	13.263	-0.1038
	10	#N/A	13.00	1.0765	14	13.8061	0.194	13.263	-0.1038
	11	#N/A	15.68	0.5741	9	7.3344	1.666	13.263	-0.1038
	12	#N/A	14.03	0.4989	7	6.3514	0.649	13.263	-0.1038
1992	1	#N/A	12.09	0.4136	5	5.2483	-0.248	13.263	-0.1038
	2	#N/A	12.86	0.4665	6	5.9028	0.097	13.263	-0.1038
	3	#N/A	10.74	0.7451	8	9.4043	-1.404	13.263	-0.1038
	4	#N/A	11.05	1.2667	14	15.9506	-1.951	13.263	-0.1038
	5	#N/A	10.54	1.7075	18	21.4557	-3.456	13.263	-0.1038
	6	#N/A	9.54	1.4682	14	18.4134	-4.413	13.263	-0.1038

	7	#N/A	9.82	0.9162	9	11.4717	-2.472	13.263	-0.1038
	8	#N/A	10.61	1.5085	16	18.8576	-2.858	13.263	-0.1038
	9	#N/A	10.31	1.3582	14	16.9555	-2.956	13.263	-0.1038
	10	#N/A	12.08	1.0765	13	13.4224	-0.422	13.263	-0.1038
	11	#N/A	13.93	0.5741	8	7.1503	0.850	13.263	-0.1038
	12	#N/A	14.03	0.4989	7	6.2074	0.793	13.263	-0.1038
1993	1	#N/A	14.51	0.4136	6	5.1409	0.859	13.263	-0.1038
	2	#N/A	6.43	0.4665	3	5.7938	-2.794	13.263	-0.1038
	3	#N/A	9.39	0.7451	7	9.2475	-2.248	13.263	-0.1038
	4	#N/A	11.05	1.2667	14	15.7106	-1.711	13.263	-0.1038
	5	#N/A	11.13	1.7075	19	21.1647	-2.165	13.263	-0.1038
	6	#N/A	13.62	1.4682	20	18.1882	1.812	13.263	-0.1038
	7	#N/A	12.01	0.9162	11	11.3452	-0.345	13.263	-0.1038
	8	#N/A	10.61	1.5085	16	18.6702	-2.670	13.263	-0.1038
	9	#N/A	10.31	1.3582	14	16.8036	-2.804	13.263	-0.1038
	10	#N/A	9.29	1.0765	10	13.3140	-3.314	13.263	-0.1038
	11	#N/A	6.97	0.5741	4	7.0983	-3.098	13.263	-0.1038
	12	#N/A	6.01	0.4989	3	6.1667	-3.167	13.263	-0.1038
1994	1	#N/A	7.25	0.4136	3	5.1105	-2.111	13.263	-0.1038
	2	#N/A	12.86	0.4665	6	5.7630	0.237	13.263	-0.1038
	3	#N/A	12.08	0.7451	9	9.2032	-0.203	13.263	-0.1038
	4	#N/A	10.26	1.2667	13	15.6429	-2.643	13.263	-0.1038
	5	#N/A	10.54	1.7075	18	21.0825	-3.082	13.263	-0.1038
	6	#N/A	8.85	1.4682	13	18.1246	-5.125	13.263	-0.1038
	7	#N/A	9.82	0.9162	9	11.3095	-2.309	13.263	-0.1038
	8	#N/A	10.61	1.5085	16	18.6172	-2.617	13.263	-0.1038
	9	#N/A	11.04	1.3582	15	16.7607	-1.761	13.263	-0.1038
	10	#N/A	11.15	1.0765	12	13.2834	-1.283	13.263	-0.1038
	11	#N/A	8.71	0.5741	5	7.0836	-2.084	13.263	-0.1038
	12	#N/A	8.02	0.4989	4	6.1552	-2.155	13.263	-0.1038
1995	1	#N/A	16.93	0.4136	7	5.1020	1.898	13.263	-0.1038
	2	#N/A	8.57	0.4665	4	5.7543	-1.754	13.263	-0.1038
	3	#N/A	24.16	0.7451	18	9.1907	8.809	13.263	-0.1038
	4	#N/A	14.21	1.2667	18	15.6237	2.376	13.263	-0.1038
	5	#N/A		1.7075	#N/A	#N/A	#N/A	13.263	-0.1038
	6	#N/A		1.4682	#N/A	#N/A	#N/A	13.263	-0.1038
	7	#N/A		0.9162	#N/A	#N/A	#N/A	13.263	-0.1038
	8	#N/A		1.5085	#N/A	#N/A	#N/A	13.263	-0.1038
	9	#N/A		1.3582	#N/A	#N/A	#N/A	13.263	-0.1038
	10	#N/A		1.0765	#N/A	#N/A	#N/A	13.263	-0.1038
	11	#N/A		0.5741	#N/A	#N/A	#N/A	13.263	-0.1038
	12	#N/A		0.4989	#N/A	#N/A	#N/A	13.263	-0.1038
1996	1	#N/A		0.4136	#N/A	#N/A	#N/A	13.263	-0.1038
	2	#N/A		0.4665	#N/A	#N/A	#N/A	13.263	-0.1038
	3	#N/A		0.7451	#N/A	#N/A	#N/A	13.263	-0.1038
	4	#N/A		1.2667	#N/A	#N/A	#N/A	13.263	-0.1038
	5	#N/A		1.7075	#N/A	#N/A	#N/A	13.263	-0.1038
	6	#N/A		1.4682	#N/A	#N/A	#N/A	13.263	-0.1038
	7	#N/A		0.9162	#N/A	#N/A	#N/A	13.263	-0.1038
	8	#N/A		1.5085	#N/A	#N/A	#N/A	13.263	-0.1038
	9	#N/A		1.3582	#N/A	#N/A	#N/A	13.263	-0.1038

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

Reset worksheet
Load data file
Extract data file
Run
Graph forecasts
Graph errors
Compute MSE table

Title1: Trend/Seasonal #4
Title2: Beconage AQ
X-axis: MONTH
Y-axis: DEMAND

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:
======== ========

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	BECONAGE AQ						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					523.880	2.1451
1991	5	1	443.74	0.6919	307	363.7835	-56.784	523.880	2.1451
	6	#N/A	472.88	0.8163	386	430.6236	-44.624	523.880	2.1451
	7	#N/A	603.37	0.6861	414	363.0459	50.954	523.880	2.1451
	8	#N/A	464.37	1.0164	472	539.2395	-67.240	523.880	2.1451
	9	#N/A	475.40	1.1212	533	596.2189	-63.219	523.880	2.1451
	10	#N/A	573.50	1.0497	602	559.4083	42.592	523.880	2.1451
	11	#N/A	532.89	1.0940	583	584.1578	-1.158	523.880	2.1451
	12	#N/A	567.32	1.0858	616	580.7710	35.229	523.880	2.1451
1992	1	#N/A	582.13	1.0599	617	567.7977	49.202	523.880	2.1451
	2	#N/A	600.40	1.0560	634	566.4769	67.523	523.880	2.1451
	3	#N/A	565.37	1.1851	670	636.5289	33.471	523.880	2.1451
	4	#N/A	574.86	1.1377	654	611.7613	42.239	523.880	2.1451
	5	#N/A	598.39	0.6919	414	372.4095	41.591	523.880	2.1451
	6	#N/A	547.61	0.8163	447	439.7831	7.217	523.880	2.1451

	7	#N/A	593.17	0.6861	407	369.9753	37.025	523.880	2.1451
	8	#N/A	611.94	1.0164	622	548.4781	73.522	523.880	2.1451
	9	#N/A	581.54	1.1212	652	605.3903	46.610	523.880	2.1451
	10	#N/A	553.50	1.0497	581	567.1363	13.864	523.880	2.1451
	11	#N/A	554.83	1.0940	607	591.4068	15.593	523.880	2.1451
	12	#N/A	586.66	1.0858	637	587.2461	49.754	523.880	2.1451
1993	1	#N/A	548.16	1.0599	581	573.4863	7.514	523.880	2.1451
	2	#N/A	503.80	1.0560	532	571.5776	-39.578	523.880	2.1451
	3	#N/A	541.74	1.1851	642	641.6807	0.319	523.880	2.1451
	4	#N/A	559.92	1.1377	637	616.2125	20.787	523.880	2.1451
	5	#N/A	582.49	0.6919	403	374.8457	28.154	523.880	2.1451
	6	#N/A	597.84	0.8163	488	442.3700	45.630	523.880	2.1451
	7	#N/A	572.77	0.6861	393	371.9324	21.068	523.880	2.1451
	8	#N/A	562.75	1.0164	572	551.0873	20.913	523.880	2.1451
	9	#N/A	570.84	1.1212	640	607.9805	32.019	523.880	2.1451
	10	#N/A	592.55	1.0497	622	569.3189	52.681	523.880	2.1451
	11	#N/A	601.45	1.0940	658	593.4541	64.546	523.880	2.1451
	12	#N/A	553.51	1.0858	601	589.0748	11.925	523.880	2.1451
1994	1	#N/A	586.84	1.0599	622	575.0929	46.907	523.880	2.1451
	2	#N/A	611.76	1.0560	646	573.0182	72.982	523.880	2.1451
	3	#N/A	618.53	1.1851	733	643.1357	89.864	523.880	2.1451
	4	#N/A	599.47	1.1377	682	617.4697	64.530	523.880	2.1451
	5	#N/A	553.59	0.6919	383	375.5338	7.466	523.880	2.1451
	6	#N/A	595.39	0.8163	486	443.1006	42.899	523.880	2.1451
	7	#N/A	572.77	0.6861	393	372.4851	20.515	523.880	2.1451
	8	#N/A	563.73	1.0164	573	551.8242	21.176	523.880	2.1451
	9	#N/A	577.08	1.1212	647	608.7121	38.288	523.880	2.1451
	10	#N/A	591.60	1.0497	621	569.9354	51.065	523.880	2.1451
	11	#N/A	594.13	1.0940	650	594.0324	55.968	523.880	2.1451
	12	#N/A	543.37	1.0858	590	589.5913	0.409	523.880	2.1451
1995	1	#N/A	578.35	1.0599	613	575.5466	37.453	523.880	2.1451
	2	#N/A	498.12	1.0560	526	573.4250	-47.425	523.880	2.1451
	3	#N/A	642.16	1.1851	761	643.5467	117.453	523.880	2.1451
	4	#N/A	582.77	1.1377	663	617.8247	45.175	523.880	2.1451
	5	#N/A		0.6919	#N/A	#N/A	#N/A	523.880	2.1451
	6	#N/A		0.8163	#N/A	#N/A	#N/A	523.880	2.1451
	7	#N/A		0.6861	#N/A	#N/A	#N/A	523.880	2.1451
	8	#N/A		1.0164	#N/A	#N/A	#N/A	523.880	2.1451
	9	#N/A		1.1212	#N/A	#N/A	#N/A	523.880	2.1451
	10	#N/A		1.0497	#N/A	#N/A	#N/A	523.880	2.1451
	11	#N/A		1.0940	#N/A	#N/A	#N/A	523.880	2.1451
	12	#N/A		1.0858	#N/A	#N/A	#N/A	523.880	2.1451
1996	1	#N/A		1.0599	#N/A	#N/A	#N/A	523.880	2.1451
	2	#N/A		1.0560	#N/A	#N/A	#N/A	523.880	2.1451
	3	#N/A		1.1851	#N/A	#N/A	#N/A	523.880	2.1451
	4	#N/A		1.1377	#N/A	#N/A	#N/A	523.880	2.1451
	5	#N/A		0.6919	#N/A	#N/A	#N/A	523.880	2.1451
	6	#N/A		0.8163	#N/A	#N/A	#N/A	523.880	2.1451
	7	#N/A		0.6861	#N/A	#N/A	#N/A	523.880	2.1451
	8	#N/A		1.0164	#N/A	#N/A	#N/A	523.880	2.1451
	9	#N/A		1.1212	#N/A	#N/A	#N/A	523.880	2.1451

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

Reset worksheet
Load data file
Extract data file
Run
Graph forecasts
Graph errors
Compute MSE table

Title1: Trend/Seasonal #5
Title2: Benzonatate
X-axis: MONTH
Y-axis: DEMAND

INPUT:	
Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	BENZONATATE						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					0.000	0.0000
1991	5	1	154.42	1.0556	163	0.0000	163.000	0.000	0.0000
	6	#N/A	149.37	0.8168	122	0.0000	122.000	0.000	0.0000
	7	#N/A	188.02	0.5159	97	0.0000	97.000	0.000	0.0000
	8	#N/A	167.00	0.4850	81	0.0000	81.000	0.000	0.0000
	9	#N/A	120.96	0.6862	83	0.0000	83.000	0.000	0.0000
	10	#N/A	129.10	0.7746	100	0.0000	100.000	0.000	0.0000
	11	#N/A	145.29	1.0049	146	0.0000	146.000	0.000	0.0000
	12	#N/A	148.97	1.1613	173	0.0000	173.000	0.000	0.0000
1992	1	#N/A	146.54	1.3171	193	0.0000	193.000	0.000	0.0000
	2	#N/A	136.43	1.3707	187	0.0000	187.000	0.000	0.0000
	3	#N/A	143.27	1.4727	211	0.0000	211.000	0.000	0.0000
	4	#N/A	162.02	1.3394	217	0.0000	217.000	0.000	0.0000
	5	#N/A	161.05	1.0556	170	0.0000	170.000	0.000	0.0000
	6	#N/A	171.40	0.8168	140	0.0000	140.000	0.000	0.0000

	7	#N/A	180.26	0.5159	93	0.0000	93.000	0.000	0.0000
	8	#N/A	167.00	0.4850	81	0.0000	81.000	0.000	0.0000
	9	#N/A	161.76	0.6862	111	0.0000	111.000	0.000	0.0000
	10	#N/A	180.74	0.7746	140	0.0000	140.000	0.000	0.0000
	11	#N/A	162.21	1.0049	163	0.0000	163.000	0.000	0.0000
	12	#N/A	167.92	1.1613	195	0.0000	195.000	0.000	0.0000
1993	1	#N/A	182.22	1.3171	240	0.0000	240.000	0.000	0.0000
	2	#N/A	184.58	1.3707	253	0.0000	253.000	0.000	0.0000
	3	#N/A	171.11	1.4727	252	0.0000	252.000	0.000	0.0000
	4	#N/A	162.02	1.3394	217	0.0000	217.000	0.000	0.0000
	5	#N/A	178.11	1.0556	188	0.0000	188.000	0.000	0.0000
	6	#N/A	175.08	0.8168	143	0.0000	143.000	0.000	0.0000
	7	#N/A	170.57	0.5159	88	0.0000	88.000	0.000	0.0000
	8	#N/A	175.25	0.4850	85	0.0000	85.000	0.000	0.0000
	9	#N/A	179.25	0.6862	123	0.0000	123.000	0.000	0.0000
	10	#N/A	178.16	0.7746	138	0.0000	138.000	0.000	0.0000
	11	#N/A	191.07	1.0049	192	0.0000	192.000	0.000	0.0000
	12	#N/A	191.17	1.1613	222	0.0000	222.000	0.000	0.0000
1994	1	#N/A	180.70	1.3171	238	0.0000	238.000	0.000	0.0000
	2	#N/A	189.69	1.3707	260	0.0000	260.000	0.000	0.0000
	3	#N/A	196.24	1.4727	289	0.0000	289.000	0.000	0.0000
	4	#N/A	187.40	1.3394	251	0.0000	251.000	0.000	0.0000
	5	#N/A	175.26	1.0556	185	0.0000	185.000	0.000	0.0000
	6	#N/A	170.18	0.8168	139	0.0000	139.000	0.000	0.0000
	7	#N/A	168.63	0.5159	87	0.0000	87.000	0.000	0.0000
	8	#N/A	181.44	0.4850	88	0.0000	88.000	0.000	0.0000
	9	#N/A	187.99	0.6862	129	0.0000	129.000	0.000	0.0000
	10	#N/A	174.29	0.7746	135	0.0000	135.000	0.000	0.0000
	11	#N/A	186.10	1.0049	187	0.0000	187.000	0.000	0.0000
	12	#N/A	185.14	1.1613	215	0.0000	215.000	0.000	0.0000
1995	1	#N/A	160.20	1.3171	211	0.0000	211.000	0.000	0.0000
	2	#N/A	175.10	1.3707	240	0.0000	240.000	0.000	0.0000
	3	#N/A	184.69	1.4727	272	0.0000	272.000	0.000	0.0000
	4	#N/A	175.45	1.3394	235	0.0000	235.000	0.000	0.0000
	5	#N/A		1.0556	#N/A	#N/A	#N/A	0.000	0.0000
	6	#N/A		0.8168	#N/A	#N/A	#N/A	0.000	0.0000
	7	#N/A		0.5159	#N/A	#N/A	#N/A	0.000	0.0000
	8	#N/A		0.4850	#N/A	#N/A	#N/A	0.000	0.0000
	9	#N/A		0.6862	#N/A	#N/A	#N/A	0.000	0.0000
	10	#N/A		0.7746	#N/A	#N/A	#N/A	0.000	0.0000
	11	#N/A		1.0049	#N/A	#N/A	#N/A	0.000	0.0000
	12	#N/A		1.1613	#N/A	#N/A	#N/A	0.000	0.0000
1996	1	#N/A		1.3171	#N/A	#N/A	#N/A	0.000	0.0000
	2	#N/A		1.3707	#N/A	#N/A	#N/A	0.000	0.0000
	3	#N/A		1.4727	#N/A	#N/A	#N/A	0.000	0.0000
	4	#N/A		1.3394	#N/A	#N/A	#N/A	0.000	0.0000
	5	#N/A		1.0556	#N/A	#N/A	#N/A	0.000	0.0000
	6	#N/A		0.8168	#N/A	#N/A	#N/A	0.000	0.0000
	7	#N/A		0.5159	#N/A	#N/A	#N/A	0.000	0.0000
	8	#N/A		0.4850	#N/A	#N/A	#N/A	0.000	0.0000
	9	#N/A		0.6862	#N/A	#N/A	#N/A	0.000	0.0000

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

\R Reset worksheet
\L Load data file
e \E Extract data file
\G Run
\F Graph forecasts
\Z Graph errors
\M Compute MSE table

Title1: Trend/Seasonal #6
Title2: CTM 8
X-axis: Month
Y-axis: Demand

OUTPUT:

Data type	Monthly
Number of data	48

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:
======== ========

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	CTM 8						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5					0.000	0.0000
DATA TYPE		-1	12						
1991	5	1	111.60	1.4337	160	0.00	160.00	22.320	11.1600
	6	2	138.70	0.9661	134	31.27	102.73	53.630	20.6772
	7	3	68.42	0.4239	29	30.62	-1.62	71.475	18.2272
	8	4	96.88	0.2787	27	24.49	2.51	89.679	17.3043
	9	5	122.21	0.4500	55	47.37	7.63	108.645	17.2698
	10	6	119.41	0.7035	84	87.36	-3.36	123.232	15.0646
	11	7	122.34	0.9073	111	124.11	-13.11	133.899	12.1130
	12	8	124.02	0.9273	115	134.27	-19.27	140.645	8.8237
1992	1	9	110.32	1.2147	134	180.49	-46.49	140.932	4.1142
	2	10	108.32	1.3386	145	193.61	-48.61	137.372	0.0715
	3	11	102.80	1.7510	180	240.65	-60.65	130.509	-3.3995
	4	12	121.48	1.6052	195	204.58	-9.58	126.256	-3.6564
	5	13	136.71	1.4337	196	185.11	10.89	124.412	-2.5673
	6	14	124.20	0.9661	120	120.31	-0.31	122.039	-2.3417

	7	15	148.63	0.4239	63	50.81	12.19	125.688	0.7704
	8	16	139.93	0.2787	39	35.26	3.74	129.064	2.0347
	9	17	133.32	0.4500	60	59.00	1.00	131.339	2.0532
	10	18	112.30	0.7035	79	93.66	-14.66	129.018	-0.2366
	11	19	120.13	0.9073	109	116.74	-7.74	127.097	-1.0670
	12	20	124.02	0.9273	115	116.79	-1.79	125.750	-1.1535
1993	1	21	125.96	1.2147	153	151.08	1.92	125.030	-0.8793
	2	22	128.49	1.3386	172	165.87	6.13	125.157	-0.3319
	3	23	146.20	1.7510	256	218.05	37.95	129.205	1.8745
	4	24	135.19	1.6052	217	210.01	6.99	131.764	2.1229
	5	25	121.37	1.4337	174	201.35	-27.35	130.043	0.0950
	6	26	125.24	0.9661	121	128.21	-7.21	128.665	-0.6465
	7	27	141.55	0.4239	60	54.39	5.61	130.727	0.7405
	8	28	136.35	0.2787	38	36.69	1.31	132.329	1.1339
	9	29	131.10	0.4500	59	60.12	-1.12	132.854	0.7730
	10	30	157.79	0.7035	111	93.76	17.24	138.461	3.1510
	11	31	142.18	0.9073	129	127.98	1.02	141.522	2.9489
	12	32	143.43	0.9273	133	133.47	-0.47	144.075	2.6031
1994	1	33	158.89	1.2147	193	177.39	15.61	148.994	3.6310
	2	34	159.87	1.3386	214	203.35	10.65	153.856	4.0651
	3	35	147.34	1.7510	258	275.54	-17.54	155.509	2.6559
	4	36	137.68	1.6052	221	253.42	-32.42	153.859	0.3701
	5	37	136.01	1.4337	195	231.93	-36.93	149.282	-2.1220
	6	38	148.01	0.9661	143	145.12	-2.12	146.942	-2.1251
	7	39	99.09	0.4239	42	61.64	-19.64	135.786	-6.5340
	8	40	118.41	0.2787	33	36.29	-3.29	127.549	-7.0589
	9	41	135.54	0.4500	61	54.63	6.37	124.024	-4.9391
	10	42	140.73	0.7035	99	84.10	14.90	123.815	-2.3269
	11	43	138.87	0.9073	126	110.26	15.74	125.198	-0.3560
	12	44	73.33	0.9273	68	115.60	-47.60	114.593	-5.4625
1995	1	45	142.42	1.2147	173	132.99	40.01	116.275	-1.6170
	2	46	147.92	1.3386	198	153.43	44.57	121.491	1.8804
	3	47	156.48	1.7510	274	215.35	58.65	129.894	5.0475
	4	48	128.96	1.6052	207	215.48	-8.48	133.378	4.0135
	5	#N/A		1.4337	#N/A	#N/A	#N/A	133.378	4.0135
	6	#N/A		0.9661	#N/A	#N/A	#N/A	133.378	4.0135
	7	#N/A		0.4239	#N/A	#N/A	#N/A	133.378	4.0135
	8	#N/A		0.2787	#N/A	#N/A	#N/A	133.378	4.0135
	9	#N/A		0.4500	#N/A	#N/A	#N/A	133.378	4.0135
	10	#N/A		0.7035	#N/A	#N/A	#N/A	133.378	4.0135
	11	#N/A		0.9073	#N/A	#N/A	#N/A	133.378	4.0135
	12	#N/A		0.9273	#N/A	#N/A	#N/A	133.378	4.0135
1996	1	#N/A		1.2147	#N/A	#N/A	#N/A	133.378	4.0135
	2	#N/A		1.3386	#N/A	#N/A	#N/A	133.378	4.0135
	3	#N/A		1.7510	#N/A	#N/A	#N/A	133.378	4.0135
	4	#N/A		1.6052	#N/A	#N/A	#N/A	133.378	4.0135
	5	#N/A		1.4337	#N/A	#N/A	#N/A	133.378	4.0135
	6	#N/A		0.9661	#N/A	#N/A	#N/A	133.378	4.0135
	7	#N/A		0.4239	#N/A	#N/A	#N/A	133.378	4.0135
	8	#N/A		0.2787	#N/A	#N/A	#N/A	133.378	4.0135
	9	#N/A		0.4500	#N/A	#N/A	#N/A	133.378	4.0135

TRENDS	Trend and seasonal smoothing	\R	Reset worksheet
	Deseas. quarterly or monthly data	\L	Load data file
	Use SEASQTR/MON to prepare data file	\E	Extract data file
		\G	Run
		\F	Graph forecasts
		\Z	Graph errors
		\M	Compute MSE table

Title1: Trend/Seasonal #7
Title2: Dimetapp
X-axis: Month
Y-axis: Demand

OUTPUT:

Data type	Monthly
Number of data	48

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	DIMETAPP						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					128.119	0.9503
1991	5	1	129.38	0.6183	80	79.75	0.25	129.056	0.8960
	6	2	119.67	0.5850	70	75.96	-5.96	127.823	-0.2133
	7	3	137.06	0.4378	60	55.87	4.13	129.517	0.7509
	8	4	131.66	0.4557	60	59.33	0.67	130.485	0.8223
	9	5	157.82	0.7603	120	99.78	20.22	136.545	3.3997
	10	6	130.31	0.9976	130	139.27	-9.27	137.746	2.1305
	11	7	128.50	1.1907	153	166.30	-13.30	137.430	0.8006
	12	8	137.03	1.3063	179	180.47	-1.47	137.925	0.6080
1992	1	9	125.81	1.4308	180	198.12	-18.12	135.939	-0.7193
	2	10	137.92	1.6894	233	228.56	4.44	135.818	-0.3845
	3	11	133.73	1.3535	181	183.36	-2.36	135.123	-0.5204
	4	12	128.55	1.1746	151	158.17	-7.17	133.435	-1.0783
	5	13	145.55	0.6183	90	81.91	8.09	135.081	0.3381
	6	14	157.27	0.5850	92	79.13	12.87	139.788	2.5057

	7	15	143.91	0.4378	63	62.23	0.77	142.396	2.4316
	8	16	147.02	0.4557	67	65.90	1.10	145.068	2.4300
	9	17	130.20	0.7603	99	112.18	-13.18	143.794	0.4565
	10	18	157.38	0.9976	157	143.76	13.24	146.860	1.7386
	11	19	144.45	1.1907	172	176.59	-4.59	147.654	1.1792
	12	20	145.45	1.3063	190	194.26	-4.26	148.064	0.7355
1993	1	21	155.16	1.4308	222	212.59	9.41	150.042	1.3200
	2	22	137.33	1.6894	232	255.53	-23.53	148.444	-0.2047
	3	23	152.94	1.3535	207	200.64	6.36	149.200	0.2855
	4	24	155.80	1.1746	183	175.47	7.53	150.739	0.8982
	5	25	150.41	0.6183	93	93.80	-0.80	151.289	0.6793
	6	26	148.73	0.5850	87	88.93	-1.93	151.243	0.2824
	7	27	143.91	0.4378	63	66.38	-3.38	149.956	-0.5165
	8	28	144.82	0.4557	66	68.15	-2.15	148.549	-0.9357
	9	29	153.88	0.7603	117	112.39	4.61	148.918	-0.2366
	10	30	148.35	0.9976	148	148.38	-0.38	148.628	-0.2513
	11	31	163.77	1.1907	195	176.51	18.49	151.511	1.3280
	12	32	160.76	1.3063	210	199.42	10.58	154.326	2.0051
1994	1	33	164.95	1.4308	236	223.27	12.73	157.910	2.6944
	2	34	171.07	1.6894	289	270.66	18.34	162.507	3.5112
	3	35	160.33	1.3535	217	224.27	-7.27	164.593	2.6230
	4	36	164.31	1.1746	193	196.10	-3.10	166.426	2.0970
	5	37	152.02	0.6183	94	104.17	-10.17	165.028	0.2444
	6	38	143.60	0.5850	84	96.72	-12.72	160.902	-1.9530
	7	39	164.47	0.4378	72	69.69	2.31	160.199	-1.2305
	8	40	162.38	0.4557	74	72.50	1.50	159.750	-0.7782
	9	41	173.60	0.7603	132	121.07	10.93	161.920	0.7352
	10	42	151.36	0.9976	151	162.23	-11.23	160.332	-0.4634
	11	43	157.05	1.1907	187	190.40	-3.40	159.343	-0.7028
	12	44	137.03	1.3063	179	207.38	-28.38	154.368	-2.8042
1995	1	45	141.88	1.4308	203	217.27	-14.27	149.850	-3.5209
	2	46	155.09	1.6894	262	247.78	14.22	148.364	-2.3270
	3	47	145.55	1.3535	197	197.95	-0.95	146.130	-2.1643
	4	48	139.62	1.1746	164	169.32	-5.32	143.276	-2.4012
	5	#N/A		0.6183	#N/A	#N/A	#N/A	143.276	-2.4012
	6	#N/A		0.5850	#N/A	#N/A	#N/A	143.276	-2.4012
	7	#N/A		0.4378	#N/A	#N/A	#N/A	143.276	-2.4012
	8	#N/A		0.4557	#N/A	#N/A	#N/A	143.276	-2.4012
	9	#N/A		0.7603	#N/A	#N/A	#N/A	143.276	-2.4012
	10	#N/A		0.9976	#N/A	#N/A	#N/A	143.276	-2.4012
	11	#N/A		1.1907	#N/A	#N/A	#N/A	143.276	-2.4012
	12	#N/A		1.3063	#N/A	#N/A	#N/A	143.276	-2.4012
1996	1	#N/A		1.4308	#N/A	#N/A	#N/A	143.276	-2.4012
	2	#N/A		1.6894	#N/A	#N/A	#N/A	143.276	-2.4012
	3	#N/A		1.3535	#N/A	#N/A	#N/A	143.276	-2.4012
	4	#N/A		1.1746	#N/A	#N/A	#N/A	143.276	-2.4012
	5	#N/A		0.6183	#N/A	#N/A	#N/A	143.276	-2.4012
	6	#N/A		0.5850	#N/A	#N/A	#N/A	143.276	-2.4012
	7	#N/A		0.4378	#N/A	#N/A	#N/A	143.276	-2.4012
	8	#N/A		0.4557	#N/A	#N/A	#N/A	143.276	-2.4012
	9	#N/A		0.7603	#N/A	#N/A	#N/A	143.276	-2.4012

TRENDS	Trend and seasonal smoothing Deseas. quarterly or monthly data Use SEASQTR/MON to prepare data file	Reset worksheet Load data file Extract data file Run Graph forecasts Graph errors Compute MSE table

Title1: Trend/Seasonal #8
Title2: Diphenhydramine
X-axis: MONTH
Y-axis: DEMAND

INPUT:	
Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

OUTPUT:	
Data type	Monthly
Number of data	48.00

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	DIPHENHYDRAMINE						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					134.24	1.0299
1991	5	1	127.38	0.7536	96	101.87	-5.87	133.61	0.1483
	6	2	131.89	1.1525	152	154.14	-2.14	133.37	-0.0520
	7	3	132.77	1.0394	138	138.57	-0.57	133.22	-0.1019
	8	4	136.30	1.2620	172	168.00	4.00	133.76	0.2255
	9	5	135.12	1.3247	179	177.46	1.54	134.19	0.3190
	10	6	128.69	1.2045	155	161.97	-6.97	133.32	-0.2920
	11	7	145.72	1.0980	160	146.10	13.90	135.59	1.0028
	12	8	145.01	0.9103	132	124.25	7.75	138.20	1.7544
1992	1	9	129.65	0.9796	127	136.92	-9.92	137.75	0.5665
	2	10	133.70	0.7554	101	104.44	-3.44	137.35	0.0538
	3	11	123.18	0.7550	93	103.74	-10.74	134.55	-1.3735
	4	12	139.85	0.7651	107	102.00	5.00	134.62	-0.5824
	5	13	145.96	0.7536	110	101.01	8.99	136.49	0.6700
	6	14	149.24	1.1525	172	157.97	14.03	139.53	1.8202

	7	15	163.56	1.0394	170	146.71	23.29	145.65	3.8787
	8	16	166.41	1.2620	210	188.25	21.75	152.58	5.2140
	9	17	173.62	1.3247	230	208.36	21.64	160.54	6.3256
	10	18	171.03	1.2045	206	200.13	5.87	167.21	6.1803
	11	19	166.66	1.0980	183	189.88	-6.88	171.52	4.9358
	12	20	153.80	0.9103	140	160.27	-20.27	171.51	2.2168
1993	1	21	174.57	0.9796	171	169.83	1.17	173.74	2.1144
	2	22	178.71	0.7554	135	132.64	2.36	176.27	2.2152
	3	23	185.43	0.7550	140	134.45	5.55	179.74	2.7297
	4	24	175.14	0.7651	134	139.46	-5.46	180.77	1.7434
	5	25	163.21	0.7536	123	137.46	-14.46	178.50	-0.3486
	6	26	161.39	1.1525	186	205.51	-19.51	174.80	-2.0052
	7	27	152.98	1.0394	159	180.08	-21.08	168.95	-3.8295
	8	28	154.52	1.2620	195	209.14	-14.14	163.26	-4.5658
	9	29	151.73	1.3247	201	211.07	-10.07	157.64	-4.8685
	10	30	161.90	1.2045	195	184.56	10.44	154.99	-3.5149
	11	31	152.09	1.0980	167	166.80	0.20	151.86	-3.1455
	12	32	161.49	0.9103	147	135.57	11.43	151.54	-1.5738
1994	1	33	163.34	0.9796	160	146.96	13.04	152.79	-0.0844
	2	34	157.53	0.7554	119	115.35	3.65	153.68	0.4078
	3	35	165.56	0.7550	125	116.23	8.77	156.37	1.5289
	4	36	159.46	0.7651	122	120.70	1.30	158.09	1.5455
	5	37	167.19	0.7536	126	120.10	5.90	161.05	2.1748
	6	38	166.60	1.1525	192	187.82	4.18	163.73	2.3204
	7	39	161.64	1.0394	168	172.40	-4.40	164.97	1.6655
	8	40	160.07	1.2620	202	210.23	-8.23	165.17	0.8476
	9	41	157.77	1.3247	209	219.95	-10.95	164.28	-0.0634
	10	42	153.60	1.2045	185	197.88	-12.88	162.09	-1.1261
	11	43	156.64	1.0980	172	176.96	-4.96	160.17	-1.4653
	12	44	166.98	0.9103	152	144.62	7.38	160.47	-0.5078
1995	1	45	160.28	0.9796	157	156.77	0.23	160.06	-0.4340
	2	46	164.15	0.7554	124	120.64	3.36	160.56	0.0545
	3	47	176.16	0.7550	133	121.27	11.73	163.72	1.6023
	4	48	175.14	0.7651	134	126.38	7.62	167.15	2.4373
	5	#N/A		0.7536	#N/A	#N/A	#N/A	167.15	2.4373
	6	#N/A		1.1525	#N/A	#N/A	#N/A	167.15	2.4373
	7	#N/A		1.0394	#N/A	#N/A	#N/A	167.15	2.4373
	8	#N/A		1.2620	#N/A	#N/A	#N/A	167.15	2.4373
	9	#N/A		1.3247	#N/A	#N/A	#N/A	167.15	2.4373
	10	#N/A		1.2045	#N/A	#N/A	#N/A	167.15	2.4373
	11	#N/A		1.0980	#N/A	#N/A	#N/A	167.15	2.4373
	12	#N/A		0.9103	#N/A	#N/A	#N/A	167.15	2.4373
1996	1	#N/A		0.9796	#N/A	#N/A	#N/A	167.15	2.4373
	2	#N/A		0.7554	#N/A	#N/A	#N/A	167.15	2.4373
	3	#N/A		0.7550	#N/A	#N/A	#N/A	167.15	2.4373
	4	#N/A		0.7651	#N/A	#N/A	#N/A	167.15	2.4373
	5	#N/A		0.7536	#N/A	#N/A	#N/A	167.15	2.4373
	6	#N/A		1.1525	#N/A	#N/A	#N/A	167.15	2.4373
	7	#N/A		1.0394	#N/A	#N/A	#N/A	167.15	2.4373
	8	#N/A		1.2620	#N/A	#N/A	#N/A	167.15	2.4373
	9	#N/A		1.3247	#N/A	#N/A	#N/A	167.15	2.4373

TRENDS	Trend and seasonal smoothing	\R	Reset worksheet
	Deseas. quarterly or monthly data	\L	Load data file
	Use SEASQTR/MON to prepare data file	e \E	Extract data file
		\G	Run
		\F	Graph forecasts
		\Z	Graph errors
		\M	Compute MSE table

Title1: Trend/Seasonal #9
Title2: Humibid LA
X-axis: MONTH
Y-axis: DEMAND

INPUT:	
Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

OUTPUT:	
Data type	Monthly
Number of data	48.00

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	HUMIBID LA						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					193.94	1.7138
1991	5	1	185.01	0.6810	126	133.13	-7.13	193.39	0.4953
	6	2	194.76	0.6778	132	131.37	0.63	194.02	0.5381
	7	3	177.91	0.5733	102	111.51	-9.51	191.19	-1.1750
	8	4	195.10	0.6817	133	129.61	3.39	191.12	-0.5600
	9	5	229.54	0.8278	190	157.79	32.21	198.40	3.3877
	10	6	169.36	0.9270	157	186.75	-29.75	195.04	-0.1599
	11	7	217.24	1.0725	233	209.03	23.97	199.36	2.0914
	12	8	206.51	1.1477	237	230.96	6.04	202.30	2.4086
1992	1	9	225.35	1.3224	298	270.38	27.62	208.64	4.2568
	2	10	231.35	1.3702	317	291.14	25.86	216.25	5.7185
	3	11	228.32	1.5198	347	336.47	10.53	222.78	5.8393
	4	12	208.53	1.1989	250	273.39	-23.39	224.13	3.3043
	5	13	224.66	0.6810	153	154.58	-1.58	226.64	2.7413
	6	14	210.99	0.6778	143	155.29	-12.29	225.48	0.6542

	7	15	221.52	0.5733	127	129.50	-2.50	225.20	0.1526
	8	16	218.58	0.6817	149	153.65	-4.65	223.97	-0.5445
	9	17	229.54	0.8278	190	185.35	4.65	224.60	0.0704
	10	18	223.30	0.9270	207	207.92	-0.92	224.47	-0.0364
	11	19	216.31	1.0725	232	240.98	-8.98	222.76	-0.8694
	12	20	234.39	1.1477	269	254.82	14.18	224.45	0.4525
1993	1	21	218.55	1.3224	289	297.64	-8.64	223.55	-0.2454
	2	22	224.78	1.3702	308	306.28	1.72	223.58	-0.0956
	3	23	216.48	1.5198	329	339.77	-10.77	222.08	-0.7945
	4	24	233.55	1.1989	280	265.16	14.84	223.84	0.5238
	5	25	239.34	0.6810	163	152.67	10.33	227.35	1.9899
	6	26	250.83	0.6778	170	155.18	14.82	233.52	3.9787
	7	27	273.85	0.5733	157	135.79	21.21	244.50	7.2848
	8	28	253.78	0.6817	173	171.14	1.86	251.61	6.8296
	9	29	248.87	0.8278	206	213.83	-7.83	255.87	5.2030
	10	30	250.27	0.9270	232	241.12	-9.12	258.58	3.6972
	11	31	239.62	1.0725	257	281.11	-24.11	257.41	1.0811
	12	32	246.59	1.1477	283	296.78	-13.78	255.99	-0.2267
1994	1	33	245.02	1.3224	324	338.48	-14.48	253.59	-1.2980
	2	34	233.54	1.3702	320	346.20	-26.20	248.61	-3.0788
	3	35	248.06	1.5198	377	373.61	3.39	246.28	-2.5481
	4	36	251.90	1.1989	302	292.42	9.58	245.59	-1.4941
	5	37	233.47	0.6810	159	166.34	-7.34	242.09	-2.4223
	6	38	239.02	0.6778	162	162.63	-0.63	239.72	-2.2725
	7	39	207.56	0.5733	119	136.32	-17.32	231.63	-5.0657
	8	40	231.78	0.6817	158	154.80	3.20	228.01	-4.0903
	9	41	224.70	0.8278	186	186.03	-0.03	224.32	-3.6852
	10	42	230.85	0.9270	214	204.45	9.55	223.07	-2.2842
	11	43	243.35	1.0725	261	237.02	23.98	225.49	0.1808
	12	44	234.39	1.1477	269	259.06	9.94	227.38	1.0285
1995	1	45	232.92	1.3224	308	301.99	6.01	229.22	1.3800
	2	46	229.16	1.3702	314	315.83	-1.83	230.19	1.1082
	3	47	236.22	1.5198	359	351.39	7.61	232.19	1.4982
	4	48	223.54	1.1989	268	279.99	-11.99	231.54	0.3481
	5	#N/A		0.6810	#N/A	#N/A	#N/A	231.54	0.3481
	6	#N/A		0.6778	#N/A	#N/A	#N/A	231.54	0.3481
	7	#N/A		0.5733	#N/A	#N/A	#N/A	231.54	0.3481
	8	#N/A		0.6817	#N/A	#N/A	#N/A	231.54	0.3481
	9	#N/A		0.8278	#N/A	#N/A	#N/A	231.54	0.3481
	10	#N/A		0.9270	#N/A	#N/A	#N/A	231.54	0.3481
	11	#N/A		1.0725	#N/A	#N/A	#N/A	231.54	0.3481
	12	#N/A		1.1477	#N/A	#N/A	#N/A	231.54	0.3481
1996	1	#N/A		1.3224	#N/A	#N/A	#N/A	231.54	0.3481
	2	#N/A		1.3702	#N/A	#N/A	#N/A	231.54	0.3481
	3	#N/A		1.5198	#N/A	#N/A	#N/A	231.54	0.3481
	4	#N/A		1.1989	#N/A	#N/A	#N/A	231.54	0.3481
	5	#N/A		0.6810	#N/A	#N/A	#N/A	231.54	0.3481
	6	#N/A		0.6778	#N/A	#N/A	#N/A	231.54	0.3481
	7	#N/A		0.5733	#N/A	#N/A	#N/A	231.54	0.3481
	8	#N/A		0.6817	#N/A	#N/A	#N/A	231.54	0.3481
	9	#N/A		0.8278	#N/A	#N/A	#N/A	231.54	0.3481

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

\R Reset worksheet
\L Load data file
\E Extract data file
\G Run
\F Graph forecasts
\Z Graph errors
\M Compute MSE table

Title1: Trend/Seasonal #10
Title2: Atarax
X-axis: MONTH
Y-axis: DEMAND

OUTPUT:

Data type	Monthly
Number of data	48.00

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	ATARAX						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					142.74	0.7821
1991	5	1	108.74	0.7081	77	101.57	-24.57	136.50	-2.7663
	6	2	137.72	0.8713	120	116.77	3.23	134.76	-2.1188
	7	3	132.50	0.8377	111	111.29	-0.29	132.78	-1.9419
	8	4	166.67	0.9840	164	128.93	35.07	138.16	1.8162
	9	5	126.46	1.1704	148	163.61	-15.61	137.13	0.3007
	10	6	157.89	0.9690	153	133.14	19.86	141.50	2.3202
	11	7	160.61	0.8717	140	125.16	14.84	146.99	3.7912
	12	8	151.19	0.9128	138	137.28	0.72	150.56	3.4904
1992	1	9	152.31	1.1293	172	173.57	-1.57	153.42	3.0020
	2	10	134.83	1.0161	137	158.64	-21.64	151.86	0.5721
	3	11	167.93	1.3101	220	199.63	20.37	155.49	2.0700
	4	12	169.74	1.2195	207	191.90	15.10	159.83	3.1016
	5	13	142.64	0.7081	101	114.86	-13.86	158.70	0.8293
	6	14	157.23	0.8713	137	138.96	-1.96	158.99	0.5211

	7	15	167.12	0.8377	140	133.58	6.42	160.99	1.2350
	8	16	146.34	0.9840	144	159.92	-15.92	158.88	-0.5022
	9	17	164.90	1.1704	193	185.24	7.76	159.75	0.2121
	10	18	187.82	0.9690	182	155.21	26.79	165.46	2.9512
	11	19	170.94	0.8717	149	146.71	2.29	168.64	2.9181
	12	20	152.28	0.9128	139	156.34	-17.34	167.47	0.7265
1993	1	21	160.28	1.1293	181	189.85	-8.85	166.56	-0.1297
	2	22	175.18	1.0161	178	168.89	9.11	168.24	0.7813
	3	23	144.27	1.3101	189	221.55	-32.55	163.98	-1.7786
	4	24	150.06	1.2195	183	198.18	-15.18	159.89	-2.8443
	5	25	183.59	0.7081	130	110.98	19.02	162.72	0.1358
	6	26	164.12	0.8713	143	141.91	1.09	163.09	0.2476
	7	27	158.76	0.8377	133	136.88	-3.88	162.39	-0.2399
	8	28	170.73	0.9840	168	159.83	8.17	163.83	0.6134
	9	29	170.03	1.1704	199	192.29	6.71	165.53	1.1261
	10	30	126.93	0.9690	123	161.89	-38.89	158.55	-2.9875
	11	31	129.64	0.8717	113	136.03	-23.03	150.58	-5.3276
	12	32	177.48	0.9128	162	132.93	29.07	152.16	-1.6062
1994	1	33	170.90	1.1293	193	170.11	22.89	154.77	0.5825
	2	34	177.14	1.0161	180	157.66	22.34	159.70	2.7245
	3	35	174.04	1.3101	228	212.32	15.68	164.54	3.6497
	4	36	170.56	1.2195	208	204.67	3.33	168.37	3.5576
	5	37	166.64	0.7081	118	121.23	-3.23	170.66	2.7440
	6	38	173.30	0.8713	151	150.88	0.12	173.16	2.4830
	7	39	169.50	0.8377	142	146.96	-4.96	174.21	1.6431
	8	40	180.90	0.9840	178	173.23	4.77	176.65	1.9624
	9	41	164.90	1.1704	193	208.78	-15.78	175.72	0.4180
	10	42	185.76	0.9690	180	170.75	9.25	178.01	1.3307
	11	43	185.85	0.8717	162	156.14	5.86	180.55	1.8704
	12	44	161.05	0.9128	147	166.51	-19.51	177.97	-0.4520
1995	1	45	171.79	1.1293	194	200.67	-6.67	176.38	-0.9969
	2	46	169.27	1.0161	172	178.40	-6.40	174.22	-1.5268
	3	47	163.35	1.3101	214	226.49	-12.49	170.94	-2.3275
	4	48	150.06	1.2195	183	205.95	-22.95	165.08	-3.9760
	5	#N/A		0.7081	#N/A	#N/A	#N/A	165.08	-3.9760
	6	#N/A		0.8713	#N/A	#N/A	#N/A	165.08	-3.9760
	7	#N/A		0.8377	#N/A	#N/A	#N/A	165.08	-3.9760
	8	#N/A		0.9840	#N/A	#N/A	#N/A	165.08	-3.9760
	9	#N/A		1.1704	#N/A	#N/A	#N/A	165.08	-3.9760
	10	#N/A		0.9690	#N/A	#N/A	#N/A	165.08	-3.9760
	11	#N/A		0.8717	#N/A	#N/A	#N/A	165.08	-3.9760
	12	#N/A		0.9128	#N/A	#N/A	#N/A	165.08	-3.9760
1996	1	#N/A		1.1293	#N/A	#N/A	#N/A	165.08	-3.9760
	2	#N/A		1.0161	#N/A	#N/A	#N/A	165.08	-3.9760
	3	#N/A		1.3101	#N/A	#N/A	#N/A	165.08	-3.9760
	4	#N/A		1.2195	#N/A	#N/A	#N/A	165.08	-3.9760
	5	#N/A		0.7081	#N/A	#N/A	#N/A	165.08	-3.9760
	6	#N/A		0.8713	#N/A	#N/A	#N/A	165.08	-3.9760
	7	#N/A		0.8377	#N/A	#N/A	#N/A	165.08	-3.9760
	8	#N/A		0.9840	#N/A	#N/A	#N/A	165.08	-3.9760
	9	#N/A		1.1704	#N/A	#N/A	#N/A	165.08	-3.9760

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

\R Reset worksheet
\L Load data file
\E Extract data file
\G Run
\F Graph forecasts
\Z Graph errors
\M Compute MSE table

Title1: Trend/Seasonal #11
Title2: Aftin
X-axis: MONTH
Y-axis: DEMAND

OUTPUT:
Data type Monthly
Number of data 48

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	AFTIN						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					110.883	0.5472
1991	5	1	70.94	0.5638	40	62.80	-22.80	103.288	-3.5508
	6	2	84.79	0.4246	36	42.50	-6.50	97.032	-4.7261
	7	3	82.39	0.2792	23	25.90	-2.90	90.701	-5.2925
	8	4	93.43	0.4709	44	40.47	3.53	87.436	-4.0140
	9	5	113.96	0.9301	106	77.97	28.03	89.851	-0.5989
	10	6	104.73	0.9739	102	86.98	15.02	92.396	1.0031
	11	7	144.65	0.9886	143	92.24	50.76	103.568	6.0377
	12	8	125.73	1.2726	160	138.72	21.28	112.347	7.1065
1992	1	9	117.04	1.3927	163	165.37	-2.37	118.403	6.2258
	2	10	148.24	1.4705	218	182.36	35.64	128.854	8.0270
	3	11	126.64	1.7688	224	240.70	-16.70	134.190	6.2801
	4	12	114.06	1.4642	167	204.75	-37.75	134.685	3.0736
	5	13	133.02	0.5638	75	77.20	-2.20	136.669	2.3750
	6	14	143.67	0.4246	61	58.84	2.16	139.825	2.6467

	7	15	154.03	0.2792	43	39.65	3.35	144.607	3.5821
	8	16	165.63	0.4709	78	69.68	8.32	151.361	4.9892
	9	17	124.71	0.9301	116	145.45	-29.45	149.540	1.3345
	10	18	129.38	0.9739	126	147.05	-21.05	146.425	-0.9570
	11	19	134.53	0.9886	133	144.62	-11.62	143.225	-2.0308
	12	20	121.80	1.2726	155	180.21	-25.21	137.441	-3.8057
1993	1	21	120.63	1.3927	168	186.61	-18.61	131.343	-4.7617
	2	22	106.76	1.4705	157	187.19	-30.19	122.958	-6.3350
	3	23	122.68	1.7688	217	207.26	9.74	118.359	-5.1506
	4	24	124.30	1.4642	182	166.19	15.81	115.887	-3.5538
	5	25	129.47	0.5638	73	63.27	9.73	116.154	-1.4658
	6	26	115.41	0.4246	49	48.70	0.30	114.977	-1.2478
	7	27	103.88	0.2792	29	31.77	-2.77	111.866	-2.1170
	8	28	93.43	0.4709	44	51.89	-7.89	106.617	-3.5773
	9	29	106.43	0.9301	99	96.29	2.71	103.978	-2.9290
	10	30	126.30	0.9739	123	98.72	24.28	106.328	-0.1432
	11	31	114.30	0.9886	113	105.42	7.58	107.726	0.6343
	12	32	127.30	1.2726	162	137.82	24.18	112.096	2.4706
1994	1	33	138.58	1.3927	193	159.02	33.98	119.205	4.6661
	2	34	122.40	1.4705	180	181.51	-1.51	123.199	4.0969
	3	35	128.90	1.7688	228	224.39	3.61	127.295	3.8915
	4	36	142.06	1.4642	208	191.32	16.68	133.077	4.6425
	5	37	118.83	0.5638	67	77.18	-10.18	133.635	2.3678
	6	38	120.12	0.4246	51	57.58	-6.58	132.664	0.5802
	7	39	121.79	0.2792	34	37.14	-3.14	130.937	-0.6026
	8	40	123.16	0.4709	58	61.44	-3.44	128.936	-1.2716
	9	41	145.14	0.9301	135	119.05	15.95	131.217	0.5683
	10	42	121.16	0.9739	118	128.62	-10.62	129.554	-0.5759
	11	43	104.19	0.9886	103	128.18	-25.18	123.965	-3.0535
	12	44	119.44	1.2726	152	154.53	-2.53	120.820	-2.9464
1995	1	45	131.40	1.3927	183	164.71	18.29	120.792	-1.3399
	2	46	116.28	1.4705	171	175.88	-4.88	118.923	-1.5377
	3	47	134.55	1.7688	238	207.89	30.11	120.944	0.3184
	4	48	132.50	1.4642	194	177.48	16.52	123.487	1.4150
	5	#N/A		0.5638	#N/A	#N/A	#N/A	123.487	1.4150
	6	#N/A		0.4246	#N/A	#N/A	#N/A	123.487	1.4150
	7	#N/A		0.2792	#N/A	#N/A	#N/A	123.487	1.4150
	8	#N/A		0.4709	#N/A	#N/A	#N/A	123.487	1.4150
	9	#N/A		0.9301	#N/A	#N/A	#N/A	123.487	1.4150
	10	#N/A		0.9739	#N/A	#N/A	#N/A	123.487	1.4150
	11	#N/A		0.9886	#N/A	#N/A	#N/A	123.487	1.4150
	12	#N/A		1.2726	#N/A	#N/A	#N/A	123.487	1.4150
1996	1	#N/A		1.3927	#N/A	#N/A	#N/A	123.487	1.4150
	2	#N/A		1.4705	#N/A	#N/A	#N/A	123.487	1.4150
	3	#N/A		1.7688	#N/A	#N/A	#N/A	123.487	1.4150
	4	#N/A		1.4642	#N/A	#N/A	#N/A	123.487	1.4150
	5	#N/A		0.5638	#N/A	#N/A	#N/A	123.487	1.4150
	6	#N/A		0.4246	#N/A	#N/A	#N/A	123.487	1.4150
	7	#N/A		0.2792	#N/A	#N/A	#N/A	123.487	1.4150
	8	#N/A		0.4709	#N/A	#N/A	#N/A	123.487	1.4150
	9	#N/A		0.9301	#N/A	#N/A	#N/A	123.487	1.4150

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

\R Reset worksheet
\L Load data file
\E Extract data file
\G Run
\F Graph forecasts
\Z Graph errors
\M Compute MSE table

Title1: Trend/Seasonal #12
Title2: RID
X-axis: MONTH
Y-axis: DEMAND

OUTPUT:

Data type	Monthly
Number of data	48

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:
======== ========

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	RID						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					121.978	0.4471
1991	5	1	6.26	0.3196	2	39.11	-37.11	99.156	-11.2098
	6	2	2.82	0.3551	1	31.62	-30.62	71.817	-18.7139
	7	3	32.36	0.2163	7	11.89	-4.89	50.452	-19.1038
	8	4	1.57	1.9130	3	63.62	-60.62	26.921	-20.3624
	9	5	0.00	1.9619	0	16.86	-16.86	6.876	-19.1857
	10	6	3.94	1.2699	5	-13.20	18.20	-7.526	-15.8342
	11	7	2.28	2.6334	6	-57.35	63.35	-16.965	-11.8453
	12	8	1.86	1.0732	2	-29.65	31.65	-21.728	-7.7118
1992	1	9	0.00	0.2417	0	-6.93	6.93	-22.935	-4.0737
	2	10	3.65	1.0967	4	-29.17	33.17	-20.552	-0.6415
	3	11	0.00	0.3849	0	-8.13	8.13	-16.903	1.5356
	4	12	5.61	0.5345	3	-8.30	11.30	-11.294	3.4954
	5	13	6.26	0.3196	2	-2.57	4.57	-5.252	4.5940
	6	14	8.45	0.3551	3	-0.39	3.39	0.816	5.1016

	7	15	0.00	0.2163	0	1.16	-1.16	4.326	4.0506
	8	16	3.66	1.9130	7	15.07	-8.07	7.118	3.2187
	9	17	6.63	1.9619	13	19.40	-6.40	9.354	2.5664
	10	18	1.57	1.2699	2	14.53	-12.53	9.652	1.3039
	11	19	5.32	2.6334	14	28.10	-14.10	9.739	0.6303
	12	20	0.00	1.0732	0	10.91	-10.91	8.245	-0.4634
1993	1	21	12.41	0.2417	3	1.87	1.13	8.776	0.0572
	2	22	3.65	1.0967	4	9.54	-5.54	7.803	-0.4611
	3	23	5.20	0.3849	2	2.81	-0.81	6.963	-0.6276
	4	24	1.87	0.5345	1	3.36	-2.36	5.500	-1.0139
	5	25	6.26	0.3196	2	1.41	0.59	4.972	-0.7200
	6	26	2.82	0.3551	1	1.70	-0.70	3.969	-0.8255
	7	27	0.00	0.2163	0	0.69	-0.69	2.581	-1.0656
	8	28	2.61	1.9130	5	3.05	1.95	1.830	-0.8551
	9	29	5.61	1.9619	11	2.05	8.95	1.988	-0.3058
	10	30	13.39	1.2699	17	2.11	14.89	4.128	0.9326
	11	31	3.42	2.6334	9	12.82	-3.82	4.671	0.6912
	12	32	13.98	1.0732	15	5.53	9.47	7.104	1.5276
1994	1	33	0.00	0.2417	0	2.03	-2.03	6.783	0.5269
	2	34	3.65	1.0967	4	7.79	-3.79	6.551	0.1211
	3	35	12.99	0.3849	5	2.52	2.48	7.967	0.7626
	4	36	7.48	0.5345	4	4.50	-0.50	8.461	0.5899
	5	37	0.00	0.3196	0	2.77	-2.77	7.193	-0.3683
	6	38	2.82	0.3551	1	2.68	-1.68	6.002	-0.7616
	7	39	18.49	0.2163	4	1.12	2.88	8.063	0.6878
	8	40	10.98	1.9130	21	16.41	4.59	9.168	0.8621
	9	41	3.06	1.9619	6	19.64	-13.64	8.562	0.0852
	10	42	2.36	1.2699	3	10.96	-7.96	7.384	-0.5508
	11	43	8.35	2.6334	22	17.73	4.27	7.221	-0.3296
	12	44	2.80	1.0732	3	7.33	-4.33	6.106	-0.7057
1995	1	45	16.55	0.2417	4	1.30	2.70	7.753	0.5059
	2	46	3.65	1.0967	4	8.76	-4.76	7.316	0.0091
	3	47	2.60	0.3849	1	2.80	-1.80	6.383	-0.4624
	4	48	3.74	0.5345	2	3.10	-1.10	5.543	-0.6279
	5	#N/A		0.3196	#N/A	#N/A	#N/A	5.543	-0.6279
	6	#N/A		0.3551	#N/A	#N/A	#N/A	5.543	-0.6279
	7	#N/A		0.2163	#N/A	#N/A	#N/A	5.543	-0.6279
	8	#N/A		1.9130	#N/A	#N/A	#N/A	5.543	-0.6279
	9	#N/A		1.9619	#N/A	#N/A	#N/A	5.543	-0.6279
	10	#N/A		1.2699	#N/A	#N/A	#N/A	5.543	-0.6279
	11	#N/A		2.6334	#N/A	#N/A	#N/A	5.543	-0.6279
	12	#N/A		1.0732	#N/A	#N/A	#N/A	5.543	-0.6279
1996	1	#N/A		0.2417	#N/A	#N/A	#N/A	5.543	-0.6279
	2	#N/A		1.0967	#N/A	#N/A	#N/A	5.543	-0.6279
	3	#N/A		0.3849	#N/A	#N/A	#N/A	5.543	-0.6279
	4	#N/A		0.5345	#N/A	#N/A	#N/A	5.543	-0.6279
	5	#N/A		0.3196	#N/A	#N/A	#N/A	5.543	-0.6279
	6	#N/A		0.3551	#N/A	#N/A	#N/A	5.543	-0.6279
	7	#N/A		0.2163	#N/A	#N/A	#N/A	5.543	-0.6279
	8	#N/A		1.9130	#N/A	#N/A	#N/A	5.543	-0.6279
	9	#N/A		1.9619	#N/A	#N/A	#N/A	5.543	-0.6279

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

\R Reset worksheet
\L Load data file
\E Extract data file
\G Run
\F Graph forecasts
\Z Graph errors
\M Compute MSE table

Title1: Trend/Seasonal #13
Title2: Robitussin DM
X-axis: MONTH
Y-axis: DEMAND

OUTPUT:

Data type	Monthly
Number of data	48

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	ROBITUSSIN						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					170.584	1.3246
1991	5	1	158.53	0.7569	120	130.03	-10.03	169.128	-0.1323
	6	2	152.51	0.5377	82	90.87	-8.87	165.708	-1.7694
	7	3	161.74	0.4390	71	72.04	-1.04	163.639	-1.8304
	8	4	177.85	0.4779	85	77.42	7.58	165.164	-0.0613
	9	5	169.95	0.8767	149	144.75	4.25	166.078	0.4292
	10	6	184.85	1.1198	207	186.41	20.59	170.142	2.2252
	11	7	187.79	1.3473	253	231.92	21.08	175.273	3.5670
	12	8	182.52	1.4409	263	257.18	5.82	179.291	3.6139
1992	1	9	185.14	1.3612	252	248.47	3.53	183.062	3.5118
	2	10	180.60	1.3234	239	246.44	-7.44	185.098	2.5983
	3	11	183.26	1.2987	238	243.43	-5.43	186.601	1.9207
	4	12	196.96	1.0205	201	192.19	8.81	190.056	2.5921
	5	13	199.49	0.7569	151	145.51	5.49	193.840	3.0582
	6	14	187.84	0.5377	101	105.60	-4.60	194.880	1.8961

	7	15	205.02	0.4390	90	86.29	3.71	198.278	2.5526
	8	16	209.24	0.4779	100	95.95	4.05	202.268	3.1436
	9	17	197.33	0.8767	173	179.86	-6.86	203.532	2.0465
	10	18	212.54	1.1198	238	230.23	7.77	206.760	2.5351
	11	19	207.83	1.3473	280	281.89	-1.89	208.762	2.1418
	12	20	203.34	1.4409	293	303.66	-10.66	209.211	1.1880
1993	1	21	181.46	1.3612	247	286.27	-39.27	204.511	-1.8151
	2	22	202.51	1.3234	268	268.40	-0.40	202.817	-1.6639
	3	23	196.35	1.2987	255	261.40	-6.40	200.334	-1.9902
	4	24	195.00	1.0205	199	202.70	-3.70	197.817	-2.1539
	5	25	206.09	0.7569	156	148.21	7.79	197.938	-0.9088
	6	26	223.18	0.5377	120	105.84	14.16	202.396	1.8200
	7	27	209.57	0.4390	92	89.59	2.41	205.130	2.1860
	8	28	188.32	0.4779	90	99.11	-9.11	203.289	0.0632
	9	29	201.89	0.8767	177	178.26	-1.26	203.059	-0.0868
	10	30	183.07	1.1198	205	227.62	-22.62	198.946	-2.0954
	11	31	202.63	1.3473	273	265.71	7.29	198.141	-1.3453
	12	32	209.59	1.4409	302	283.73	18.27	199.467	0.0574
1994	1	33	231.42	1.3612	315	271.23	43.77	205.958	3.2712
	2	34	216.11	1.3234	286	276.37	9.63	210.358	3.6723
	3	35	220.99	1.2987	287	277.36	9.64	215.149	4.0479
	4	36	210.68	1.0205	215	223.34	-8.34	217.159	2.8265
	5	37	199.49	0.7569	151	166.32	-15.32	215.655	0.5200
	6	38	195.28	0.5377	105	116.19	-11.19	211.960	-1.6135
	7	39	193.63	0.4390	85	92.46	-7.46	207.110	-3.1508
	8	40	211.33	0.4779	101	97.67	3.33	205.667	-2.1394
	9	41	214.44	0.8767	188	178.59	9.41	205.888	-0.8524
	10	42	218.79	1.1198	245	229.79	15.21	207.837	0.5907
	11	43	197.44	1.3473	266	281.03	-15.03	206.139	-0.5831
	12	44	199.18	1.4409	287	296.43	-9.43	204.306	-1.1788
1995	1	45	185.14	1.3612	252	276.73	-24.73	199.612	-2.8772
	2	46	218.38	1.3234	289	260.74	28.26	201.294	-0.4542
	3	47	198.66	1.2987	258	260.86	-2.86	200.444	-0.6290
	4	48	204.80	1.0205	209	203.95	5.05	200.868	-0.0714
	5	#N/A		0.7569	#N/A	#N/A	#N/A	200.868	-0.0714
	6	#N/A		0.5377	#N/A	#N/A	#N/A	200.868	-0.0714
	7	#N/A		0.4390	#N/A	#N/A	#N/A	200.868	-0.0714
	8	#N/A		0.4779	#N/A	#N/A	#N/A	200.868	-0.0714
	9	#N/A		0.8767	#N/A	#N/A	#N/A	200.868	-0.0714
	10	#N/A		1.1198	#N/A	#N/A	#N/A	200.868	-0.0714
	11	#N/A		1.3473	#N/A	#N/A	#N/A	200.868	-0.0714
	12	#N/A		1.4409	#N/A	#N/A	#N/A	200.868	-0.0714
1996	1	#N/A		1.3612	#N/A	#N/A	#N/A	200.868	-0.0714
	2	#N/A		1.3234	#N/A	#N/A	#N/A	200.868	-0.0714
	3	#N/A		1.2987	#N/A	#N/A	#N/A	200.868	-0.0714
	4	#N/A		1.0205	#N/A	#N/A	#N/A	200.868	-0.0714
	5	#N/A		0.7569	#N/A	#N/A	#N/A	200.868	-0.0714
	6	#N/A		0.5377	#N/A	#N/A	#N/A	200.868	-0.0714
	7	#N/A		0.4390	#N/A	#N/A	#N/A	200.868	-0.0714
	8	#N/A		0.4779	#N/A	#N/A	#N/A	200.868	-0.0714
	9	#N/A		0.8767	#N/A	#N/A	#N/A	200.868	-0.0714

TRENDS Trend and seasonal smoothing
Deseas. quarterly or monthly data
Use SEASQTR/MON to prepare data file

\R Reset worksheet
\L Load data file
\E Extract data file
\G Run
\F Graph forecasts
\Z Graph errors
\M Compute MSE table

Title1: Trend/Seasonal #14
Title2: Sunscreen
X-axis: MONTH
Y-axis: DEMAND

OUTPUT:

Data type	Monthly
Number of data	48

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	SUNSCREEN						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					26.891	-0.1222
1991	5	1	20.62	1.1156	23	29.88	-6.88	25.548	-0.7264
	6	2	22.51	1.3330	30	33.18	-3.18	24.417	-0.8926
	7	3	26.11	1.3021	34	30.75	3.25	24.113	-0.5534
	8	4	25.11	1.3941	35	32.92	2.08	23.913	-0.3491
	9	5	23.21	1.3788	32	32.54	-0.54	23.521	-0.3532
	10	6	28.38	1.0570	30	24.53	5.47	24.239	0.2000
	11	7	27.66	0.6869	19	16.77	2.23	25.067	0.5043
	12	8	36.55	0.5198	19	13.26	5.74	27.728	1.5573
1992	1	9	26.58	0.5643	15	16.44	-1.44	28.620	1.1466
	2	10	25.19	0.6352	16	18.83	-2.83	28.759	0.5857
	3	11	21.81	0.8711	19	25.51	-6.51	27.791	-0.2204
	4	12	24.52	1.1421	28	31.51	-3.51	26.978	-0.5059
	5	13	21.51	1.1156	24	29.52	-5.52	25.531	-0.9511
	6	14	24.76	1.3330	33	32.86	0.14	24.696	-0.8454

	7	15	28.42	1.3021	37	31.20	5.80	24.826	-0.3157
	8	16	28.69	1.3941	40	34.24	5.76	25.368	0.1291
	9	17	25.38	1.3788	35	35.13	-0.13	25.465	0.1066
	10	18	21.76	1.0570	23	27.08	-4.08	24.791	-0.2888
	11	19	29.12	0.6869	20	16.87	3.13	25.441	0.1949
	12	20	26.94	0.5198	14	13.37	0.63	25.859	0.2966
1993	1	21	28.35	0.5643	16	14.73	1.27	26.576	0.4921
	2	22	26.76	0.6352	17	17.14	-0.14	26.976	0.4215
	3	23	27.55	0.8711	24	23.77	0.23	27.409	0.4063
	4	24	22.77	1.1421	26	31.68	-5.68	26.778	-0.1327
	5	25	26.89	1.1156	30	29.61	0.39	26.729	-0.0845
	6	26	25.51	1.3330	34	35.49	-1.49	26.428	-0.1883
	7	27	19.97	1.3021	26	34.29	-8.29	24.990	-0.8041
	8	28	21.52	1.3941	30	33.91	-3.91	23.707	-1.0033
	9	29	24.66	1.3788	34	31.44	2.56	23.176	-0.7170
	10	30	25.54	1.0570	27	23.83	3.17	23.130	-0.3454
	11	31	18.93	0.6869	13	15.72	-2.72	22.029	-0.7060
	12	32	11.54	0.5198	6	11.17	-5.17	19.413	-1.6255
1994	1	33	19.49	0.5643	11	10.13	0.87	18.259	-1.3087
	2	34	22.04	0.6352	14	10.83	3.17	18.080	-0.6783
	3	35	24.11	0.8711	21	15.18	5.82	18.810	0.0595
	4	36	26.27	1.1421	30	21.48	8.52	20.360	0.8020
	5	37	25.10	1.1156	28	23.42	4.58	21.906	1.1340
	6	38	23.26	1.3330	31	30.52	0.48	22.999	1.0567
	7	39	25.34	1.3021	33	31.19	1.81	24.228	1.0897
	8	40	23.67	1.3941	33	35.18	-2.18	24.896	0.8244
	9	41	23.93	1.3788	33	35.37	-2.37	25.294	0.5701
	10	42	27.44	1.0570	29	27.33	1.67	26.123	0.6709
	11	43	24.75	0.6869	17	18.38	-1.38	26.325	0.4030
	12	44	34.63	0.5198	18	13.86	4.14	28.281	1.1594
1995	1	45	31.90	0.5643	18	16.56	1.44	29.833	1.2981
	2	46	34.64	0.6352	22	19.71	2.29	31.721	1.5277
	3	47	34.44	0.8711	30	28.86	1.14	33.357	1.5059
	4	48	25.39	1.1421	29	39.67	-10.67	32.845	0.4216
	5	#N/A		1.1156	#N/A	#N/A	#N/A	32.845	0.4216
	6	#N/A		1.3330	#N/A	#N/A	#N/A	32.845	0.4216
	7	#N/A		1.3021	#N/A	#N/A	#N/A	32.845	0.4216
	8	#N/A		1.3941	#N/A	#N/A	#N/A	32.845	0.4216
	9	#N/A		1.3788	#N/A	#N/A	#N/A	32.845	0.4216
	10	#N/A		1.0570	#N/A	#N/A	#N/A	32.845	0.4216
	11	#N/A		0.6869	#N/A	#N/A	#N/A	32.845	0.4216
	12	#N/A		0.5198	#N/A	#N/A	#N/A	32.845	0.4216
1996	1	#N/A		0.5643	#N/A	#N/A	#N/A	32.845	0.4216
	2	#N/A		0.6352	#N/A	#N/A	#N/A	32.845	0.4216
	3	#N/A		0.8711	#N/A	#N/A	#N/A	32.845	0.4216
	4	#N/A		1.1421	#N/A	#N/A	#N/A	32.845	0.4216
	5	#N/A		1.1156	#N/A	#N/A	#N/A	32.845	0.4216
	6	#N/A		1.3330	#N/A	#N/A	#N/A	32.845	0.4216
	7	#N/A		1.3021	#N/A	#N/A	#N/A	32.845	0.4216
	8	#N/A		1.3941	#N/A	#N/A	#N/A	32.845	0.4216
	9	#N/A		1.3788	#N/A	#N/A	#N/A	32.845	0.4216

TRENDS	Trend and seasonal smoothing	
	Deseas. quarterly or monthly data	
	Use SEASQTR/MON to prepare data file	

\R	Reset worksheet
\L	Load data file
\E	Extract data file
\G	Run
\F	Graph forecasts
\Z	Graph errors
\M	Compute MSE table

Title1:	Trend/Seasonal #15
Title2:	Seldane
X-axis:	MONTH
Y-axis:	DEMAND

OUTPUT:

Data type	Monthly
Number of data	48

INPUT:

Level weight	0.20
Trend weight	0.10
Seasonal weight	0.01
Trend modifier	0.90
Number of warm-up data	36
Final forecast period	48
Method for setting initial level and trend: 1 = Avg. diff., 2 = Regression	2

DATA FILE:

		COU	DES. DATA	SEAS. INDEX	ORIGINAL DATA	FCST.	ERROR	LEVEL	TREND
		-12							
		-11							
		-10							
		-9							
		-8							
		-7							
		-6							
		-5							
TEXT LINE		-4	SELDANE						
BEG. YEAR		-3	1991						
BEG. PERIOD		-2	5						
DATA TYPE		-1	12					728.371	2.6642
1991	5	1	737.95	0.6599	487	482.26	4.74	732.206	3.1161
	6	2	679.37	0.9303	632	683.76	-51.76	723.882	-2.7596
	7	3	968.52	0.8054	780	580.98	199.02	770.822	22.2284
	8	4	730.63	1.2154	888	961.17	-73.17	778.788	13.9855
	9	5	704.77	1.2912	910	1021.83	-111.83	774.053	3.9262
	10	6	732.63	1.1848	868	921.27	-53.27	768.595	-0.9624
	11	7	761.14	1.0813	823	830.12	-7.12	766.411	-1.5249
	12	8	769.11	1.0194	784	779.85	4.15	765.852	-0.9658
1992	1	9	745.63	0.9696	723	741.77	-18.77	761.112	-2.8045
	2	10	766.08	0.8889	681	674.34	6.66	760.086	-1.7752
	3	11	694.63	1.0596	736	803.66	-67.66	745.718	-7.9831
	4	12	661.99	0.8943	592	660.45	-68.45	723.223	-14.8394
	5	13	736.44	0.6599	486	468.51	17.49	715.167	-10.7058
	6	14	715.92	0.9303	666	655.83	10.17	707.719	-8.5416

	7	15	834.42	0.8054	672	565.58	106.42	726.375	5.4843
	8	16	809.61	1.2154	984	888.14	95.86	747.097	12.8288
	9	17	751.24	1.2912	970	978.47	-8.47	757.330	10.8893
	10	18	784.96	1.1848	930	908.35	21.65	770.788	11.6291
	11	19	767.62	1.0813	830	844.67	-14.67	778.539	9.1089
	12	20	762.24	1.0194	777	802.02	-25.02	781.829	5.7441
1993	1	21	755.94	0.9696	733	762.92	-29.92	780.826	2.0833
	2	22	755.95	0.8889	672	695.85	-23.85	777.337	-0.8073
	3	23	738.05	1.0596	782	822.15	-40.15	769.024	-4.5195
	4	24	798.41	0.8943	714	683.36	30.64	771.816	-0.6377
	5	25	834.93	0.6599	551	509.21	41.79	783.902	5.7559
	6	26	848.14	0.9303	789	733.61	55.39	800.998	11.1378
	7	27	772.33	0.8054	622	656.44	-34.44	802.511	5.7689
	8	28	770.12	1.2154	936	981.95	-45.95	800.143	1.4120
	9	29	817.07	1.2912	1055	1033.54	21.46	804.742	2.9346
	10	30	801.84	1.1848	950	956.24	-6.24	806.330	2.1146
	11	31	783.34	1.0813	847	873.69	-26.69	803.294	-0.5660
	12	32	797.55	1.0194	813	818.12	-5.12	801.781	-1.0117
1994	1	33	837.42	0.9696	812	776.06	35.94	808.288	2.7985
	2	34	797.58	0.8889	709	720.58	-11.58	808.200	1.2152
	3	35	896.61	1.0596	950	856.33	93.67	826.998	9.9460
	4	36	875.57	0.8943	783	747.11	35.89	843.981	12.9670
	5	37	762.20	0.6599	503	565.39	-62.39	836.766	2.2278
	6	38	772.89	0.9303	719	780.39	-61.39	825.575	-4.5931
	7	39	722.66	0.8054	582	664.52	-82.52	801.039	-14.3347
	8	40	753.67	1.2154	916	957.72	-41.72	781.272	-16.3341
	9	41	765.95	1.2912	989	988.81	0.19	766.600	-14.6862
	10	42	759.64	1.1848	900	892.22	7.78	754.696	-12.5608
	11	43	787.04	1.0813	851	803.35	47.65	752.210	-6.8956
	12	44	740.66	1.0194	755	760.21	-5.21	744.982	-6.7168
1995	1	45	779.66	0.9696	756	716.37	39.63	747.112	-1.9576
	2	46	736.83	0.8889	655	662.30	-7.30	743.706	-2.5840
	3	47	851.30	1.0596	902	785.31	116.69	763.413	8.6906
	4	48	820.77	0.8943	734	689.60	44.40	781.165	12.7869
	5	#N/A		0.6599	#N/A	#N/A	#N/A	781.165	12.7869
	6	#N/A		0.9303	#N/A	#N/A	#N/A	781.165	12.7869
	7	#N/A		0.8054	#N/A	#N/A	#N/A	781.165	12.7869
	8	#N/A		1.2154	#N/A	#N/A	#N/A	781.165	12.7869
	9	#N/A		1.2912	#N/A	#N/A	#N/A	781.165	12.7869
	10	#N/A		1.1848	#N/A	#N/A	#N/A	781.165	12.7869
	11	#N/A		1.0813	#N/A	#N/A	#N/A	781.165	12.7869
	12	#N/A		1.0194	#N/A	#N/A	#N/A	781.165	12.7869
1996	1	#N/A		0.9696	#N/A	#N/A	#N/A	781.165	12.7869
	2	#N/A		0.8889	#N/A	#N/A	#N/A	781.165	12.7869
	3	#N/A		1.0596	#N/A	#N/A	#N/A	781.165	12.7869
	4	#N/A		0.8943	#N/A	#N/A	#N/A	781.165	12.7869
	5	#N/A		0.6599	#N/A	#N/A	#N/A	781.165	12.7869
	6	#N/A		0.9303	#N/A	#N/A	#N/A	781.165	12.7869
	7	#N/A		0.8054	#N/A	#N/A	#N/A	781.165	12.7869
	8	#N/A		1.2154	#N/A	#N/A	#N/A	781.165	12.7869
	9	#N/A		1.2912	#N/A	#N/A	#N/A	781.165	12.7869

Appendix D: 6 Month Simple Moving Average - Items 1-15

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH ~~12~~ 6

SUM OF SQUARED ERRORS (SSE)	1025.51
MEAN SQUARED ERROR (MSE)	28.4864
STANDARD ERROR (SE)	5.33727
MEAN ABSOLUTE DEVIATION (MAD)	4.39351
MEAN ABS PERCENTAGE ERROR (MAPE)	41.67
MEAN PERCENTAGE ERROR (MPE)	-19.45

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	4.28894	14.7500	25.2110

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	7.00000			
2	8.00000			
3	10.0000			
4	11.0000			
5	15.0000			
6	19.0000	11.6666		
7	18.0000	13.5000	11.6666	6.33333
8	16.0000	14.8333	13.5000	2.50000
9	16.0000	15.8333	14.8333	1.16666
10	17.0000	16.8333	15.8333	1.16666
11	18.0000	17.3333	16.8333	1.16666
12	16.0000	16.8333	17.3333	-1.33333
13	8.00000	15.1666	16.8333	-8.83333
14	4.00000	13.1666	15.1666	-11.1666
15	9.00000	12.0000	13.1666	-4.16666
16	15.0000	11.6666	12.0000	3.00000
17	14.0000	11.0000	11.6666	2.33333
18	17.0000	11.1666	11.0000	6.00000
19	20.0000	13.1666	11.1666	8.83333
20	15.0000	15.0000	13.1666	1.83333
21	14.0000	15.8333	15.0000	-1.00000
22	19.0000	16.5000	15.8333	3.16666
23	22.0000	17.8333	16.5000	5.50000
24	20.0000	18.3333	17.8333	2.16666
25	8.00000	16.3333	18.3333	-10.3333
26	6.00000	14.8333	16.3333	-10.3333
27	8.00000	13.8333	14.8333	-6.83333
28	13.0000	12.8333	13.8333	-0.83333
29	15.0000	11.6666	12.8333	2.16666
30	18.0000	11.3333	11.6666	6.33333
31	23.0000	13.8333	11.3333	11.6666
32	21.0000	16.3333	13.8333	7.16666
33	17.0000	17.8333	16.3333	0.66666
34	20.0000	19.0000	17.8333	2.16666
35	25.0000	20.6666	19.0000	6.00000
36	21.0000	21.1666	20.6666	0.33333
37	9.00000	18.8333	21.1666	-12.1666
38	6.00000	16.3333	18.8333	-12.8333
39	9.00000	15.0000	16.3333	-7.33333
40	14.0000	14.0000	15.0000	-1.00000
41	14.0000	12.1666	14.0000	0.00000
42	17.0000	11.5000	12.1666	4.83333
43	21.0000	13.5000	11.5000	9.50000
44	17.0000	15.3333	13.5000	3.50000
45	15.0000	16.3333	15.3333	-0.33333
46	18.0000	17.0000	16.3333	1.66666
47	20.0000	18.0000	17.0000	3.00000
48	17.0000	18.0000	18.0000	-1.00000

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	2.881E+05
MEAN SQUARED ERROR (MSE)	6858.93
STANDARD ERROR (SE)	82.8187
MEAN ABSOLUTE DEVIATION (MAD)	71.2857
MEAN ABS PERCENTAGE ERROR (MAPE)	56.92
MEAN PERCENTAGE ERROR (MPE)	-20.02

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	80.0086	242.333	404.658

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	90.0000			
2	97.0000			
3	91.0000			
4	107.000			
5	133.000			
6	150.000	111.333		
7	175.000	125.500	111.333	63.6666
8	190.000	141.000	125.500	64.5000
9	199.000	159.000	141.000	58.0000
10	222.000	178.166	159.000	63.0000
11	241.000	196.166	178.166	62.8333
12	217.000	207.333	196.166	20.8333
13	62.0000	188.500	207.333	-145.333
14	81.0000	170.333	188.500	-107.500
15	62.0000	147.500	170.333	-108.333
16	118.000	130.166	147.500	-29.5000
17	146.000	114.333	130.166	15.8333
18	157.000	104.333	114.333	42.6666
19	173.000	122.833	104.333	68.6666
20	193.000	141.500	122.833	70.1666
21	239.000	171.000	141.500	97.5000
22	238.000	191.000	171.000	67.0000
23	257.000	209.500	191.000	66.0000
24	218.000	219.666	209.500	8.50000
25	63.0000	201.333	219.666	-156.666
26	89.0000	184.000	201.333	-112.333
27	90.0000	159.166	184.000	-94.0000
28	133.000	141.666	159.166	-26.1666
29	150.000	123.833	141.666	8.33333
30	173.000	116.333	123.833	49.1666
31	222.000	142.833	116.333	105.666
32	262.000	171.666	142.833	119.166
33	270.000	201.666	171.666	98.3333
34	277.000	225.666	201.666	75.3333
35	282.000	247.666	225.666	56.3333
36	210.000	253.833	247.666	-37.6666
37	76.0000	229.500	253.833	-177.833
38	105.000	203.333	229.500	-124.500
39	79.0000	171.500	203.333	-124.333
40	144.000	149.333	171.500	-27.5000
41	146.000	126.666	149.333	-3.33333
42	163.000	118.833	126.666	36.3333
43	202.000	139.833	118.833	83.1666
44	250.000	164.000	139.833	110.166
45	246.000	191.833	164.000	82.0000
46	250.000	209.500	191.833	58.1666
47	276.000	231.166	209.500	66.5000
48	230.000	242.333	231.166	-1.16666

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	1780.19
MEAN SQUARED ERROR (MSE)	42.3855
STANDARD ERROR (SE)	6.51042
MEAN ABSOLUTE DEVIATION (MAD)	5.59920
MEAN ABS PERCENTAGE ERROR (MAPE)	76.65
MEAN PERCENTAGE ERROR (MPE)	-44.38

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	-3.42709	9.33333	22.0937

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	15.0000			
2	16.0000			
3	19.0000			
4	17.0000			
5	17.0000			
6	14.0000	16.3333		
7	9.00000	15.3333	16.3333	-7.33333
8	7.00000	13.8333	15.3333	-8.33333
9	5.00000	11.5000	13.8333	-8.83333
10	6.00000	9.66666	11.5000	-5.50000
11	8.00000	8.16666	9.66666	-1.66666
12	14.0000	8.16666	8.16666	5.83333
13	18.0000	9.66666	8.16666	9.83333
14	14.0000	10.8333	9.66666	4.33333
15	9.00000	11.5000	10.8333	-1.83333
16	16.0000	13.1666	11.5000	4.50000
17	14.0000	14.1666	13.1666	0.83333
18	13.0000	14.0000	14.1666	-1.16666
19	8.00000	12.3333	14.0000	-6.00000
20	7.00000	11.1666	12.3333	-5.33333
21	6.00000	10.6666	11.1666	-5.16666
22	3.00000	8.50000	10.6666	-7.66666
23	7.00000	7.33333	8.50000	-1.50000
24	14.0000	7.50000	7.33333	6.66666
25	19.0000	9.33333	7.50000	11.5000
26	20.0000	11.5000	9.33333	10.6666
27	11.0000	12.3333	11.5000	-0.50000
28	16.0000	14.5000	12.3333	3.66666
29	14.0000	15.6666	14.5000	-0.50000
30	10.0000	15.0000	15.6666	-5.66666
31	4.00000	12.5000	15.0000	-11.0000
32	3.00000	9.66666	12.5000	-9.50000
33	3.00000	8.33333	9.66666	-6.66666
34	6.00000	6.66666	8.33333	-2.33333

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	5.456E+05
MEAN SQUARED ERROR (MSE)	12991.6
STANDARD ERROR (SE)	113.980
MEAN ABSOLUTE DEVIATION (MAD)	97.4126
MEAN ABS PERCENTAGE ERROR (MAPE)	18.72
MEAN PERCENTAGE ERROR (MPE)	-1.57

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	410.431	633.833	857.235

STATISTIX 4.0

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	307.000			
2	386.000			
3	414.000			
4	472.000			
5	533.000			
6	602.000	452.333		
7	583.000	498.333	452.333	130.666
8	616.000	536.666	498.333	117.666
9	617.000	570.500	536.666	80.3333
10	634.000	597.500	570.500	63.5000
11	670.000	620.333	597.500	72.5000
12	654.000	629.000	620.333	33.6666
13	414.000	600.833	629.000	-215.000
14	447.000	572.666	600.833	-153.833
15	407.000	537.666	572.666	-165.666
16	622.000	535.666	537.666	84.3333
17	652.000	532.666	535.666	116.333
18	581.000	520.500	532.666	48.3333
19	607.000	552.666	520.500	86.5000
20	637.000	584.333	552.666	84.3333
21	581.000	613.333	584.333	-3.33333
22	532.000	598.333	613.333	-81.3333
23	642.000	596.666	598.333	43.6666
24	637.000	606.000	596.666	40.3333
25	403.000	572.000	606.000	-203.000
26	438.000	538.833	572.000	-134.000
27	393.000	507.500	538.833	-145.833
28	572.000	514.166	507.500	64.5000
29	640.000	513.833	514.166	125.833
30	622.000	511.333	513.833	108.166
31	658.000	553.833	511.333	146.666
32	601.000	581.000	553.833	47.1666
33	622.000	619.166	581.000	41.0000
34	646.000	631.500	619.166	26.8333
35	733.000	647.000	631.500	101.500
36	682.000	657.000	647.000	35.0000
37	383.000	611.166	657.000	-274.000
38	486.000	592.000	611.166	-125.166
39	393.000	553.833	592.000	-199.000
40	573.000	541.666	553.833	19.1666
41	647.000	527.333	541.666	105.333
42	621.000	517.166	527.333	93.6666
43	650.000	561.666	517.166	132.833
44	590.000	579.000	561.666	28.3333
45	613.000	615.666	579.000	34.0000
46	526.000	607.833	615.666	-89.6666
47	761.000	626.833	607.833	153.166
48	663.000	633.833	626.833	36.1666

STATISTIX 4.0 FIVE, 07/21/95, 14:14

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	2.328E+05
MEAN SQUARED ERROR (MSE)	5542.93
STANDARD ERROR (SE)	74.4508
MEAN ABSOLUTE DEVIATION (MAD)	66.3769
MEAN ABS PERCENTAGE ERROR (MAPE)	44.22
MEAN PERCENTAGE ERROR (MPE)	-8.52

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	80.7429	226.666	372.590

STATISTIX 4.0

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	163.000			
2	122.000			
3	97.0000			
4	81.0000			
5	83.0000			
6	100.000	107.666		
7	146.000	104.833	107.666	38.3333
8	173.000	113.333	104.833	68.1666
9	193.000	129.333	113.333	79.6666
10	187.000	147.000	129.333	57.6666
11	211.000	168.333	147.000	64.0000
12	217.000	187.833	168.333	48.6666
13	170.000	191.833	187.833	-17.8333
14	140.000	186.333	191.833	-51.8333
15	93.0000	169.666	186.333	-93.3333
16	81.0000	152.000	169.666	-88.6666
17	111.000	135.333	152.000	-41.0000
18	140.000	122.500	135.333	4.66666
19	163.000	121.333	122.500	40.5000
20	195.000	130.500	121.333	73.6666
21	240.000	155.000	130.500	109.500
22	253.000	183.666	155.000	98.0000
23	252.000	207.166	183.666	68.3333
24	217.000	220.000	207.166	9.83333
25	188.000	224.166	220.000	-32.0000
26	143.000	215.500	224.166	-81.1666
27	88.0000	190.166	215.500	-127.500
28	85.0000	162.166	190.166	-105.166
29	123.000	140.666	162.166	-39.1666
30	138.000	127.500	140.666	-2.66666
31	192.000	128.166	127.500	64.5000
32	222.000	141.333	128.166	93.8333
33	238.000	166.333	141.333	96.6666
34	260.000	195.500	166.333	93.6666
35	289.000	223.166	195.500	93.5000
36	251.000	242.000	223.166	27.8333
37	185.000	240.833	242.000	-57.0000
38	139.000	227.000	240.833	-101.833

STATISTIX 4.0

SIX, 07/21/95, 14:15

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	2.756E+05
MEAN SQUARED ERROR (MSE)	6562.03
STANDARD ERROR (SE)	81.0064
MEAN ABSOLUTE DEVIATION (MAD)	68.1785
MEAN ABS PERCENTAGE ERROR (MAPE)	71.56
MEAN PERCENTAGE ERROR (MPE)	-29.97

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	15.5607	174.333	333.105

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	160.000			
2	134.000			
3	29.0000			
4	27.0000			
5	55.0000			
6	84.0000	81.5000		
7	111.000	73.3333	81.5000	29.5000
8	115.000	70.1666	73.3333	41.6666
9	134.000	87.6666	70.1666	63.8333
10	145.000	107.333	87.6666	57.3333
11	180.000	128.166	107.333	72.6666
12	195.000	146.666	128.166	66.8333
13	170.000	156.500	146.666	23.3333
14	140.000	160.666	156.500	-16.5000
15	93.0000	153.833	160.666	-67.6666
16	81.0000	143.166	153.833	-72.8333
17	111.000	131.666	143.166	-32.1666
18	140.000	122.500	131.666	8.33333
19	163.000	121.333	122.500	40.5000
20	195.000	130.500	121.333	73.6666
21	240.000	155.000	130.500	109.500
22	253.000	183.666	155.000	98.0000
23	252.000	207.166	183.666	68.3333
24	217.000	220.000	207.166	9.83333
25	174.000	221.833	220.000	-46.0000
26	121.000	209.500	221.833	-100.833
27	60.0000	179.500	209.500	-149.500
28	38.0000	143.666	179.500	-141.500
29	59.0000	111.500	143.666	-84.6666
30	111.000	93.8333	111.500	-0.50000
31	129.000	86.3333	93.8333	35.1666
32	133.000	88.3333	86.3333	46.6666
33	193.000	110.500	88.3333	104.666
34	214.000	139.833	110.500	103.500
35	258.000	173.000	139.833	118.166
36	221.000	191.333	173.000	48.0000
37	195.000	202.333	191.333	3.66666
38	143.000	204.000	202.333	-59.3333
39	42.0000	178.833	204.000	-162.000
40	33.0000	148.666	178.833	-145.833
41	61.0000	115.833	148.666	-87.6666
42	99.0000	95.5000	115.833	-16.8333

STATISTIX 4.0 SEVEN, 07/21/95, 14:15

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	2.479E+05
MEAN SQUARED ERROR (MSE)	5901.66
STANDARD ERROR (SE)	76.8222
MEAN ABSOLUTE DEVIATION (MAD)	68.2142
MEAN ABS PERCENTAGE ERROR (MAPE)	58.25
MEAN PERCENTAGE ERROR (MPE)	-19.11

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	72.7616	223.333	373.904

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	94.0000			
2	84.0000			
3	72.0000			
4	74.0000			
5	132.000			
6	151.000	101.166		
7	187.000	116.666	101.166	85.8333
8	179.000	132.500	116.666	62.3333
9	203.000	154.333	132.500	70.5000
10	262.000	185.666	154.333	107.666
11	197.000	196.500	185.666	11.3333
12	164.000	198.666	196.500	-32.5000
13	80.0000	180.833	198.666	-118.666
14	70.0000	162.666	180.833	-110.833
15	60.0000	138.833	162.666	-102.666
16	60.0000	105.166	138.833	-78.8333
17	120.000	92.3333	105.166	14.8333
18	130.000	86.6666	92.3333	37.6666
19	153.000	98.8333	86.6666	66.3333
20	179.000	117.000	98.8333	80.1666
21	180.000	137.000	117.000	63.0000
22	233.000	165.833	137.000	96.0000
23	181.000	176.000	165.833	15.1666
24	151.000	179.500	176.000	-25.0000
25	90.0000	169.000	179.500	-89.5000
26	92.0000	154.500	169.000	-77.0000
27	63.0000	135.000	154.500	-91.5000
28	67.0000	107.333	135.000	-68.0000
29	99.0000	93.6666	107.333	-8.33333
30	157.000	94.6666	93.6666	63.3333
31	172.000	108.333	94.6666	77.3333
32	190.000	124.666	108.333	81.6666
33	222.000	151.166	124.666	97.3333
34	232.000	178.666	151.166	80.8333
35	207.000	196.666	178.666	28.3333
36	183.000	201.000	196.666	-13.6666
37	93.0000	187.833	201.000	-108.000
38	87.0000	170.666	187.833	-100.833
39	63.0000	144.166	170.666	-107.666
40	66.0000	116.500	144.166	-78.1666
41	117.000	101.500	116.500	0.50000
42	148.000	95.6666	101.500	46.5000
43	195.000	112.666	95.6666	99.3333
44	210.000	133.166	112.666	97.3333
45	236.000	162.000	133.166	102.833
46	289.000	199.166	162.000	127.000
47	217.000	215.833	199.166	17.8333

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	70365.2
MEAN SQUARED ERROR (MSE)	1675.36
STANDARD ERROR (SE)	40.9312
MEAN ABSOLUTE DEVIATION (MAD)	35.3452
MEAN ABS PERCENTAGE ERROR (MAPE)	23.96
MEAN PERCENTAGE ERROR (MPE)	-7.27

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	70.2748	150.500	230.725

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	123.000			
2	186.000			
3	159.000			
4	195.000			
5	201.000			
6	195.000	176.500		
7	167.000	183.833	176.500	-9.50000
8	147.000	177.333	183.833	-36.8333
9	160.000	177.500	177.333	-17.3333
10	119.000	164.833	177.500	-58.5000
11	125.000	152.166	164.833	-39.8333
12	122.000	140.000	152.166	-30.1666
13	126.000	133.166	140.000	-14.0000
14	192.000	140.666	133.166	58.8333
15	168.000	142.000	140.666	27.3333
16	202.000	155.833	142.000	60.0000
17	209.000	169.833	155.833	53.1666
18	185.000	180.333	169.833	15.1666
19	172.000	188.000	180.333	-8.33333
20	152.000	181.333	188.000	-36.0000
21	157.000	179.500	181.333	-24.3333
22	124.000	166.500	179.500	-55.5000
23	133.000	153.833	166.500	-33.5000
24	134.000	145.333	153.833	-19.8333
25	96.0000	132.666	145.333	-49.3333
26	152.000	132.666	132.666	19.3333
27	138.000	129.500	132.666	5.33333
28	172.000	137.500	129.500	42.5000
29	179.000	145.166	137.500	41.5000
30	155.000	148.666	145.166	9.83333
31	160.000	159.333	148.666	11.3333
32	132.000	156.000	159.333	-27.3333
33	127.000	154.166	156.000	-29.0000
34	101.000	142.333	154.166	-53.1666
35	93.0000	128.000	142.333	-49.3333
36	107.000	120.000	128.000	-21.0000
37	110.000	111.666	120.000	-10.0000
38	172.000	118.333	111.666	60.3333
39	170.000	125.500	118.333	51.6666
40	210.000	143.666	125.500	84.5000
41	230.000	166.500	143.666	86.3333

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SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	3.431E+05
MEAN SQUARED ERROR (MSE)	8169.02
STANDARD ERROR (SE)	90.3826
MEAN ABSOLUTE DEVIATION (MAD)	80.9206
MEAN ABS PERCENTAGE ERROR (MAPE)	38.75
MEAN PERCENTAGE ERROR (MPE)	-6.18

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	119.349	296.500	473.650

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	126.000			
2	132.000			
3	102.000			
4	133.000			
5	190.000			
6	157.000	140.000		
7	233.000	157.833	140.000	93.0000
8	237.000	175.333	157.833	79.1666
9	298.000	208.000	175.333	122.666
10	317.000	238.666	208.000	109.000
11	347.000	264.833	238.666	108.333
12	250.000	280.333	264.833	-14.8333
13	153.000	267.000	280.333	-127.333
14	143.000	251.333	267.000	-124.000
15	127.000	222.833	251.333	-124.333
16	149.000	194.833	222.833	-73.8333
17	190.000	168.666	194.833	-4.83333
18	207.000	161.500	168.666	38.3333
19	232.000	174.666	161.500	70.5000
20	269.000	195.666	174.666	94.3333
21	289.000	222.666	195.666	93.3333
22	308.000	249.166	222.666	85.3333
23	329.000	272.333	249.166	79.8333
24	280.000	284.500	272.333	7.66666
25	163.000	273.000	284.500	-121.500
26	170.000	256.500	273.000	-103.000
27	157.000	234.500	256.500	-99.5000
28	173.000	212.000	234.500	-61.5000
29	206.000	191.500	212.000	-6.00000
30	232.000	183.500	191.500	40.5000
31	257.000	199.166	183.500	73.5000
32	283.000	218.000	199.166	83.8333
33	324.000	245.833	218.000	106.000
34	320.000	270.333	245.833	74.1666
35	377.000	298.833	270.333	106.666
36	302.000	310.500	298.833	3.16666
37	159.000	294.166	310.500	-151.500
38	162.000	274.000	294.166	-132.166
39	119.000	239.833	274.000	-155.000
40	158.000	212.833	239.833	-81.8333
41	186.000	181.000	212.833	-26.8333
42	214.000	166.333	181.000	33.0000
43	261.000	183.333	166.333	94.6666
44	269.000	201.166	183.333	85.6666
45	308.000	232.666	201.166	106.833
46	314.000	258.666	232.666	81.3333
47	359.000	287.500	258.666	100.333
48	268.000	296.500	287.500	-19.5000

STATISTIX 4.0 TEN, 07/21/95, 14:17

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	36630.0
MEAN SQUARED ERROR (MSE)	872.144
STANDARD ERROR (SE)	29.5320
MEAN ABSOLUTE DEVIATION (MAD)	24.2936
MEAN ABS PERCENTAGE ERROR (MAPE)	15.18
MEAN PERCENTAGE ERROR (MPE)	-0.73

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	120.783	178.666	236.549

STATISTIX 4.0 TEN, 07/21/95, 14:17

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	77.0000			
2	120.000			
3	111.000			
4	164.000			
5	148.000			
6	153.000	128.833		
7	140.000	139.333	128.833	11.1666
8	138.000	142.333	139.333	-1.33333
9	172.000	152.500	142.333	29.6666
10	137.000	148.000	152.500	-15.5000
11	220.000	160.000	148.000	72.0000
12	207.000	169.000	160.000	47.0000
13	101.000	162.500	169.000	-68.0000
14	137.000	162.333	162.500	-25.5000
15	140.000	157.000	162.333	-22.3333
16	144.000	158.166	157.000	-13.0000
17	193.000	153.666	158.166	34.8333
18	182.000	149.500	153.666	28.3333
19	149.000	157.500	149.500	-0.50000
20	139.000	157.833	157.500	-18.5000
21	181.000	164.666	157.833	23.1666
22	178.000	170.333	164.666	13.3333
23	189.000	169.666	170.333	18.6666
24	183.000	169.833	169.666	13.3333
25	130.000	166.666	169.833	-39.8333
26	143.000	167.333	166.666	-23.6666
27	133.000	159.333	167.333	-34.3333
28	168.000	157.666	159.333	8.66666
29	199.000	159.333	157.666	41.3333
30	201.000	162.333	159.333	41.6666
31	183.000	171.166	162.333	20.6666
32	157.000	173.500	171.166	-14.1666
33	194.000	183.666	173.500	20.5000
34	172.000	184.333	183.666	-11.6666
35	210.000	186.166	184.333	25.6666
36	181.000	182.833	186.166	-5.16666
37	118.000	172.000	182.833	-64.8333
38	151.000	171.000	172.000	-21.0000
39	142.000	162.333	171.000	-29.0000
40	178.000	163.333	162.333	15.6666
41	193.000	160.500	163.333	29.6666
42	180.000	160.333	160.500	19.5000
43	162.000	167.666	160.333	1.66666
44	147.000	167.000	167.666	-20.6666
45	194.000	175.666	167.000	27.0000
46	172.000	174.666	175.666	-3.66666
47	214.000	178.166	174.666	39.3333
48	183.000	178.666	178.166	4.83333

STATISTIX 4.0

ELEVEN, 07/21/95, 14:18

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	2.339E+05
MEAN SQUARED ERROR (MSE)	5569.29
STANDARD ERROR (SE)	74.6276
MEAN ABSOLUTE DEVIATION (MAD)	66.6309
MEAN ABS PERCENTAGE ERROR (MAPE)	80.48
MEAN PERCENTAGE ERROR (MPE)	-35.14

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	27.2297	173.500	319.770

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	40.0000			
2	36.0000			
3	23.0000			
4	44.0000			
5	106.000			
6	102.000	58.5000		
7	143.000	75.6666	58.5000	84.5000
8	160.000	96.3333	75.6666	84.3333
9	163.000	119.666	96.3333	66.6666
10	218.000	148.666	119.666	98.3333
11	224.000	168.333	148.666	75.3333
12	167.000	179.166	168.333	-1.33333
13	75.0000	167.833	179.166	-104.166
14	61.0000	151.333	167.833	-106.833
15	43.0000	131.333	151.333	-108.333
16	78.0000	108.000	131.333	-53.3333
17	116.000	90.0000	108.000	8.00000
18	126.000	83.1666	90.0000	36.0000
19	133.000	92.8333	83.1666	49.8333
20	155.000	108.500	92.8333	62.1666
21	168.000	129.333	108.500	59.5000
22	157.000	142.500	129.333	27.6666
23	217.000	159.333	142.500	74.5000
24	182.000	168.666	159.333	22.6666
25	73.0000	158.666	168.666	-95.6666
26	49.0000	141.000	158.666	-109.666
27	29.0000	117.833	141.000	-112.000
28	44.0000	99.0000	117.833	-73.8333
29	99.0000	79.3333	99.0000	0.00000
30	123.000	69.5000	79.3333	43.6666
31	113.000	76.1666	69.5000	43.5000
32	162.000	95.0000	76.1666	85.8333
33	193.000	122.333	95.0000	98.0000
34	180.000	145.000	122.333	57.6666
35	228.000	166.500	145.000	83.0000
36	208.000	180.666	166.500	41.5000
37	67.0000	173.000	180.666	-113.666
38	51.0000	154.500	173.000	-122.000
39	34.0000	128.000	154.500	-120.500
40	58.0000	107.666	128.000	-70.0000
41	135.000	92.1666	107.666	27.3333
42	118.000	77.1666	92.1666	25.8333
43	103.000	83.1666	77.1666	25.8333
44	152.000	100.000	83.1666	68.8333
45	183.000	124.833	100.000	83.0000
46	171.000	143.666	124.833	46.1666
47	238.000	160.833	143.666	94.3333
48	194.000	173.500	160.833	33.1666

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	1690.38
MEAN SQUARED ERROR (MSE)	40.2473
STANDARD ERROR (SE)	6.34408
MEAN ABSOLUTE DEVIATION (MAD)	4.91269
MEAN ABS PERCENTAGE ERROR (MAPE)	97.72
MEAN PERCENTAGE ERROR (MPE)	-56.41

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	-6.43439	6.00000	18.4343

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	2.00000			
2	1.00000			
3	7.00000			
4	3.00000			
5	0.00000			
6	5.00000	3.00000		
7	6.00000	3.66666	3.00000	3.00000
8	2.00000	3.83333	3.66666	-1.66666
9	0.00000	2.66666	3.83333	-3.83333
10	4.00000	2.83333	2.66666	1.33333
11	0.00000	2.83333	2.83333	-2.83333
12	3.00000	2.50000	2.83333	0.16666
13	2.00000	1.83333	2.50000	-0.50000
14	3.00000	2.00000	1.83333	1.16666
15	0.00000	2.00000	2.00000	-2.00000
16	7.00000	2.50000	2.00000	5.00000
17	13.0000	4.66666	2.50000	10.5000
18	2.00000	4.50000	4.66666	-2.66666
19	14.0000	6.50000	4.50000	9.50000
20	0.00000	6.00000	6.50000	-6.50000
21	3.00000	6.50000	6.00000	-3.00000
22	4.00000	6.00000	6.50000	-2.50000
23	2.00000	4.16666	6.00000	-4.00000
24	1.00000	4.00000	4.16666	-3.16666
25	2.00000	2.00000	4.00000	-2.00000
26	1.00000	2.16666	2.00000	-1.00000
27	0.00000	1.66666	2.16666	-2.16666
28	5.00000	1.83333	1.66666	3.33333
29	11.0000	3.33333	1.83333	9.16666
30	17.0000	6.00000	3.33333	13.6666
31	9.00000	7.16666	6.00000	3.00000
32	15.0000	9.50000	7.16666	7.83333
33	0.00000	9.50000	9.50000	-9.50000
34	4.00000	9.33333	9.50000	-5.50000
35	5.00000	8.33333	9.33333	-4.33333
36	4.00000	6.16666	8.33333	-4.33333
37	0.00000	4.66666	6.16666	-6.16666
38	1.00000	2.33333	4.66666	-3.66666
39	4.00000	3.00000	2.33333	1.66666
40	21.0000	5.83333	3.00000	18.0000
41	6.00000	6.00000	5.83333	0.16666
42	3.00000	5.83333	6.00000	-3.00000
43	22.0000	9.50000	5.83333	16.1666
44	3.00000	9.83333	9.50000	-6.50000
45	4.00000	9.83333	9.83333	-5.83333
46	4.00000	7.00000	9.83333	-5.83333
47	1.00000	6.16666	7.00000	-6.00000
48	2.00000	6.00000	6.16666	-4.16666

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	3.660E+05
MEAN SQUARED ERROR (MSE)	8714.48
STANDARD ERROR (SE)	93.3514
MEAN ABSOLUTE DEVIATION (MAD)	82.8452
MEAN ABS PERCENTAGE ERROR (MAPE)	52.34
MEAN PERCENTAGE ERROR (MPE)	-17.13

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	96.6978	279.666	462.635

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	151.000			
2	105.000			
3	85.0000			
4	101.000			
5	188.000			
6	245.000	145.833		
7	266.000	165.000	145.833	120.166
8	287.000	195.333	165.000	122.000
9	252.000	223.166	195.333	56.6666
10	289.000	254.500	223.166	65.8333
11	258.000	266.166	254.500	3.50000
12	209.000	260.166	266.166	-57.1666
13	120.000	235.833	260.166	-140.166
14	82.0000	201.666	235.833	-153.833
15	71.0000	171.500	201.666	-130.666
16	85.0000	137.500	171.500	-86.5000
17	149.000	119.333	137.500	11.5000
18	207.000	119.000	119.333	87.6666
19	253.000	141.166	119.000	134.000
20	263.000	171.333	141.166	121.833
21	252.000	201.500	171.333	80.6666
22	239.000	227.166	201.500	37.5000
23	238.000	242.000	227.166	10.8333
24	201.000	241.000	242.000	-41.0000
25	151.000	224.000	241.000	-90.0000
26	101.000	197.000	224.000	-123.000
27	90.0000	170.000	197.000	-107.000
28	100.000	146.833	170.000	-70.0000
29	173.000	136.000	146.833	26.1666
30	238.000	142.166	136.000	102.000
31	280.000	163.666	142.166	137.833
32	293.000	195.666	163.666	129.333
33	247.000	221.833	195.666	51.3333
34	268.000	249.833	221.833	46.1666
35	255.000	263.500	249.833	5.16666
36	199.000	257.000	263.500	-64.5000
37	156.000	236.333	257.000	-101.000
38	120.000	207.500	236.333	-116.333
39	92.0000	181.666	207.500	-115.500
40	90.0000	152.000	181.666	-91.6666
41	177.000	139.000	152.000	25.0000
42	205.000	140.000	139.000	66.0000
43	273.000	159.500	140.000	133.000
44	302.000	189.833	159.500	142.500
45	315.000	227.000	189.833	125.166
46	286.000	259.666	227.000	59.0000
47	287.000	278.000	259.666	27.3333
48	215.000	279.666	278.000	-63.0000

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	4492.05
MEAN SQUARED ERROR (MSE)	106.953
STANDARD ERROR (SE)	10.3418
MEAN ABSOLUTE DEVIATION (MAD)	9.21428
MEAN ABS PERCENTAGE ERROR (MAPE)	49.44
MEAN PERCENTAGE ERROR (MPE)	-21.62

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	2.06332	22.3333	42.6033

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	23.0000			
2	30.0000			
3	34.0000			
4	35.0000			
5	32.0000			
6	30.0000	30.6666		
7	19.0000	30.0000	30.6666	-11.6666
8	19.0000	28.1666	30.0000	-11.0000
9	15.0000	25.0000	28.1666	-13.1666
10	16.0000	21.8333	25.0000	-9.00000
11	19.0000	19.6666	21.8333	-2.83333
12	28.0000	19.3333	19.6666	8.33333
13	24.0000	20.1666	19.3333	4.66666
14	33.0000	22.5000	20.1666	12.8333
15	37.0000	26.1666	22.5000	14.5000
16	40.0000	30.1666	26.1666	13.8333
17	35.0000	32.8333	30.1666	4.83333
18	23.0000	32.0000	32.8333	-9.83333
19	20.0000	31.3333	32.0000	-12.0000
20	14.0000	28.1666	31.3333	-17.3333
21	16.0000	24.6666	28.1666	-12.1666
22	17.0000	20.8333	24.6666	-7.66666
23	24.0000	19.0000	20.8333	3.16666
24	26.0000	19.5000	19.0000	7.00000
25	30.0000	21.1666	19.5000	10.5000
26	34.0000	24.5000	21.1666	12.8333
27	26.0000	26.1666	24.5000	1.50000
28	30.0000	28.3333	26.1666	3.83333
29	34.0000	30.0000	28.3333	5.66666
30	27.0000	30.1666	30.0000	-3.00000
31	13.0000	27.3333	30.1666	-17.1666
32	6.00000	22.6666	27.3333	-21.3333
33	11.0000	20.1666	22.6666	-11.6666
34	14.0000	17.5000	20.1666	-6.16666
35	21.0000	15.3333	17.5000	3.50000
36	30.0000	15.8333	15.3333	14.6666
37	28.0000	18.3333	15.8333	12.1666
38	31.0000	22.5000	18.3333	12.6666
39	33.0000	26.1666	22.5000	10.5000
40	33.0000	29.3333	26.1666	6.83333
41	33.0000	31.3333	29.3333	3.66666
42	29.0000	31.1666	31.3333	-2.33333
43	17.0000	29.3333	31.1666	-14.1666
44	18.0000	27.1666	29.3333	-11.3333
45	18.0000	24.6666	27.1666	-9.16666
46	22.0000	22.8333	24.6666	-2.66666
47	30.0000	22.3333	22.8333	7.16666
48	29.0000	22.3333	22.3333	6.66666

STATISTIX 4.0 FIFTEEN, 07/21/95, 14:20

SINGLE MOVING AVERAGES FORECAST TABLE FOR X

TIME	ACTUAL VALUE	MOVING AVERAGE	FORECAST	FORECAST ERROR
1	487.000			
2	632.000			
3	780.000			
4	888.000			
5	910.000			
6	868.000	760.833		
7	823.000	816.833	760.833	62.1666
8	784.000	842.166	816.833	-32.8333
9	723.000	832.666	842.166	-119.166
10	681.000	798.166	832.666	-151.666
11	736.000	769.166	798.166	-62.1666
12	592.000	723.166	769.166	-177.166
13	486.000	667.000	723.166	-237.166
14	666.000	647.333	667.000	-1.00000
15	672.000	638.833	647.333	24.6666
16	984.000	689.333	638.833	345.166
17	970.000	728.333	689.333	280.666
18	930.000	784.666	728.333	201.666
19	830.000	842.000	784.666	45.3333
20	777.000	860.500	842.000	-65.0000
21	733.000	870.666	860.500	-127.500
22	672.000	818.666	870.666	-198.666
23	782.000	787.333	818.666	-36.6666
24	714.000	751.333	787.333	-73.3333
25	551.000	704.833	751.333	-200.333
26	789.000	706.833	704.833	84.1666
27	622.000	688.333	706.833	-84.8333
28	936.000	732.333	688.333	247.666
29	1055.00	777.833	732.333	322.666
30	950.000	817.166	777.833	172.166
31	847.000	866.500	817.166	29.8333
32	813.000	870.500	866.500	-53.5000
33	812.000	902.166	870.500	-58.5000
34	709.000	864.333	902.166	-193.166
35	950.000	846.833	864.333	85.6666
36	783.000	819.000	846.833	-63.8333
37	503.000	761.666	819.000	-316.000
38	719.000	746.000	761.666	-42.6666
39	582.000	707.666	746.000	-164.000
40	916.000	742.166	707.666	208.333
41	989.000	748.666	742.166	246.833
42	900.000	768.166	748.666	151.333
43	851.000	826.166	768.166	82.8333
44	755.000	832.166	826.166	-71.1666
45	756.000	861.166	832.166	-76.1666
46	655.000	817.666	861.166	-206.166
47	902.000	803.166	817.666	84.3333
48	734.000	775.500	803.166	-69.1666

SINGLE MOVING AVERAGES FOR X

MOVING AVERAGE LENGTH 6

SUM OF SQUARED ERRORS (SSE)	1.075E+06
MEAN SQUARED ERROR (MSE)	25593.0
STANDARD ERROR (SE)	159.978
MEAN ABSOLUTE DEVIATION (MAD)	132.317
MEAN ABS PERCENTAGE ERROR (MAPE)	17.65
MEAN PERCENTAGE ERROR (MPE)	-4.11

LEAD	95% C.I. LOWER BOUND	FORECAST	95% C.I. UPPER BOUND
1	461.942	775.500	1089.05

Bibliography

1. Ammer, Dean S. Purchasing and Materials Management for Health-Care Institutions. Lexington MA: D.C. Heath and Company, 1983.

2. Bittel, Grace Ann and Daniel L. Gartner. An Analysis of Forecasting Techniques for Wholesale Demand: The Applicability of Multi-Mode Forecasting. MS thesis LSSR 48-82. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September, 1982 (AD-A122-884).

3. Blazer, Douglas J. Demand Forecasting, Air Force Logistics Management Center Report LS 791003-3, Gunter AFS AL, May 1984 (AD-A158 601).

4. Bloss, James F. and others. A Simulation of a Medical Center Pharmacy Inventory System. MS thesis SLSR 5-74A, School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, January 1974 (AD-A143-775).

5. Bowerman, Bruce L. and Richard T. O'Connell. Time Series Forecasting. Boston: PWS Publishers, 1987.

6. Brown, Robert G. Statistical Forecasting for Inventory Control. York PA: McGraw-Hill, 1959.

7. Cleary, James P. and Hans Levenbach. The Professional Forecaster: The Forecasting Process Through Data Analysis. Belmont CA: Lifetime Learning Publishing: 1982.

8. Cooper, Donald R. and C. William Emory. Business Research Methods (Fifth Edition). Burr Ridge IL: Irwin, 1994.

9. Coyle, John J and others. The Management of Business Logistics (Fifth Edition). St. Paul MN: West Publishing, 1988.

10. Dussault, Christian J. H. Evaluation of Air Force and Navy Demand Forecasting Systems. AFIT/GLM/LAL/95M-1. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 1995 (AD-A285299).

11. Evans, R. James. Applied Production and Operations Management (Fourth Edition). St. Paul MN: West Publishing, 1993.

12. Ferguson, Richard W. An Analysis of the Effects of Multiple Parameter Changes in the MMMS for the Computation of Inventory System Variables. Unpublished research, Air Force Medical Material Field Office, Frederick MD, 1977.

13. Fischer, Donald C. and Paul S. Gibson. The Application of Exponential Smoothing to Forecasting Demand for Economic Order Quantities. MS thesis SLSR-21-2A. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, January 1972 (AD-743-412).

14. Gilloth, Vaden R. and others. An Evaluation of Seasonality in the United States Air Force Medical Material Management System. MS thesis, LSSR 13-79B. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1979 (AD-A076922).

15. Hadley, G. and T. M. Whitin. Analysis of Inventory Systems. Englewood Cliffs NJ: Prentice-Hall, 1969.

16. Hanke, John E. and Arthur G. Reitsch. Business Forecasting (Fourth Edition). Boston: Allyn and Bacon, 1992.

17. Hill, W.J. Alternative Inventory Control Methods for Use in Managing Medical Supply Inventory. MS thesis, AFIT/GLM/LSM/88S-35. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September, 1988 (AD-A202777).

18. Hoff, John C. A Practical Guide to Box-Jenkins Forecasting. Reston VA: Reston Publishing Co., 1977.

19. Kerlinger, Fred N. Foundations of Behavioral Research (Third Edition). New York: Holt, Rinehart, and Winston, 1986.

20. Knowles, Thomas W. Management Science. Homewood IL: Irwin Publishing, 1989.

21. McClave, James T. and P. George Benson. Statistics for Business and Economics (Sixth Edition). New York: Macmillan College Publishing Company, 1994.

22. McGee, Timothy R. Inventory Management in a United States Air Force Regional Medical Center Pharmacy. MS thesis, AFIT/GLM/LSM/89S-42. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1989 (AD-A215547).

23. Peacock, Steven S. and Mark R. Seale. A Simulation Study of the Effects of Applying Variable Safety Levels in a Medical Inventory System. MS thesis, SLSR 15-75A, School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1989 (AD-A215094).

24. Peterson, Rein and Edward A. Silver. Decision Systems for Inventory Management and Production Planning. New York: John Wiley and Sons, 1979.

25. Reymann, Maria. Launch Weather Officer, Patrick AFB FL. Personal Interview. 24 Jan 95.

26. Romeyn, Thomas N. Director of Medical Logistics, 645th Medical Group, Wright-Patterson AFB OH. Personal Interview. 5 Nov 1994.

27. Sherbrooke, C. Craig. Optimal Inventory Modeling of Systems. New York: John Wiley and Sons, 1992.

28. Sneider, Richard M. and John F. Murphy. "Automating Material Management Systems" Hospital Material Management Quarterly-8: 40-47 (February, 1987).

29. Spilker, John Michael. Officer-in-Charge, OutPatient Pharmacy, 645th Medical Group, Wright-Patterson AFB OH. Personal Interview. 17 Nov 1994.

30. Sullivan, William G. and W. Wayne Claycombe. Fundamentals of Forecasting. Belmont CA: Lifetime Learning Publications, 1983.

31. Syzdek, Mark A. The Identification and Forecast of Seasonal Demand Consumable Items in Base Supply. MS thesis, AFIT/GLM/LSM/89S-64. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH. September 1989 (AD-A210395).

32. Tersine, Richard J. Principles of Inventory and Materials Management (Fourth Edition). Englewood Cliffs NJ: Prentice Hall, 1994.

33. U.S. Department of the Air Force. Air Force Medical Material Management System -- General. AFM 67-1, Vol. V. Washington: Government Printing Office, 1992.

34. Wheelwright, Steven C. and Spyros Makridakis. Forecasting Methods for Management (Fourth Edition). New York: John Wiley and Sons, 1985.

35. Wilson, J. Holton and Barry Keating. Business Forecasting (Second Edition). Burr Ridge IL: Irwin Publishing, 1994.

Vita

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This research was conducted to determine the accuracy of statistical forecasting techniques forecasting the inventory of pharmaceutical items. Because pharmaceutical items are subject to a degree of seasonality of demand, the Director of Medical Logistics at the Wright-Patterson Medical Center believed that the use of such techniques may provide a more accurate forecast for the items stocked by the Outpatient Pharmacy. In addition to the technique used by the Outpatient Pharmacy (the 12 month moving average) three statistical forecasting methods were employed; the 6 month moving average, simple exponential smoothing, and Winter's exponential smoothing. These techniques were used to obtain forecasts, and the results were analyzed for measurement error.

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