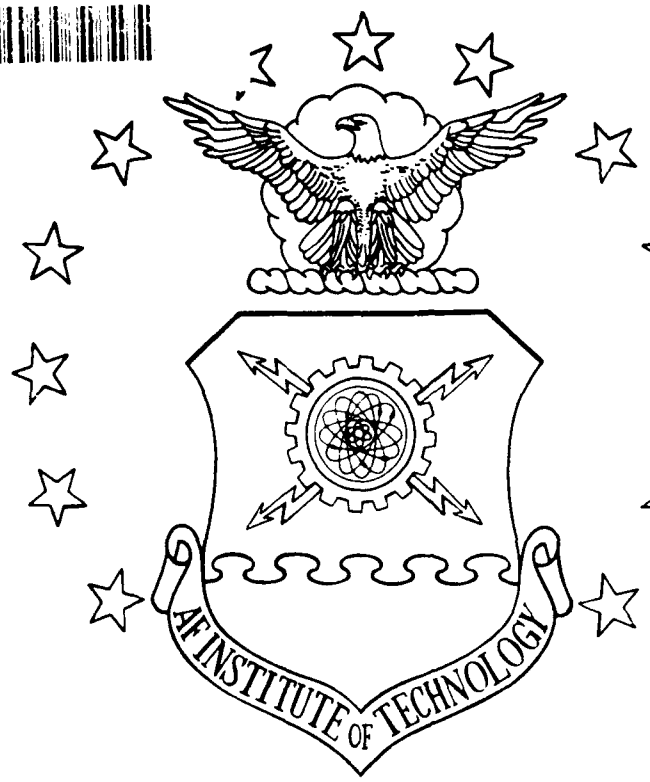

HEURISTICS FOR HOSPITAL INVENTORY MANAGEMENT

THESIS

Thomas G. Hibson, Captain, USAF

AFIT/GLM/LSM/91S-29

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/GLM/LSM/91S-29

HEURISTICS FOR HOSPITAL INVENTORY MANAGEMENT

THESIS

Thomas G. Hibson, Captain, USAF

AFIT/GLM/LSM/91S-29

The views expressed in this thesis are those of the authors and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

AFIT/GLM/LSM/91S-29

HEURISTICS FOR HOSPITAL INVENTORY MANAGEMENT

THESIS

Presented to the Faculty of the School of Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Logistics Management

Thomas G. Hibson, B.S., M.S.

Captain, USAF

September 1991

Preface

The purpose of this research was to discover and record the heuristics used by hospital inventory management experts. An expert system was developed to verify the captured knowledge and the system is now being used by the Wright-Patterson AFB Medical Logistics Branch.

The methodology was chosen for the simplicity of developing an expert system. Though the methodology is aimed towards developing an expert system, it is an outstanding method for obtaining information from experts. An underlying point of this research is that the knowledge extracted from experts for use in computer programs must be made readily accessible to the end user of the program. To this end, I hope this research ensures the knowledge will not be lost and demonstrates the power of expert systems.

I had a great deal of help in performing this research and writing of this thesis. I am indebted to my thesis advisor, Lieutenant Commander Don McNeeley, for his lasting patience and assistance. My sincere appreciation goes to Captain Lois Schloz for proofing my grammar. I also wish to thank Captain John Hill of the WPAFB Medical Logistics Branch for suggesting the topic and a special thanks go to Senior Master Sergeant Donovant, Master Sergeant Spain and Staff Sergeant Howard for serving as experts, making hours of decisions on data sets and helping solve computer programming problems. Finally, I wish to thank my wife Terri for her understanding and support while I was busy working on my computer to complete this effort.

Thomas G. Hibson

Table of Contents

List of Figures

List of Tables

Abstract

This study investigated the reasoning strategies used by hospital logistics management experts and was conducted at the Wright-Patterson AFB (WPAFB) Medical Center. An expert system was developed to verify the captured strategies. The particular area of interest of this study was the reasoning strategies involved in the reconciliation of the Monthly Stock Status Report within the Medical Logistics Branch. A literature review revealed there were few guidelines as to when and what action to pursue when reconciling the Monthly Stock Status Report. Though there were no references in the literature on expert systems that dealt with this particular report, there were many references to the development of such an expert system. The research was done in three phases. The first phase was knowledge acquisition which is when the researcher interviewed the expert and did the initial formulation of the reasoning strategy. During the second phase, the researcher developed an expert system which was then validated in the third phase. The validation revealed the expert system made the same decision as the human expert over 98% of the time in the validation data sets. It was therefore concluded the reasoning strategies were captured. The WPAFB medical logistics personnel readily accepted the expert system and recommendations for further testing of this expert system and possible applications for new expert systems are provided.

Heuristics for Hospital Inventory Management

I. Introduction

Overview

Effective decision-making is an important part of any manager's job. Often faced with uncertainty, pressure, and poor information, managers must make consistent, reliable, and timely decisions. In his book Putting Artificial Intelligence to Work, Schoen offers a diagram depicting the manager's decision environment (Figure 1). It is a rare occurrence when managers have enough time or information to make a perfect decision. This forces managers to make acceptable decisions, but not necessarily optimal, decisions. Although the decision may not be optimal it must still solve the problem using the resources within the manager's control.

Inventory managers are subject to this same decision-making environment, and are tasked with the added responsibility of ensuring operating inventories contain the right items in the correct quantities. This responsibility is an integral aspect of monitoring inventories. Unneeded items and overstocked items waste money since procuring, storing, and accounting for these unneeded items require time, space and money which could have been used on more critical assets. Not having the right items or stocking an insufficient number of critical items incurs the cost of only partly meeting the mission or possibly not meeting the mission at all. Another complex issue is determining inventory requirements for mission effectiveness in a continuously changing world. The world is not static, and

as the operational environment changes, the material needed to complete the mission requirements can change quickly and drastically. Operating inventories must quickly reflect these environmental changes to ensure adequate mission support.

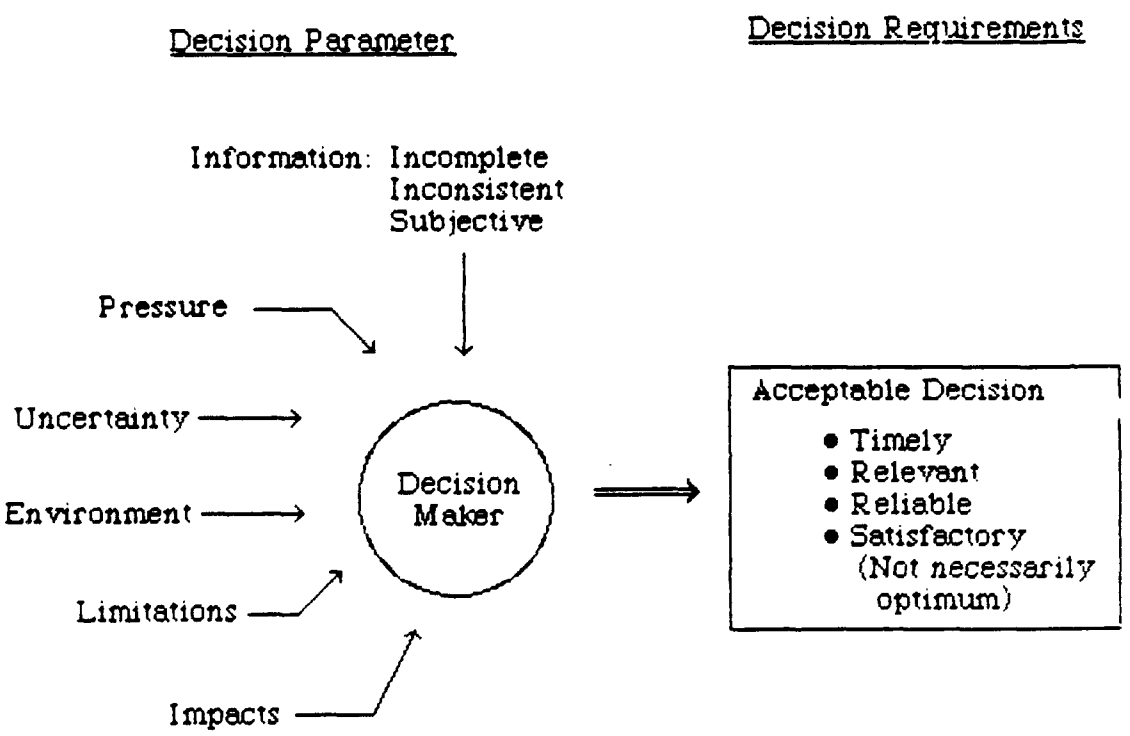

Figure 1. Manager's Decision Environment (20:18)

Defense Department Logistics Environment

The decision environment described above also permeates the Defense Department but the pressure is compounded by the past practices of inventory managers and the present government policies of budget and total force reduction. Since 1974, the General Accounting Office (GAO) conducted at least 21 audits, which revealed problems of overstocking in all

sectors of the Department of Defense. Some reasons for this are the failure to cancel excess stocks on order, keeping unneeded parts, and a lack of management controls (2:61). The Air Force Logistics Command (AFLC) responded to these charges by saying the stocks were insurance against not-mission-capable situations, which is when a lack of parts makes weapon systems unavailable for their intended use (2:63).

Senior military logistics officials are aware of the lengthening lead times for the procurement of assets, which is another contributor to overstocking (2:63). The primary cause of the lengthening lead times is the congressional push for increased competition among the suppliers of assets. Increased competition increases the time before a contract is awarded, which increases the lead times for stock replenishment resulting in the need for larger inventories (3:16).

Longer lead times are not the only problem faced by DOD inventory managers. The sheer size and complexity of many DOD inventories causes severe inventory management problems. Charles Bowsher, comptroller general for GAO, testifying on the DOD inventory system before the Senate Committee on Governmental Affairs in October 1987, said "there was no comparable supply system anywhere" (3:16). The DOD inventory system contains over 4.5 million parts and the Air Force alone has over 18 million square feet of warehouses (approximately 43.7 Astrodomes) (3:16-17). Bowsher continued:

> While the sheer magnitude makes it a challenge to manage, the magnitude makes it imperative to have good management to promote efficient and effective operations, support military missions and protect the inventories from fraud waste and abuse. (3:16)

The inventory of the Wright-Patterson Air Force Base (WPAFB) Medical Logistics Management Branch is one of the largest medical supply inventories in the Air Force. Because of the inventory account size, the dynamics of the account, and the reliance on experienced people to manage the account, the WPAFB Medical Logistics Management Branch is encountering many of the inventory management problems discussed earlier.

Presently, there are about 7,000 line items in the account, which are managed using limited automated detection of inventory management problems. A senior Noncommissioned Officer (NCO) currently spends nearly 25 hours per month reviewing the Monthly Stock Status Report, which identifies potential problems and deciding on corrective actions. Refer to appendix A for a copy of an annotated page from a Monthly Stock Status Report. Hospital inventory management personnel then perform the corrective actions and update the computer records. If this process is delayed, it is finished just before the next month's Monthly Stock Status Report is produced which could increase the number and complexity of inventory problems.

The WPAFB medical logistics inventory account is not only large, but is also very dynamic. When new doctors arrive, they requisition equipment and supplies they are familiar with, but which may not already exist in the logistics system. Items are also added to the logistics system when a new procedure is implemented and the required support materials are not in the medical logistics inventory system. Therefore, the inventory can have items which have very little demand history data. The reverse of this situation also happens. As doctors leave and old procedures are abandoned, many items remain in the inventory which will have few future demands placed

on them. The detection of these situations are compounded by the stockage of low use items which are essential to have available when needed.

Finally, the reliance on experienced personnel to manage the system causes a severe strain on management functions. Once an NCO has a solid background in the various aspects of hospital inventory management, it takes an additional 6 months of on-the-job training working with the Monthly Stock Status Report to become proficient at analyzing the report and making correct decisions. The required training time prevents many personnel from becoming proficient at analyzing the listing. Also, if a trained person is not available to review the report because of leave or temporary duty, the listing does not get reviewed, compounding the number and severity of the inventory problems the next month.

The Medical Logistics Management Branch management believes an expert system could alleviate some of these problems. If the system produced consistent results and allowed a junior NCO to analyze the inventory data and come to similar decisions as the senior NCOs, some of the present management problems would be eliminated. While the expert system may not analyze the inventory data faster, it can run 24 hours a day and generate action-specific reports containing items with similar problems. This should allow for faster entry of the corrective actions into the logistics system; therefore reducing the number of work hours spent on this process.

Solving these problems is of the utmost importance since Air Force managers are faced with the real threat of deep personnel and financial resource cuts under the current government policies. This situation requires the hospital inventory management to harness the power of technology to do more with less. This also means the junior NCOs must

learn how to make decisions that are the same as those the experts make within this environment.

The researcher and the Hospital Logistics Management senior personnel believe these goals can be met by designing and implementing an expert system. Because the researcher is more interested in the thought process of the human expert, the expert system is not the goal of the research. The expert system is the means by which to verify if the researcher captured the expert's decision process correctly. This position is based on a belief that "capturing knowledge for reuse in a new way can be a goal in itself" (20:12).

Specific Problem

Can the decision-making strategies used by hospital inventory management experts be captured in an expert system to help junior managers make similar decisions similar to their superiors?

Investigative Questions

1. What type of reasoning strategies do hospital inventory management experts use to solve inventory problems?
2. If the experts use heuristic reasoning:

   A. Can the researcher generalize the specific heuristics for possible use in solving other types of problems?

   B. Can the researcher verify the heuristic reasoning by building an expert system?

   C. Does the expert system make the same decisions as the human expert?

Scope of the Study

Because of time constraints, the research was limited to the WPAFB Hospital Logistics Management Branch. The location of WPAFB, the interest expressed in the project by the Director of Logistics Management, and his assurance of the cooperation of his personnel and the availability of several experts made WPAFB the ideal choice.

Limitations

The expert system was programmed using dBase III plus. The dBase environment was chosen because it can process large amounts of information quickly. To use almost any other programming language, the raw data from the computer would have to be parsed from an ASCII file and some data preparation might have to be done. Parsing the data and data preparation would most probably be done in a dBase environment because of its speed in performing changes to large data sets. Using dBase will also reduce the number of times data will have to be passed from one computer program to another, reducing the chance for data loss or damage.

Since the dBase expert system has very little user interface, it was decided to develop a tutorial using the same decision rules as its dBase counterpart. The tutorial allowed management and those learning about inventory management to see how decisions are made and allowed them to run data in an alternate environment. The tutorial allowed personnel to run a parsed dBase file or to have the system ask them interactive questions to determine management actions for a particular set of items. VP Expert was the expert system shell used for the tutorial. Expert system shells contain the "inference engine and other control mechanisms, while the user

supplies the knowledge" (11:5). An expert system shell was acceptable for this project because many companies are developing expert systems using expert system shells for commercial sale (22:1). VP Expert was chosen based on the ease of programming and availability. Ease of programming was a primary consideration because the hospital staff would have to program any future changes in the knowledge base to reflect changes in inventory policy.

Summary

This chapter discussed the decision-making environment of managers and then discussed how expert systems interface with this environment. The specific problem with the investigative questions were then proposed. Chapter Two discusses the characteristics of the WPAFB hospital logistics management account and the data collection procedures. It also discusses the underlying assumptions of the model and how hospital management will use the model. Chapter Three then outlines the specific method used to conduct this research.

II. Literature Review

Overview

This chapter discusses the history of heuristics, what heuristics are, and then gives an overview of what expert systems are and some of their underlying assumptions. The discussion also touches on some of the important differences between expert systems and other computer programs. The discussion then turns to the policies of the WPAFB Hospital Logistics Management Branch and describes the characteristics of the WPAFB hospital logistics management inventory account. The chapter concludes with a discussion on why the researcher and the Medical Logistics Management Branch personnel believe an expert system is the best way to computerize certain aspects of the WPAFB hospital inventory management decisions.

History of Heuristics

The ancient Greek mathematician Pappus was the first to describe heuristics. The following is a paraphrase by Polya, of Pappus's report in The Thirteen Books of Euclid's Elements. "The so-called Heuristic is. . . a special body of doctrine for the use of those who, after studied the ordinary Elements, are desirous of acquiring the ability to solve mathematical problems, and it is useful for this alone" (17:141).

Pappus believed heuristics were good for solving mathematical problems only and could not be applied to other fields of study. This was later deemed to be false by René Descartes, who determined he used heuristics or rules of thumb to solve many different types of problems. The

following passage from Descartes treatise, Rules For the Direction of Mind, shows how he discovered and used heuristics.

> And whenever any book by it's title promised some new discovery, before I read further I tried whether I could achieve something similar by means of some inborn faculty of invention, and I was careful lest a premature perusal of the book might deprive me of this harmless pleasure. So often was I successful that at length I perceived that I no longer came upon the truth by proceeding as others do, vis. by pursuing vague and blind inquiries and relying more on good fortune than on skill. I saw that by long experience I had discovered certain rules which are of little help in this inquiry, and which were used afterwards in devising further rules. Thus it was that I diligently elaborated the whole of this method and came to the conclusion that I had followed that plan of study which was the most fruitful of all. (5:16)

Heuristics were in use long before Descartes wrote about them. Gyorgy Polya in his book How to Solve It, describes heuristics as very old problem-solving strategies that were not clearly recorded in the history books, but were nevertheless used in a many areas of study as can be seen in the following passage:

> Heuristic, or heuretic, or 'ars inveniendi' was the name of a certain branch of study, not very clearly circumscribed, belonging to logic, or to philosophy, or to psychology, often outlined, seldom presented in detail, and as good as forgotten today. (17:112)

Definition of Heuristic and Heuristic Reasoning

Even though heuristics have been in use for centuries, and quite possibly for millennia, Polya was the first to define heuristic as an adjective. Simply stated, it means "serving to discover" (17:113). He continues to say "heuristic discusses human behavior in the face of problems, this has been in fashion, presumably, since the beginning of human society. . ." (17:132). Ever since Polya gave a modern definition of heuristics, others have followed by redefining heuristic to meet their

particular needs or views. Artificial intelligence and expert system literature contain virtually hundreds of definitions for heuristic. Barr and Feigenbaum give the following definition of heuristic in their book The Handbook of Artificial Intelligence:

> A heuristic (heuristic rule, heuristic method) is a rule of thumb, strategy, trick, simplification, or any other kind of device which drastically limits the search for solutions in large problem spaces. Heuristics do not guarantee optimal solutions, in fact they do not guarantee any solution at all, all that can be said for a useful heuristic is that it offers solutions which are good enough most of the time. (1:29)

One aspect of heuristics that is almost universally agreed upon, is that they are useful for solving problems. However, not everyone sees heuristics as hard and fast rules or methods. Walter Reitman views information as heuristics to aid in solving problems. He asserts information about a problem can suggest the order to apply possible solutions to the problem, and the information might rule out many solutions earlier thought possible, or may provide a test by which to distinguish likely from unlikely possibilities. Reitman's definition of heuristic is as follows: "All these kinds of information are heuristics things that aid discovery. Heuristics seldom provide infallible guidance. . . Often they 'work,' but the results are variable and success is seldom guaranteed" (18:182).

Judea Pearl agrees with Reitman that heuristics are information based, but adds the human dimension of intuition and common sense. Pearl describes heuristics as:

> . . . rules of thumb, educated guesses, intuitive judgements or simply common sense. In more precise terms, heuristics stand for strategies using readily accessible though loosely applicable information to control problem-solving processes in human beings and machine. (14:vii)

Pearl continues to say heuristics represent a compromise between two basic requirements of decision-making: the need to keep criteria simple and the need to "discriminate correctly between good and bad choices" (14:3).

Herbert Simon builds his definition of heuristic on a foundation of simplifying the problem at hand so a human expert can come to a reasonable decision. He describes heuristic search as a "powerful problem-solving and decision-making tool for people who are unassisted by any computers except their own minds," and must simplify the problem to find an approximate solution. He continues to say heuristics are the "principle engine for human problem solving" (23:35-36).

Since there are so many different definitions of heuristic, the literature often blurs the definitions of heuristics, heuristic reasoning, and heuristic search, and uses the terms interchangeably. It is not as important to be able to distinguish between these terms as it is to understand the power of heuristics and their effect on every-day problem solving. In the following passage, Polya states the power of heuristics, which sets the platform for the rest of this research. This definition of heuristic reasoning is as follows:

> Heuristic reasoning is reasoning not regarded as final and strict but as provisional and plausible only, whose purpose is to discover the solution of the present problem. We are often obliged to use heuristic reasoning. We shall attain complete certainty when we shall have obtained the complete solution, but before obtaining certainty we must often be satisfied with a more or less plausible guess. We may need the provisional before we attain the final. We need heuristic reasoning when we construct a strict proof as we need scaffolding when we erect a building. (17:113)

As seen, heuristics form the cornerstone of human thought processes and are discovered by solving problems and by watching others solve

problems (17:130). Observing others solving problems forms the basis of knowledge engineering, which is a process for building expert systems.

Expert systems are computer programs which apply logic based on heuristics and heuristic reasoning. The next few sections discuss what expert systems are and their relationship to and some of their differences from other computer programs.

Definition of Expert System

Schoen describes an expert system as:

> . . . a computer program designed to represent knowledge of a particular subject as provided by a human expert or other source of information. The system also includes procedures for using this knowledge to arrive at a solution to a problem of the type which would normally require human expertise. (20:5)

This description states expert systems make decisions in domains normally reserved for some human expert. Also note, that expert systems are generally developed for a specific field or area of study. Thus, the focus of expert systems is on enriching the human decision-making environment and increasing the quality and consistency of routine decision making (20:6).

Characteristics of an Expert System

Expert systems are able to enrich the human decision-making environment by manipulating known facts using heuristics and an inference strategy from an expert. Expert systems use heuristics to apply logic, thus manipulating known facts to create new facts. These new facts combined with the old facts allow the expert system to arrive at a problem solution. The manipulation of known facts is accomplished by applying the expert's

knowledge, captured through the observation of the decision-making processes or knowledge engineering. Expert systems can also provide this knowledge to many other inexperienced decision makers, which effectively increases the number of available experts within the organization (12).

Expert systems can also provide consistent, affordable, transportable, and permanent expertise to most any decision maker. These characteristics give expert systems their popularity and usefulness. If the system is posed with the same information repeatedly, it will always give the same result. On the other hand, a human expert in a like situation might give two different answers. Besides being consistent, expert systems are affordable. This is because the organization does not have to hire an expert for projects calling for the knowledge the expert system already contains. Once the company has paid for an expert system, they can use it to solve similar problems in other projects. The knowledge of expert systems is also easily transportable and permanent. Most expert systems can run on small portable computers, and the disk containing the program can be mailed between offices or divisions. This has the added benefit of lending predictability in touchy situations around the company. Also, since the knowledge is in a computer program, it will still be there tomorrow, as computers do not retire or get transferred to another division (12).

Expert System Design

Some of the previously mentioned characteristics of expert systems stem from the design of expert systems. There are many different expert system designs in the literature, but all of them share the following three elements:

1. Knowledge base (or knowledge source)--a domain of facts and heuristics associated with the problem.
2. Inference procedure (or control structure)--uses the knowledge base to find a solution to the problem.
3. A working memory (or global data base)--keeps track of problem status, input data, and rules used in the solution process (9:47)

Figure 2 pictorially shows the relationship of these three elements of expert systems.

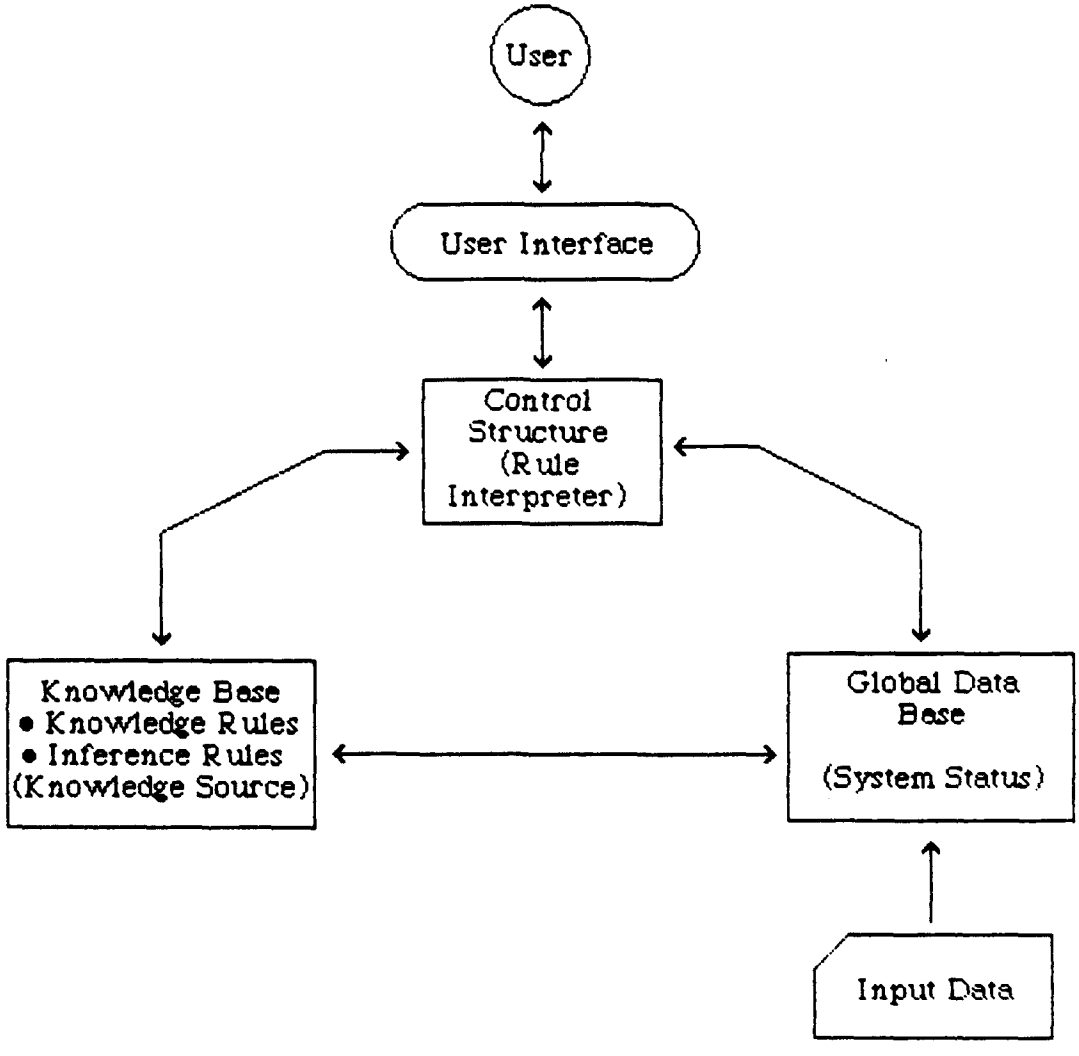

Figure 2. Basic Structure of an Expert System (9:52)

The wiring diagram in Figure 2 is similar for many other types of computer systems, including decision support systems. Though expert systems are very similar to decision support systems, there are distinct differences in the way they store and use the information available to them (Table 1). The main difference of expert systems and other computer programs is "their knowledge is separate from the inference mechanism and they explain their reasoning" (8:9). Though the two types of systems are different, many people use expert systems as decision support systems.

Table 1

Comparison of Expert System and Decision Support System (20:50)

Features	Expert System	Decision Support System
Primary Function	Make available knowledge of an expert	Assist in decision making
Application	Unique, complex, or ill-defined problems	Structured or repetitive problems
Major Focus	Dissemination of expertise	Support decision making
Problem Domain	Complex, wide	Narrow
Data Representation	Symbolic	Numeric
Information in Data Base	Procedural and factual	Factual
Human Interface	System poses questions	Human poses questions
Reasoning Capability	Yes, but limited	No
Explanation Capacity	Yes	No
Source of Recommendation	The system	Human (using system input)

Knowledge Bottlenecks

As with many other types of computer programs, the gathering of the information needed by an expert system to operate efficiently can cause many problems. Knowledge engineering, or knowledge acquisition, is the gathering and "transformation of problem-solving expertise from some knowledge source to a program" (21:321). The knowledge acquisition process is the main bottleneck. This happens for at least one of the following reasons:

1. The expert has trouble verbalizing the rules he follows.
2. There are no experts or a lack of consensus among the experts.
3. The expert system needs a mechanism to refine its rules (21:316).

Once the expert's knowledge has been captured, it is translated into some formal computer language and entered in the system as expressions. A specialized programmer or knowledge engineer does the translation, meaning only a limited number of people have both the problem domain knowledge and programming knowledge. This results in a knowledge bottleneck (16:1-5). Freiling reflects this type of thinking in his definition of knowledge bottleneck, but also sees the bottleneck forming because of inadequate dispersal of much needed knowledge. His definition is as follows:

> In any large organization it is quite common to find "pockets of knowledge" or "knowledge bottlenecks." Pockets of knowledge occur when knowledge crucial to the success of an organization is possessed by only one or a few individuals. Knowledge bottlenecks are pockets of knowledge that impede an organization's progress because the knowledge needs to be more widely distributed. . . . Pockets of knowledge can quickly become serious bottlenecks if the individuals retire or decide to leave the organization. (7:37)

WPAFB Logistics Policies

Expert systems can help with the distribution of critical knowledge throughout an organization. This critical knowledge is not only found in the minds of experts, but often is found in the management policies of the organization. Therefore, a good understanding of the WPAFB hospital logistics management policies is as important as understanding heuristics and the characteristics of expert systems.

The Logistics Management Branch follows the guidance as outlined in AFM 67-1 for monitoring inventories AFM 67-1 contains no procedures concerning the review of the Monthly Stock Status Report. It does however contain definitions of the fields contained within the Monthly Stock Status Report. It does say the medical Logistics Management Branch "should maintain a minimal level, based upon average usage and resupply frequency, of recurring demand consumable supplies" (4:10-1). There are also no local policy letters on file regarding the decision process for the Monthly Stock Status Report or inventory management techniques. During the past Staff Assistance Visit (SAV), the inspector suggested the Logistics Management Branch reduce the size of its inventory through a reduction of assets in economic retention status. This guidance was given verbally and is not contained in the SAV report.

WPAFB Logistics Management Inventory Account

This logistics management guidance is applied to a large and very dynamic medical supplies inventory. The WPAFB medical supplies inventory consists of approximately 7,000 line items with a total dollar value exceeding one million dollars. Approximately 250 line items are added and

200 items deleted from the inventory each month. The Monthly Stock Status Report contains 2700 line items per month. This report contains potential problem items in the inventory and all items requiring manual monitoring. This report is computer generated and does not give a recommended corrective action.

Why An Expert System?

From the discussion so far, it can be concluded that the WPAFB medical logistics inventory account is large and very complex, and that there is very little guidance provided in either Air Force Regulations or local policies on the types of decisions under investigation. This obvious lack of guidance means inventory managers must rely on their expertise and experience to make decisions. Given the size and dynamics of the logistics account and the number of items contained in the Monthly Stock Stock Report, it is difficult for the managers to continually make decisions concerning the status of items in the account. Therefore, the managers are looking for a way to automate this decision making process.

In order to automate the system, one must first examine the reasonings of the experts in the particular field. When this is accomplished, "we shall perhaps be relieved entirely of the task of constructing a new logic norm and action" (19:1). This examination will also allow the knowledge to be examined, and if any flaws are found, they can be corrected; thus improving the knowledge beyond what is presently used (19:1).

Given the circumstances surrounding the medical logistics inventory account and the environment in which expert systems can operate, their characteristics and how knowledge is obtained and used, expert systems are

an ideal choice for this particular problem. Use of an expert system will allow for the automation of the "techniques for representing and executing judgement on existing databases" such as those used to support the hospital logistics management inventory account (10:42). An expert system would also "provide an unambiguous demonstration that a mechanism equipped with a set of methods and rules of thumb . . . can solve a significant number of problems in domains once the exclusive preserve of human intelligence" (18:154-155).

Summary

This chapter discussed heuristics and how they have been viewed and used throughout history. The characteristics of expert systems were discussed to provide a better understanding of how they operate and the environment in which they operate. The discussion then led to the logistics policies the Hospital Logistics Management Branch follows and some of the characteristics of their inventory account and why an expert system is a good choice in this given situation. The next chapter will discuss the methodology used to conduct the research at hand.

III. Procedure

Overview

This chapter discusses the methodology used to discover the decision processes used by the experts and the methodology used to develop the expert systems. The methodology was chosen for its easy implementation and the fact that it produced some type of physical evidence of progress even though an actual computer program was not written until late in the process. Following this is a discussion of the statistical tests used to validate the expert system and how these tests were applied.

Knowledge Engineering

Starting a new knowledge engineering project is a difficult challenge for both the novice and the experienced knowledge engineer. There are two main reasons for this. First: the intuitions and requirements-oriented methods learned when developing programs does not apply well to knowledge engineering tasks. Second: the "methodologies for developing expert systems by extracting, representing, and manipulating an expert's knowledge have been slow in coming" (7:37).

To make a knowledge engineering project easier and appreciate the process, one must recognize there are three basic underlying assumptions to the knowledge engineering process. First, knowledge is more important than the inference strategy (7:37). In short, this means knowledge is more important than the way the expert applies his knowledge. Often the knowledge engineer only has time to acquire the knowledge or the inference strategy. Since it is easier to recreate the inference strategy than the

knowledge, the knowledge engineer should gather the knowledge. Once the knowledge is gathered, the knowledge engineer has the luxury of being able to work on it later when time is not such a limiting factor to develop an expert system. This situation can occur when people retire or leave the company after many years and have not shared their expertise. In cases like this, it is essential to make the time to gather the knowledge so it is not lost.

The second assumption "is that knowledge cannot be gotten all at once" (15:169). This assumption implies that an expert can not elicit all his knowledge in a two hour knowledge engineering session. In fact, if this assumption is taken to the extreme, the knowledge engineer will never obtain all the information an expert knows on the subject in question.

The final assumption is:

> a knowledge engineering project must provide adequate documentation of its progress. At any stage in the process, knowledge engineers must be able to show some fruits of their labor. (7:37)

Freiling suggests a six step approach to knowledge engineering which embodies the three previous assumptions. An outline of this approach is in Table 2. Only the first four steps of Freiling's six step approach are discussed because it was not necessary for the researcher to build an inference engine or extensive user interface for either expert system. The dBase expert system had minimal user interface because once it knows what file to act on it makes decisions and prints the results automatically. The inference engine and the user interface are part of the VP Expert system shell used for the tutorial.

The first three steps are "aimed at acquiring and representing the knowledge necessary for solving the problem" (7:42), and the fourth step is

the actual building of the knowledge base. Associated with each step is some form of documentation which acts as a deliverable product to show the successful conclusion of any given step. This documentation is important because it can be used to show progress on the project even though a computer program has not yet been written (7:42).

TABLE 2

Six Steps of Knowledge Acquisition (7:41)

Knowledge Definition Phase

Number	Step	Project Document
(1)	Familiarization	Paper knowledge base
(2)	Organizing knowledge	Knowledge acquisition grammar
(3)	Representing knowledge	Internal knowledge base formats

Prototype Implementation Phase

Number	Step	Project Document
(4)	Acquiring knowledge	Knowledge base
(5)	Inference strategy design	Inference engine
(6)	Interface design	Interface

A step-by-step approach has several advantages (7:37). First, it allows a knowledge engineering project to proceed from "initiation to implementation without inducing conceptual bottlenecks into the development process" (7:37). Second, by using a step by step approach, one can see wider applicability for this approach. When this approach is communicated to others, it helps reduce both "development times and the level of external consulting required by other projects" (7:41). Third,

though this process does not describe how experts think, it does describe "how most acquisition interviews seem to work" (15:165). If the knowledge engineer understands this method, he will then know where in the process he is, and he can guide the interview accordingly (15:165).

The Knowledge Definition Phase

Every knowledge engineering project begins with the knowledge definition phase. The main emphasis at this stage is to analyze a large complex problem while not getting caught up in the specifics of the problem (7:41).

Step 1 - Familiarization. In this stage of the project, the knowledge engineer determines the "scope and complexity of the task" (7:42). An obvious first step is to "read whatever written sources you can find that provide a high-level perspective on the domain. As you read, note key terms, definitions, and ambiguities in meaning" (15:163). During this stage of the project, the knowledge engineer should choose a representative problem which is simple and not very complex to familiarize himself with basic problems. Also, during the first few knowledge engineering sessions, the knowledge engineer should watch the expert solve these problems or discuss with the expert how to solve the problem to expand the knowledge engineer's understanding of the problem domain (7:42).

Good technique in this stage means the knowledge engineer must not only capture the knowledge reliably, but needs to commit it to some medium which can be reviewed and analyzed later (15:163). When the session is over, the tapes and notes are combed and transcribed in an effort to develop a paper knowledge base consisting of English sentences representing the

facts and rules elicited from the expert (7:43). This step is necessary as new knowledge may be obtained and old knowledge clarified during this review. After the knowledge is put into English and diagrams, the expert must review the paper knowledge base for completeness and accuracy (15:163-164). It will most likely take many sessions with the expert before the paper knowledge base reaches a stable form. The paper knowledge base serves as the documentation for this stage of the project (7:43).

Step 2 - Organizing Knowledge. As the paper knowledge base gets larger, it will soon be out of control. Regularities or patterns should start to appear frequently in the document and the knowledge engineer must group these regularities together. "The next step is to capture these regularities by building a knowledge acquisition grammar to express the facts and rules in the paper knowledge base" (7:43). The syntactic definition of the knowledge acquisition grammar forms the documentation for this step (7:43).

Step 3 - Representing Knowledge. After the knowledge acquisition grammar is specified, it is used to guide "how the knowledge is to be represented in a prototype expert system" (7:44). These internal knowledge base formats are the actual expressions which will be used to program the prototype expert system. The definition of the internal knowledge base formats becomes the documentation of this stage (7:44).

Step 4 - Acquiring Knowledge. At this point of the project, the semantic grammar and the internal rule formats have been defined and the knowledge engineer can now make a "wholesale effort to acquire knowledge relevant to a particular task" (7:45).

> The documentation of this step is a prototype knowledge base, containing facts and rules specially relevant to the prototype under construction. The prototype knowledge base will exist in two forms, an external knowledge base consisting of rules as acquired from the expert in English and an internal knowledge base ready to be processed by some inference engine. (7:45)

Experience has shown the knowledge "elicited from the expert consists primarily of references to objects, relations, observations, and events which are well known in the problem world" (7:46). It is at the final grammatical processing that the "references aggregate into heuristic connections, say between an observation and a conclusion" (7:46). This is not surprising, because "heuristics are discovered by consulting simplified models of the problem domain" (14:115) and often appear as repetitions in the problem solving process.

Interviewing

A very important part of the knowledge acquisition process is interviewing the expert. These interviews are usually unstructured to allow the researcher to probe as deeply as necessary to gain a full understanding of the problem and its domain.

The importance of good interviewing techniques cannot be over emphasized, as the knowledge engineer must interview at least one expert to develop a system. One of the first rules of successful interviewing is to allow the expert to complete his thoughts without interruptions from the researcher. This keeps the expert from getting off track which "may stop the flow of a productive hypothesis" (15:170). The interviewer should take notes of the side areas the expert touches on in order to ask questions about these areas after the expert finishes speaking. Also, the exchange of ideas should not be limited by your ability to immediately absorb everything the

expert says. This could drastically affect the amount of output you receive (15:170).

Another factor affecting the amount of output you receive is that some experts may have great difficulty expressing their thoughts, or might give answers which are shallow or incomplete. These types of problems happen frequently and the researcher "must deal with these factors and use procedures which encourage and clarify responses" (24:15). Probing is a procedure which can help to overcome these difficulties. A probe has two major purposes: first, it must motivate the expert to clarify or explain the reasons behind what was said or done. Second, it must focus the expert's attention on the problem so "irrelevant and unnecessary information can be avoided" (24:15). The most important thing to remember about a probe is it must not introduce bias (24:15).

There are several different kinds of probes. First there is repeating the question, which allows the expert hear the question one more time giving him time to think and collect thoughts while focusing on the question. The expectant pause is the simplest way to convey understanding that the expert has begun to answer, but acknowledges there is more to be said. Repeating the expert's reply is another important probing technique which allows the expert to hear his answer and reflect on the information he has given. Another means is asking for further clarification (24:15-16). Lastly, "ask one question at a time, preferably subjunctive questions that use words like 'might,' 'should,' 'could,' 'would,' and 'assuming'. Then be quiet and listen" (15:172). All in all,

> successful probing requires that you recognize immediately just how the respondents answer has failed to meet the

objective of the question and then be able to formulate a neutral probe to elicit the information needed. (24:16)

After understanding the discussed techniques, the knowledge engineer was ready to conduct the research in three phases: knowledge acquisition and analysis, expert system development, and validation of the expert system. During the research, these phases often overlapped each other. Each individual phase is discussed in turn in the following sections.

Knowledge Acquisition and Analysis

The objective of this phase of the research was to acquire the expert knowledge to determine the reasoning strategies used by the inventory management experts and to develop a prototype of the expert system and dBase program.

Step 1 - Background Information. The first step was for the researcher to become familiar with the types of problems to be solved and the problem domain. To accomplish this, the researcher obtained an annotated copy of the Monthly Stock Status Report to analyze. The researcher then reviewed the report to become familiar with the variables involved in the problem domain and to determine some of the relationships between these variables. After the initial familiarization, the researcher chose several representative problems and developed several modifications by changing the values of some variables and had the expert reevaluate the problem. First, the researcher modified the variables one at a time while holding all others constant, then at other times, the researcher modified the variables in combination to check for interaction between the variables. During this phase the researcher also reviewed applicable regulations.

manuals, and policy letters of the medical logistics field to develop a sound understanding of hospital logistics management policies.

Step 2 - Expert Selection. Once familiarized with the problem domain, the researcher then began the task of selecting an expert. The WPAFB Medical Logistics Branch had two senior Noncommissioned Officers (NCO) who were possible candidates to act as experts for this research. The Director of Medical Logistics recommended both NCOs, and each has over 15 years of experience in medical logistics. The researcher used only one expert for the knowledge acquisition phase, because one NCO attended the Senior NCO Academy during this phase, and was unavailable. However, both experts were used to verify the expert system results.

Step 3 - Extracting Knowledge. After the researcher selected an expert, he began the process of extracting the expert's knowledge. During this crucial step the expert solved the problems selected in step 1. The knowledge engineer first observed the expert solve the problem, then probed the expert as needed to acquire additional information and a thorough understanding of the problem. The knowledge engineer continued to present problems and probe the expert until thorough understanding of the problem solving techniques was reached.

The knowledge engineer conducted ten 1 hour problem solving sessions. Each session was tape recorded and copious notes were taken. After each session the knowledge engineer listened to the tapes and referred to the notes to extract the facts and rules used to solve the problems. This data extraction formed the paper knowledge base described previously.

Step 4 - Knowledge Analysis. Analysis of the paper knowledge base for patterns and regularities started upon completion of the paper

knowledge base. These regularities form the heuristics involved in solving the problems. Analysis and generalization of the specific heuristics then proceeded.

System Development

This phase of the research involved building a working prototype expert system from the paper knowledge base and developing the expert system into a fully operational system. The process proceeded in a stepwise manner to reduce the number of problems with incompatible rules.

After gaining a thorough understanding of the problem solving process, the knowledge engineer coded that particular portion of the paper knowledge base into a quasi machine code. The expert then reviewed the English knowledge base for accuracy. The expert changed the English code and the knowledge engineer later changed the quasi machine code. The knowledge engineer then programmed a prototype expert system using the quasi machine code as a guide.

When the knowledge engineer believed the prototype made the correct decisions, the prototype was demonstrated for the expert. The expert solved a given set of problems by hand and then solved the same problems using the prototype expert system. If the system did not produce a similar answer, the knowledge engineer and the expert analyzed the prototype knowledge base for completeness and accuracy. This process was repeated several times varying the input data. Once the prototype expert system performed adequately and the knowledge engineer understood a different type of problem well enough, a new type of problem was added to the prototype

system in the same manner. This process continued until the system could solve all types of problems and performed as well as the expert.

System Validation

Once the prototype performed adequately, the researcher began efforts to validate the system. This phase of the research involved comparing the results of the expert system with those of the expert. The researcher took a stratified random sample from each month of available data to validate the system. A stratified random sample was chosen because the total inventory consists of over 7,000 line items, and the researcher wanted to ensure all price ranges of items were represented. Robert O'Keefe suggests a stratified random sample because the real "issue is not the number of test cases, it is the coverage of test cases--that is , how well they reflect the input domain" (13:83). A computer generated the uniform random numbers to be used for the stratified random sample of the inventory leveling data. The inventory leveling data was stratified by using price as a criteria. The specific groups used were: less than ten dollars per unit, between ten dollars and less than 100 dollars per unit, and more than 100 dollars per unit. Leveling data was used because the researcher could not capture the Monthly Stock Status Report data as it is deleted once the report is written. The leveling data was an excellent alternative as it is modified by a report generating program to produce the Monthly Stock Status Report. Appendix B contains a description of the data elements contained in the leveling data file.

Using preliminary estimates for the size of the account and its standard deviation, the number of problem items in the account and its standard

deviation, and a 95 percent confidence factor, the optimal sample size was determined to be 39 using the formula found in Business Research Methods by Emory (6:296). Appendix C contains the data used to determine the sample size. To account for any errors in the estimates, a sample size of fifty was used for all sample sets. To give the statistical tests used to determine if the expert system was operating as planned significant value, 15 random samples were taken over a period of 9 months of inventory leveling data and can be found in Appendix D.

The researcher edited each decision file so that it contained only the data from the random sampling. The researcher then appended the expert's responses taken from a hard copy of the selected items to the file on the computer. The researcher then compared the decisions made by the expert system to the human expert's decision. If the decisions did not match, the researcher consulted with the expert to see if a mistake had been made. If the expert stood by his decision, the researcher then tried to determine if the program contained faulty logic or if there were unusual characteristics within the data causing the discrepancy.

Once the researcher determined all decisions were accurate and correct, he compared the results statistically. This was done by calculating a 95 percent confidence interval of the mean number of responses that agreed, across all 15 data sets. First, the researcher performed a t test on the decisions. To accomplish this, the researcher compared both sets of responses and assigned a numerical value of zero for decisions that agreed, and a value of one for decisions that disagreed. Next, a two-tailed t test was performed using a mean of zero. Lastly, the t probability value was

analyzed using a confidence limit of 95 percent to determine if the mean of the distribution was in fact zero.

Summary

This chapter described the procedure used to conduct the research in an effort to answer the investigative questions. It discussed the process used to gather and analyze the knowledge and build the expert system. The discussion led to how the researcher measured the effectiveness of the expert system he developed. The next chapter will discuss the results of the research.

IV. Findings and Results

Overview

This chapter discusses the rules the expert uses when analyzing the Monthly Stock Status Report and some of the logic underlying these rules. The discussion concludes with the results of the verification of the expert system.

Findings

The researcher found the expert used ten different decision rules to determine five different management actions. While some of the rules are based on the expert's past experience, some rules reflect the way management wants to change the structure of the inventory account. The expert also used several other rules to aid in the analysis of the data before applying the decision rules. These rules changed the raw numerical data into a symbolic or boolean form which the expert used in the decision rules. These types of data transformation occurred during the following situations: if there had been three months with demands in the past six months, or if demand was consistent over the past six months, if the item was recently added to the inventory system and other such data transformations. These transformations were captured in the knowledge engineering sessions and coded into the expert system to eliminate human interaction with the decision process. Then the expert used the decision rules to assign one of the following management actions: delete the item, determine if prior action is required before deleting a nonrecurring demand item, excess part of the

item inventory, establish an operating level for an item, or to remove the unique management code from an item record.

The decision rules are discussed in the order they appear in the program. The order within the program minimized rule interaction and reflects management's priority of actions to perform on the items. Interaction amongst the decision rules at times was quite prevalent and often times an item met the criteria in several rules.

The first four decision rules deal with deleting an item from the inventory. These rules are at the beginning of the program because medical logistics management is trying to reduce the size of the inventory due to a move to a smaller facility in the future. Management believes that a smaller inventory may relieve some of the strain caused by a dwindling experienced manpower pool and reduced budgets also assumed this posture.

The first rule deletes items which have not been issued for the past six months and have no outstanding due ins or due outs. This rule deletes items because the usage is not at a sufficient level to warrant stockage and there is no pending action against the particular stock number. The low usage rate indicates the item is rarely used and unless the item is critical, management should delete the item. The item is retained in the system if there is a due in or due out pending because most of the time they could not stop the shipment from arriving. The second rule has similar criteria as rule one. This rule examines items which have been in the system for six months. It recommends these items be deleted if there has only been demand for the month they entered the system. Items meeting this criteria should probably been ordered as a one time buy. This situation most likely occurs because the customer said the item would be used on a recurring basis and

medical logistics personnel should add it to the medical supplies inventory. Since the customer requested the item only once since it entered the system six months ago, logistics management personnel should delete it because of its low usage and nonrecurring demand.

The item's consumption pattern and average pipeline time form the basis of the third deletion rule. If an item has low consumption, less than 0.3 units demanded per month, and a short pipeline time, less than 31 days, logistics management personnel would delete the item. This rule deletes all items used infrequently with short lead times. The consumption rate is based on the expert's experience and is not analytically based nor determined; therefore, this value may not be optimal but is working well. The expert chose 31 days as the cut based on his experience. The computer defaults to an average pipeline time of 31 days when it has insufficient data to calculate an average pipeline time. If the average pipeline time was less than 31 days, the potential to leave items in the inventory system when they should be deleted is increased.

The fourth deletion rule determines whether the stock number should have even been loaded in the system. This rule looks at the stock number to determine if it starts with a 'P', ends with an 'IF' or if the string 'LFB' is in the stock number. These character strings are appended to or imbedded in the stock number of items purchased on a nonrecurring basis. These numbers usually are not supposed to be entered into the system because they will not have recurring demand, but inadvertently were entered into the system. This normally occurs because someone made a mistake and entered the item as having a recurring demand. Management should delete any stock number containing one of these character strings unless there is a due in or

due out pending, in which case management treats the item differently before deletion. In such a case, the expert system places the item into a separate report. This rule was not added to the system until the validation phase because the expert did not convey this information during the original knowledge engineering sessions. The above illustrates the difficulty in obtaining knowledge from an expert. Under certain circumstances, the expert recalls more form memory than at other times.

The fifth rule of the expert system deals with identifying items to be put into excess status. Items are placed into excess status when the quantity in economic retention minus the number due out exceeds half the value of the economic retention level. AFM 67-1 contains no guidance as to when an item is declared in excess status or how many to declare. The expert determined the above criteria would not allow the inventory of the items in question to get too large, yet would keep an adequate number of assets in stock to minimize the loss of investment cost of the items. This situation usually happens as demand for an item falls off which lowers the demand rate. The lowered demand rate results in the computer setting a lower operating level forcing assets in stock into economic retention status and eventually into excess. If the demand stays steady at the lower rate, the customers will eventually use the items in economic retention status. If the demand rate becomes too low, the expert system will recommend deletion of the item sometime in the future.

Establishing an operating level for those items which have no established operating level and are not contract specific is the focus of the sixth rule. Contract specific items contain the character string 'CT' at the end of the stock number. The contracting section manages these items and

hospital logistics management should take few if any actions on the item. This situation seemed to affect only this rule. This rule only applies to items with an operating level of zero and occurs when customers order a particular quantity of an item which is different from the quantity unit pack the logistics management branch has to order from the supplier. In this situation, the logistics management branch orders more than the customer needs although there is no demand for all the items. The quantity due in will exceed the quantity due out. The operating level of zero occurs because the person entering the data into the inventory system does not recognize what is happening or forgets to establish an operating level for the item. The action portion of this rule determines whether a daily demand rate has been established for the item. If the item has a daily demand rate, the expert system suggests an operating level of ninety times the demand level, or a three month supply. The expert suggested this operating level, which should provide enough assets to cover one month lead time, one month of demand, and one month of safety stock. If no demand level has been established, the expert system suggests an operating level equal to the difference between what is due in and due out.

The next three rules determine if the U management code should be removed from the item record. Management places this code on an item record when they wish to manually review and control the asset. This situation usually happens when an item enters the system or the customer requests the logistics management personnel to delete the item from the medical supplies inventory. When an item enters the system, management overrides the computer generated operating level with one they deem more appropriate and they place the U code on the item. The U code acts as a flag

causing the computer to print the item in the Monthly Stock Status Report; therefore allowing management to manually review the record. If an item entered the inventory less than six months ago and has at least three months with demands, logistics management personnel should remove the U management code. This indicates the customer demands for the item are at an acceptable and steady level. Management should also remove this code if the item entered the system more than six months ago but less than 12 months ago. By this time, the computer generated operating level is usually the same as the operating level deemed appropriate by management.

The third way to remove a U management code is when the demand is consistent over the past six months, the item is old, and the demand in the last six months is less than half of the demand of the previous six months. Inventory management will place a U management code on an item record when a customer requests the item to be deleted from the inventory account. This is done to give the item visibility and to determine if there are other users of the item. If demand for the item continues and the demand is consistent, the U code will be removed. Demand for an item is consistent if in the past six months there were no two months in a row with no demand and the demand in any given month is less than the operating level. If there are no other users of the item, management will delete the item when six months have passed with no demands placed on the item.

The last decision rule deals with checking dates of certain dated items. If the on hand serviceable balance of a dated item exceeds the operating level, the expert system flags this item so someone can check the expiration date. This rule is necessary because as the demand of a dated item declines, there is the possibility that the item will exceed its expiration date before it

is issued. This rule does not differentiate between the different types of dated items and makes no other recommendation other than to check the expiration date.

The expert system had two more rules which were added for the sake of good programming practices. The first added rule checked to see if an item had either a demand in the past six months, a due in or due out. Any items fitting this criteria were given an action of 'ok.' If there were any items which did not fit any of the criteria outlined by the previous rules, the expert system gave that item an action of 'unknown.' The expert system printed the items with an action of unknown on a separate report. This allowed the inventory managers visibility of any items the expert system did not know how to handle. In all the validation and verification tests, this last rule was never activated by an item.

Table 3 lists the decision rules as they are found in the expert system.

Table 3

Expert System Decision Rules

Rule No.	Rule Description
1	Delete items with no issues in past six months
2	Delete new items with no issues in past five months
3	Delete items with low consumption and short pipeline time
4	Delete one time buy items
5	Place items into excess status
6	Establish operating level
7	Remove U code for new items with three demands in past 6 months
8	Remove U code for new items in system for more than six months
9	Remove U for old items with another user
10	Check date on dated items
11	Determine items that are ok
12	Unknown

Results

The expert system applied the rules discussed above to 15 sets of validation data, and the researcher compared these results to the answers prepared by the expert for the same data. Refer to Appendix E for a listing of the decisions made for each data set. Discrepancies were not verified at this point in the analysis. Table 4 shows the results of this analysis.

Table 4

Results Without Verification of Decision Discrepancies

Sample Set	Correct Responses	t Value	2 tail t Probability	Conclusion
1	49	1.000	0.3222	fail to reject
2	43	2.824	0.0068	reject
3	40	3.500	0.0010	reject
4	44	2.585	0.0128	reject
5	46	2.064	0.0443	reject
6	39	3.718	0.0005	reject
7	43	2.824	0.0068	reject
8	44	2.585	0.0128	reject
9	42	3.055	0.0036	reject
10	45	2.333	0.0238	reject
11	40	3.500	0.0010	reject
12	40	3.500	0.0010	reject
13	47	1.769	0.0832	fail to reject
14	44	2.585	0.0128	reject
15	43	2.824	0.0068	reject

95% confidence interval 43.267 ± 1.559

This table shows the expert system made the correct decision on average 43 times out of 50, or 86% of the time. The t-test results indicate rejection of the hypothesis that the expert system performs as well as the human expert is warranted.

These test results led the researcher to verify the discrepancies with the human expert. The researcher then found the human expert often forgot to apply one or more of the decision rules. The expert confirmed that often it was hard to concentrate because of frequent interruptions or because he was tired. Sometimes he just made a mistake because he did not review all pertinent data. This verification process added validity to the expert system. This increased validity was obtained because the expert sometimes changed his decision when confronted, and the expert system chose the new decision from the outset. The expert changed his decision usually when he took into account all of the data provided and came to a less than optimal decision. After the discrepancies were verified, the following results were obtained:

Table 5

Results With Verification of Decision Discrepancies

Sample Set	Correct Responses	t Value	2 tail t Probability	Conclusion
1	50	•	•	fail to reject
2	49	1.000	0.3222	fail to reject
3	49	1.000	0.3222	fail to reject
4	50	•	•	fail to reject
5	48	1.429	0.1594	fail to reject
6	49	1.000	0.3222	fail to reject
7	50	•	•	fail to reject
8	50	•	•	fail to reject
9	49	1.000	0.3222	fail to reject
10	50	•	•	fail to reject
11	50	•	•	fail to reject
12	49	1.000	0.3222	fail to reject
13	50	•	•	fail to reject
14	49	1.000	0.3222	fail to reject
15	50	•	•	fail to reject

95% confidence interval 49.5 ± 0.354

These results indicate the expert system performs very well. In fact, the expert system made the correct decision 99% of the time. The t-test indicates failure to reject the null hypothesis that the expert system makes the same decisions as the human expert. Therefore, it is reasonable to assume the expert system made the same decisions as the human expert for the verification data sets because the t-test did not reject the null hypothesis.

One interesting note about the decisions that the expert system and the human expert did not agree on, is most of these items should have had some action taken upon them at some time in the past. The expert system was not programmed to find these items and most of the time, the expert system would have made the same decision as the human expert in the previous month. Most of the items fell into one of two decision categories. The first situation was when an old item had a U management code in the item record and the item was being used at a consistent rate. The human expert concluded the U code should be removed and the expert system determined the item was ok. This disparity occurred because the expert system was not programmed to remove U codes from old records which had consistent demand data over the past year. The second decision category was old items with a demand the previous month, but with no other or very few demands for the rest of the year. In this circumstance the human expert concluded the item should be deleted and the expert system concluded the item was ok. The expert system reached this decision because the item record data did not fit the criteria for the deletion rules, but did for the ok rule. When this situation occurred, it was noticed that generally the expert system would

have deleted the item the previous month which would have agreed with the decision the human expert.

Summary

This chapter discussed the decision rules the human expert used to determine management actions on items in the medical inventory system. The discussion also included those rules used to transform the raw numerical data into a more symbolic form. Following these rules was a short discussion of the results of the verification process of the expert system. The results of the verification process indicated the expert system was more consistent in the decisions it made than the decisions made by the human expert. The next chapter discusses the conclusions we can draw from the findings and results outlined in this chapter.

V. Conclusions

Overview

This chapter briefly outlines the investigative questions of this research, the methodology used for the research and the research findings. The discussion answers the investigative questions and draws conclusions from the findings and results presented in chapter four. This discussion is followed by a short section on areas that might be of interest for further research.

Summary of Research Effort

This section briefly discusses the research objective, the methodology used to achieve this objective and the findings and results from applying the methodology.

Research Objective. The objective of this research was to discover the reasoning process of hospital inventory management experts. This knowledge was used to develop an expert system to help junior NCOs to make the same decisions as the inventory expert in an effort to help alleviate some of the budget constraints and manpower shortages the WPAFB Medical Logistics Management Branch is experiencing. The other reason for doing this research was to record the knowledge which is fairly well known now in a medium which can be readily accessed in the future when most people have forgotten the underlying processes of the computer programs they run every day. Thus, the underlying objective of this research was to expand the knowledge base of inventory managers.

Research Methodology. The research was conducted in three phases: knowledge acquisition, system development, and system validation. The knowledge acquisition phase consisted of domain familiarization and the actual knowledge acquisition interviews. During the system development stage, the knowledge was analyzed and problem patterns began to emerge. This knowledge was translated into a computer code in a piece wise fashion. As each problem area was added, the system was verified to ensure minimal interactions of the variables. Once all the problem areas were encoded, system validation was accomplished. During this phase of the research, 15 stratified random samples of actual data were analyzed using the expert system and the human expert. The expert system answers were compared and verified with those of the inventory expert. This phase of the research was necessary to verify that the expert system contained and applied the human expert's knowledge correctly.

Research Findings. It was found during the course of the research that the expert used ten different rules to determine five different possible management actions. In the course of reaching a decision, the expert often converted the raw numerical data into a more symbolic form. During the expert system validation phase, it was found that the expert system provided more consistent results than the human expert. This was revealed when the discrepancies between the expert system and the human expert were verified and the human expert realized he did not look at all of the data or had made a mistake. Once the discrepancies were verified, the expert system made the correct decision over 49 times out of 50. A listing of the rules can be found in Table 3.

Conclusions

The following conclusions are directly based on the investigative questions forming the framework for this research.

Investigative Question 1: What type of reasoning strategies do hospital inventory management experts use to solve inventory problems?

Conclusion 1: Hospital inventory managers use heuristic reasoning based on their past experience and intuition. There is little guidance provided in AFM 67-1 or in local policy letters on the types of decisions being made on the Monthly Stock Status Report. This forces the inventory managers to rely on their past experience and intuition when dealing with management problems. Secondly, they are not using any type of algorithmic process to determine if the criteria set forth in the decision rules is optimal or any type of post analysis to determine if the decision made based upon the item leveling data is optimal. The inventory management experts have found that over a long period of time, the criteria in the decision rules works well enough most of the time. This does not imply that the decisions are correct all of the time or even that they are optimal, but that most of the time they are acceptable.

Investigative Question 2: If the experts use heuristic reasoning:

A. Can the researcher generalize the specific heuristics for possible use in solving other types of problems?

B. Can the researcher verify the heuristic reasoning by building an expert system?

C. Does the expert system make the same decisions as the human expert?

Conclusion 2: The heuristics used by the WPAFB Medical Logistics Management Branch can be generalized for possible use in solving other types of problems. Time, consistency of use, determination of low consumption and when to let the computer track items are four of the most useful generalized heuristics resulting from this research. These generalizations were taken from the rules for the expert system and discussions with the expert.

Generalization 1: Six time periods provide an adequate history to base decisions on for dynamic situations. A larger number of time periods may allow more accurate decisions, but the loss of timeliness may cost more in the long run. While a smaller number of time periods would provide better timeliness, the short history may not provide enough data to determine accurate trends causing erroneous decisions. There is no set length of time that makes up a time period, though the time period must be consistent across the analysis. Also note that the more dynamic a situation is, the shorter the time period can be to ensure timeliness of the decision. The rules in the expert system frequently used six months as the basis of the decision.

Generalization 2: Consistency of demand or usage is often important. If the situation is characterized by a Poisson distribution with a mean significantly different than zero, it is consistent if a demand occurs at least every other time period and does not exceed a reasonable value within the past six time periods. When the mean is close to zero, the number of consecutive time periods with no demand must be increased. This is because a demand of one unit must be averaged over a greater number of time

periods to approximate the mean. The reasonable value must be set by management and is usually some fraction of total possible output.

Generalization 3: Low demand or usage in a dynamic environment is characterized by a rate of less than 0.3 per time period. This could vary according to the length of the time period and the rate of demand. Usually an event is not given much weight in a dynamic environment if it has a less then one-third chance of happening. In these situations, one would truly be run over by the elephants while he was taking care of the ants.

Generalization 4: If there is an automated tracking system, allow it to track events which occur three out of six time periods. Usually automated tracking systems need fairly consistent data and a good history of the event. Six time periods of data usually gives a good indication of the frequency of the event for a good forecast. If the event occurs more frequently, fewer time periods are usually needed.

Conclusion 3: The researcher was able to build an expert system from the knowledge obtained from the knowledge engineering sessions. The researcher built two expert systems. The first one was done in VP Expert, which asks the user questions to determine what action to take. A listing of this program is in Appendix F. The user inputs the response when prompted. If the user does not know why the expert system is asking him a certain question, he can ask the system why it needs to know that piece of information. The user can also ask for help to determine the criteria used to convert the numerical data into a more symbolic form. This particular system was designed to be a tutorial.

The second expert system was done in dBase III+. The listing for this program is in Appendix G. This expert system uses an unparsed ASCII file

as input, and produces a dBase file as output. This expert system uses the exact same rule set as the VP Expert program, but has minimal interface with the user. This program has a short optional instruction screen before asking the user for the input file and the name of the output file it should create. Once this system completes the decision making process, it prints the results to a line printer rather than the screen. A sample of the output is in Appendix H. The dBase expert system does not delete the output file, which can be used to perform management specific queries not in the expert system reports generator by accessing the output file using dBase III+.

Conclusion 4: The expert system made the same decisions as the human expert and in some cases performed better than the human expert. Table 5 shows there is no significant difference in the decisions the expert system made versus the de ions made by the human expert for the fifteen verification data sets. In fifteen data sets, the expert system made the same decision 49.4 ± .4 times out of fifty at a 95 percent confidence level as the human expert would. In fact, the expert system was more consistent than the human expert due to human error.

Recommendations for Future Research

This research broadened the knowledge base of the application of expert systems to the field of logistics management. The research also revealed several other areas which should be studied further to enhance the body of published knowledge. These areas include other areas of logistics management burdened with computer listings which presently require human analysis, the long term use and effectiveness of expert systems, and further research on the application of expert systems to inventory control.

The logistics management arena offers numerous opportunities to apply expert systems. Over the years as researchers enhanced computer data storage capabilities, the number of reports managers review increased dramatically. Most of these reports are excellent candidates for the application of an expert system even though it may not be a very large project. It is very likely a researcher could build an expert system that analyzes several reports since many reports may share a common database. In this case, a significant amount of data preparation could be eliminated while creating a much more meaningful and comprehensive report.

Freeing managers of the burden of reviewing volumes of computer generated reports to make basic everyday decisions would impact office effectiveness and efficiency. The use of expert systems would free managers to solve larger more complex problems making them more effective. Since an expert system would very possibly arrive at a decision faster than the manager could manually, the manager's efficiency could very well be increased. Efficiencies could also be increased dramatically if the expert system transfers its solutions back to the computer which supplied the data as an automated input for problem correction. In this way, human intervention is not needed and the system would react automatically to known problem conditions.

A more intriguing question to research is what happens to expert systems once they are implemented and in service for an extended period of time? There has been little research done on the updating and extended use of expert systems. This allows for much debate over who should update the knowledge base of an expert system, the developer or the end user? The end user usually has the expert knowledge to update the system, but not the

programming knowledge. The reverse is true for the developer who usually builds the system on contract. This leads to another important area for further research, how many expert systems are not being used because the knowledge they contain is old and no longer valid? Many expert systems have been built in the recent past and were readily accepted by the management community. As the environment changes and policies are updated, have the expert systems been enhanced to reflect these changes or have they fallen by the wayside because they no longer perform the function required by management? The answer to this question can affect the future design of expert systems and further define when it is effective to build an expert system. Design changes could very well be aimed at easing the updating mechanism of the expert system by the user.

More research needs to be done in the area of expert systems and inventory control. The two main areas for research within this broad topic are capturing the knowledge of inventory control practices and integrating the expert systems developed from this knowledge into the inventory control computer to increase the computer automation of the process. The just completed research looked mainly at deleting items from the inventory. An area just as important which needs to be researched is when to increase levels of items already in the inventory. Many times demand for items rises over time causing shortages within the supply system. If the knowledge surrounding this situation was captured and refined into an expert system, inventory systems might react quicker to this situation and thus there would be an increase in customer service levels. Presently, WPAFB medical logistics management does not review the Monthly Stock Status Report or search the inventory database for this situation.

Another area worthy of research is the application of an expert system for inventory control in a just-in-time environment. With the pressures to reduce costs, many managers are cutting their overhead by moving into smaller warehouses, reducing inventories, and going to a just-in-time inventory policy. The management of inventories becomes paramount in this environment. There is less margin of error and system reaction must be faster. With the number of items stocked in any company, an expert system should reduce the effort required to manage the inventory system.

To further reduce the effort required to manage inventory systems, the expert systems developed to run on microcomputers should be integrated into the inventory mainframe computer. Many expert systems print reports which indicate the action to be taken, but an operator still has to input these actions into another computer. It would be well worth the research effort to determine if expert systems now in existence could be integrated into the host mainframe computer to reduce operator interface. This should result in faster updating of vital inventory records with increased accuracy. This would allow the management of inventory systems to be almost completely automated.

Summary

Expert systems have an impact on the way managers conduct their business. They allow most anyone to make the same decisions as a seasoned expert in the area for which they were developed. As managers develop more computer programs to make life easier, one fact is often overlooked. People are becoming more dependent upon computers and view the computer processes as a black box. As this happens, people will become less

aware of the heuristics and knowledge behind the computerized process. Therefore, managers must not let the knowledge they possess be forgotten or lost in some computer program where subordinates would have a hard time recreating and understanding the process. Expert systems are a unique type of computer program which not only make life easier through computer automation, but can also explain the process they perform filling the knowledge gap which would otherwise exist.

Appendix A: Monthly Stock Status Report

The following page is a copy of an annotated page from the Monthly Stock Status Report dated 1 Oct 90.

```
PREPARED 90 OCT 01                        MONTHLY STOCK STATUS REPORT        AS OF 90 SEP 30    RCN SIOOR-YO8
                                                                                                JULIAN DATE 90274

                                   F NIC                       FU EX RS&M    INT        STANDARD       ADJUSTED      LOCATION
STOCK NUMBER    ITEM IDENTIFICATION I CO  <  ITEM STATUS  > NO CD CODE RID PACK   UNIT PRICE U/I  UNIT PRICE L/I    CODE

6505C1[illegible]  AC [illegible] SULFAT  [illegible]  DATED     [illegible] 1  L4  LG[illegible]   20.71 EA          BULK

EET CODE A  [illegible]              STOCK CONTROL DATA    ISSUE HISTORY      <   I T E M   R E V I E W   >
SERV                                 [illegible]       6 JAN    3 JUL   108    CD    DESCRIPTION
REP                                  [illegible]  1.045  FEB      AUG     6    10 SCL < MINIMUM REQUIREMENT
SUSP                                 [illegible]  QTY  12 MAR  30 SEP    54
C/I                                  LIFE [illegible] UNIG  0 APR  27 OCT
C/O                                  PLF   4 PLF   6 MAY   22 NOV    36
CURR LEVEL                           PLF     PLF   7 JUN   30 DEC    18
SUGG LEVEL                           PLF   4 PLF   4 TOTAL ISSUES   345
ECON AUTH      7                     AVG PIPELINE  5 $ VAL ISSUES  7144.95   CURR MONTH ISSUE

                                   F NIC                       FU EX RS&M    INT        STANDARD       ADJUSTED      LOCATION
STOCK NUMBER    ITEM IDENTIFICATION I CO  <  ITEM STATUS  > NO CD CODE RID PACK   UNIT PRICE U/I  UNIT PRICE U/I    CODE

6505[illegible]  [illegible]                 DATED     AS 1  L4  LU[illegible]    [illegible].29 EA                  LOOS

EET CODE A  [illegible]              STOCK CONTROL DATA    ISSUE HISTORY      <   I T E M   R E V I E W   >
SERV                                 [illegible]       3 JAN      JUL     3    CD    DESCRIPTION
REP                                  [illegible]  .067   FEB      AUG     2    06 OPERATING ASSET EXCEEDS LEVEL
SUSP                                 [illegible]  QTY    1 MAR    SEP     1    10 SCL < MINIMUM REQUIREMENT
C/I                                  LIFE [illegible] UNIQ  0 APR    OCT
C/O                                  PLF   5 PLF     MAY      NOV
CURR LEVEL                           PLF     PLF       JUN      DEC
SUGG LEVEL                           PLF     PLF      TOTAL ISSUES      6
ECON AUTH                            AVG PIPELINE  31 $ VAL ISSUES   91.74   CURR MONTH ISSUE

                                   F NIC                       FU EX RS&M    INT        STANDARD       ADJUSTED      LOCATION
STOCK NUMBER    ITEM IDENTIFICATION I CO  <  ITEM STATUS  > NO CD CODE RID PACK   UNIT PRICE U/I  UNIT PRICE U/I    CODE

6505C1311378[illegible]  PHENYLEPHRIN [illegible]  DATED  [illegible] 1  L4  LPR      2.74 BT                 LOOS

EET CODE A  [illegible]              STOCK CONTROL DATA    ISSUE HISTORY      <   I T E M   R E V I E W   >
SERV                                 [illegible]       3 JAN      JUL    72    CD    DESCRIPTION
REP                                  [illegible]  .514   FEB      AUG          10 SCL < MINIMUM REQUIREMENT
SUSP                                 [illegible]  QTY  12 MAR  12 SEP    24
C/I                                  LIFE [illegible] UNIQ  0 APR    OCT
C/O                                  PLF  71 PLF       MAY      NOV
CURR LEVEL                           PLF     PLF       JUN      DEC
SUGG LEVEL                           PLF     PLF      TOTAL ISSUES    103
ECON AUTH                            AVG PIPELINE  31 $ VAL ISSUES  2[illegible].92   CURR MONTH ISSUE
```

Appendix B: Level Data File Field Positions/Definitions

Column	Field Length	Field Name	Field Type
1 - 4	4	SRAN	Numeric
5 - 19	15	NSN	Alphanumeric
20	1	Expendability Code	Numeric
21 - 45	25	Nomenclature	Alphanumeric
46	1	Dated Item Code	Numeric
47	1	Delete Code	Alpha
48 - 49	2	PSM	Alphanumeric
50	1	Function Identifier	Alpha
51 - 58	8	Price (multiplied x 100)	Numeric
59 - 60	2	Unit of Issue	Alpha
61	1	Requirement Code	Numeric
62 - 63	2	Reorder %	Numeric
64 - 66	3	Avg Pipeline Time	Numeric
67 - 70	4	1st Pipeline Date	Numeric
71 - 74	4	1st Pipeline days	Numeric
75 - 78	4	2nd Pipeline Date	Numeric
79 - 82	4	2nd Pipeline days	Numeric
83 - 86	4	3rd Pipeline Date	Numeric
87 - 90	4	3rd Pipeline days	Numeric
91 - 94	4	4th Pipeline Date	Numeric
95 - 98	4	4th Pipeline days	Numeric
99 - 102	4	5th Pipeline Date	Numeric
103 - 106	4	5th Pipeline days	Numeric
107 - 110	4	6th Pipeline Date	Numeric
111 - 114	4	6th Pipeline days	Numeric
115 - 120	6	DDR (multiplied x 1000)	Numeric
121 - 124	4	History Begin Date	Numeric
125	1	Unique Code	Alpha
126 - 131	6	Control Level	Numeric
132 - 137	6	Operating Level	Numeric
138 - 143	6	Excess Qty	Numeric
144 - 149	6	Due In Qty	Numeric
150 - 155	6	Due Out Qty	Numeric
156 - 161	6	Jan Issues	Numeric
162 - 167	6	Feb Issues	Numeric
168 - 173	6	Mar Issues	Numeric
174 - 179	6	Apr Issues	Numeric
180 - 185	6	May Issues	Numeric
186 - 191	6	Jun Issues	Numeric
192 - 197	6	Jul Issues	Numeric
198 - 203	6	Aug Issues	Numeric
204 - 209	6	Sep Issues	Numeric
210 - 215	6	Oct Issues	Numeric
216 - 221	6	Nov Issues	Numeric
222 - 227	6	Dec Issues	Numeric

ColumnField Length		Field Name	Field Type
228 - 229	6	Month Rpt Downloaded	Numeric
230 - 231	6	Year Rpt Downloaded	Numeric

Appendix C: Sample Size Determination

Preliminary screening of three months of leveling data using a prototype of the expert system, the following results were obtained:

	Month 1	Month 2	Month 3
# of actions	2270	2280	2874
Total records	6177	6085	6660

This results in a mean number of actions of 2,475 with a standard deviation of 346. The researcher deemed the expert system should detect the expected average number of inventory problems within an interval of 5% or 124 records. This is to be done with a 95% percent confidence factor. This results in the following:

$$s = 346$$

$$\sigma = (124 / 1.95)$$

$$n = (s / \sigma)^2 + 1$$

$$n = 30.606$$

Though the equations indicate a sample size of 31 is adequate, a sample size of 50 was used to account for any variations in the sample estimates.

Appendix D: Random Samples

The following data sets were used to validate the expert system. The month each data set was created is the first month identified after the history begin date field. The random data sets were generated over a period of time and some fields are slightly different. In some data sets the operating level was adjusted not to exceed the control level and some data sets have a negative economic retention level. This results from the economic retention level having to be calculated within the expert sytem and was not changed to zero. These anomalies within the data sets had no effect on the decisions made by the expert system and were corrected in the expert system to avoid confusion in the printed reports.

Random Sample 1

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN	DEC
6505001336000	2.05	0	19		0.482	58	25	0	347	0	0	0	6906	24	12	2	27	25	20	10	19	8
6505001538480	0.24	1	26		7.134	906	283	0	5136	0	0	0	6906	456	124	255	240	53	234	325	238	27
6505002998296	1.86	1	20		1.751	145	67	0	1261	0	0	0	6906	71	64	47	66	87	44	31	37	37
6505006167836	34.72	1	22		0.016	2	0	0	12	0	2	1	8805	0	2	0	1	0	1	0	0	1
6505007539902	0.82	1	24		0.312	47	18	0	225	0	0	0	6906	6	13	13	1	6	13	12	12	12
6505009264773	22.80	1	22		1.329	94	38	0	957	0	60	0	7708	26	36	72	24	26	46	36	54	6
6505011424914	16.50	1	31		0.050	5	5	0	36	5	0		9002	0	0	1	4	0	0	4	0	0
6505011533334	9.05	1	31		0.037	4	4	0	27	12	0	0	8911	0	0	0	0	0	0	0	0	0
6505011648737	2.50	1	58		0.047	9	9	0	34	3	0	0	8405	4	6	0	0	0	0	4	0	0
6505011749908	33.63	1	33		0.129	12	12	0	93	0	0	0	8103	6	0	0	10	5	5	8	5	0
6505012463781	4.50	2	31		2.200	176	0	0	1584	0	148	1	8701	39	167	96	4	68	84	75	33	36
6515002469835	22.44	0	31	U	0.000	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
6515003343800	4.91	0	24		0.386	48	30	0	278	0	0	0	6906	34	4	0	0	2	0	0	0	0
6515003344300	6.57	0	21		0.301	37	34	0	217	0	0	0	6906	12	0	0	0	0	0	0	0	0
6515005507199	93.08	0	26		0.055	4	4	0	40	0	0	0	6906	1	0	1	7	2	1	0	0	0

Random Sample 1 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN	DEC
6515010500208	26.88	0	31	U	0.008	2	2	0	6	0	0	0	8907	0	2	0	0	0	1	0	0	0
6515011443553	1.14	0	31		0.104	11	11	0	75	4	0	0	8911	0	1	0	0	0	0	0	7	0
6515011783894	33.88	0	31	U	0.000	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
6515012148727	76.00	2	31	U	0.050	0	0	0	36	0	1	1	8912	0	0	0	0	0	0	0	0	12
6515012378468	5.05	0	31	U	0.167	0	0	0	120	0	0	0	9004	0	0	0	0	20	0	0	0	0
6515012656301	18.00	0	35		0.110	15	13	0	79	0	2	0	8703	4	3	7	2	2	0	1	1	0
6515012892003	1076.94	0	31	U	0.000	1	0	0	0	0	1	0	9008	0	0	0	0	0	0	0	0	0
6515L200988	42.84	0	50		0.022	3	1	0	16	0	2	0	8409	1	1	0	1	2	1	0	1	0
6515L201233	56.00	0	52		0.014	2	0	0	10	0	3	1	8303	0	0	2	0	1	0	0	0	1
6515L300049	80.00	0	46		0.003	1	1	0	2	2	0	0	8310	1	0	0	0	0	0	0	0	0
6515L300050	137.80	0	41		0.241	22	3	0	174	0	19	0	8311	8	13	4	7	5	7	11	11	7
6515L400284	5.00	0	31		0.014	3	3	0	10	0	0	0	8406	0	0	0	0	0	0	5	0	0
6515L501233	13.70	0	31	U	0.222	5	0	0	160	0	5	0	9005	0	5	0	15	0	0	0	0	0
6515L501241	12.45	1	31		0.030	5	0	0	22	0	5	0	8909	0	0	0	0	0	0	0	0	0

Random Sample 1 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN	DEC
6515L501771	25.75	1	47		0.003	1	1	0	2	1	0	0	8711	0	0	0	0	0	0	1	0	0
6515L890494	50.00	1	31		0.021	3	2	0	15	0	0	0	8909	0	0	0	5	1	0	0	0	0
6515L890539	90.78	0	31		0.050	4	4	0	36	0	0	0	8912	0	0	0	4	0	2	0	4	2
6515L890582	650.00	0	31		0.076	5	2	0	55	0	3	0	9001	0	8	2	2	0	0	1	3	0
6515L890587	600.00	1	31	U	0.033	2	2	0	24	2	0	0	9001	0	1	1	1	0	0	0	4	0
6515L900221	125.00	0	31	U	0.056	1	1	0	40	0	0	0	9005	0	0	3	2	0	0	0	0	0
6515L900302	27.60	0	31	U	0.489	30	20	0	352	0	10	0	9005	0	0	20	24	0	0	0	0	0
6515LS00108	34.24	2	38		0.192	17	9	0	138	0	8	0	8312	14	14	3	5	8	6	6	8	0
6520005523150	3.67	0	29		0.025	4	3	0	18	0	0	0	6906	9	0	0	0	0	0	0	0	0
6520010033917	5.47	0	31	U	0.025	0	0	0	18	0	0	0	9004	0	0	0	0	3	0	0	0	0
6520L104095	15.25	0	34		0.027	4	0	0	19	0	6	2	7411	0	0	4	1	1	2	1	1	0
6520L890071	2.94	0	31	U	0.057	0	0	0	41	0	0	0	9001	0	0	0	0	0	0	0	12	0
6530008368134	17.86	0	17		0 247	20	8	0	178	0	0	0	8806	7	7	3	9	8	9	6	10	8
6530012246058	150.00	0	31		0.056	4	2	0	40	0	2	0	9002	0	0	0	8	1	0	1	0	0
6810L900008	18.00	0	31	U	0.000	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0

Random Sample 1 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	Ex CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN	DEC
7360L500009	41.00	0	31	U	0.014	0	0	0	10	0	0	0	9001	0	0	0	0	0	0	0	3	0
8940L000043	0.01	1	31	U	0.017	4	1	0	12	0	0	0	8910	0	0	1	0	0	0	0	0	0
P4501065673	25.33	0	31	U	0.017	0	0	0	12	0	0	0	9002	0	0	0	0	0	0	3	0	0
P4501186962	198.73	0	31	U	0.011	0	0	0	8	0	0	0	9005	0	0	0	1	0	0	0	0	0
P4512016420	47.85	0	31	U	0.033	0	0	0	24	0	0	0	9003	0	0	0	0	1	4	0	0	0
P8459MV3001	321.00	0	31	U	0.013	0	0	0	9	0	0	0	8910	0	1	0	0	0	0	0	2	0

Random Sample 2

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
4820LHC0190	2.90	0	31	U	0.029	0	0	0	21	0	0	0	9002	0	0	0	0	0	0	0	6	0
4820LHC0199	8.00	0	31	U	0.007	0	0	0	5	0	0	0	9004	0	0	0	0	0	1	0	0	0
6505000221337	10.03	1	61		0.025	5	5	0	18	0	0	0	7007	0	0	1	1	1	0	1	1	2
6505001161374	15.31	1	22		0.027	4	6	0	19	2	0	0	8904	0	0	0	0	4	0	6	0	0
6505004321065	5.92	1	22		0.929	66	52	0	669	0	0	0	8406	0	12	24	36	12	24	84	0	0
6505006640856	1.08	1	33		0.707	95	64	0	509	0	0	0	6906	6	12	0	42	12	0	42	24	60
6505007715359	280.80	1	42		0.036	3	5	0	26	2	0	0	7901	0	1	2	0	1	3	2	0	1
6505010723426	57.53	1	20		4.373	302	133	0	3149	0	156	0	7911	144	96	96	156	96	156	216	132	168
6505010854625	12.50	0	30		0.181	24	14	0	130	0	11	0	6906	7	4	6	10	0	7	6	6	0
6505011159852	3.50	1	21		0.334	41	30	0	240	0	0	0	8610	10	10	20	10	0	10	0	30	20
6505011313436	130.31	1	21		0.189	13	0	0	136	0	9	0	8812	0	29	3	2	4	5	5	3	8
6505011533938	457.21	1	31		0.008	1	0	0	6	0	1	0	8709	1	0	0	0	0	0	0	0	1
6505011534480	36.17	1	41		0.027	4	2	0	19	0	3	0	8810	0	0	2	2	1	2	0	0	0
6505012166274	3.41	1	28		5.151	397	257	0	3709	0	0	0	8604	180	96	54	254	120	193	155	168	222
6505012783669	1.75	1	31	U	0.100	0	0	0	72	0	0	0	9005	0	0	0	0	12	0	0	0	0

Random Sample 2 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
6505012888068	3.35	1	31		0.111	11	20	0	80	9	0	0	9003	0	0	0	0	16	0	4	0	0
6510002003040	18.35	0	26		0.077	10	14	0	55	4	0	0	6906	6	0	1	0	2	7	1	0	4
6510009268884	4.81	2	33		0.227	30	33	0	163	3	0	0	8309	2	0	4	4	12	15	4	0	24
6510010606370	13.22	2	27		1.142	87	63	0	822	0	0	0	7811	25	28	50	28	43	26	26	37	58
6510010959283	12.67	2	57		0.444	45	22	0	320	0	14	0	7811	17	12	22	16	0	0	22	12	0
6515002998009	6.14	0	31		0.036	6	11	0	26	5	0	0	8701	0	0	1	0	0	0	0	0	0
6515004571471	29.37	0	38		0.008	1	0	0	6	0	3	2	8310	1	1	1	0	0	0	0	0	0
6515011210990	19.64	0	17		0.079	9	8	0	57	0	0	0	8408	0	2	2	0	4	4	3	0	7
6515012398289	7.69	0	31	U	0.333	0	0	0	240	0	0	0	9006	0	0	0	30	0	0	0	0	0
6515012669061	230.11	0	52		0.014	2	2	0	10	0	0	0	8704	0	0	0	1	1	0	2	0	0
6515012839305	4.75	0	31		0.289	26	4	0	208	0	31	0	9006	0	6	0	20	0	0	0	0	0
6515L501772	66.00	0	49		0.005	1	2	0	4	1	0	0	8710	0	0	0	0	0	0	0	1	0
6515L800228	4.00	0	31	U	0.056	0	0	0	40	0	0	0	9003	0	0	0	0	0	0	10	0	0
6515L800385	40.00	0	31		0.063	6	3	0	45	0	3	0	8808	3	2	2	4	1	2	0	3	2

Random Sample 2 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EXCESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
6515L890189	110.00	0	31		0.011	1	0	0	8	0	1	0	8905	0	2	0	0	0	2	0	0	0
6515L890382	25.57	0	35	U	0.008	0	0	0	6	0	1	1	8906	1	0	1	0	0	0	0	1	0
6515L890416	13.30	0	31		0.085	11	5	0	61	0	6	0	8910	0	2	4	0	2	0	2	0	0
6515L890696	126.86	0	31		0.108	7	4	0	78	0	3	0	9001	0	3	8	0	2	0	5	3	5
6515L890761	85.00	0	31		0.056	4	10	0	40	6	0	0	9003	0	0	0	0	0	0	10	0	0
6515L900118	126.25	0	31	U	0.058	2	0	0	42	0	2	0	9005	0	2	0	2	3	0	0	0	0
6515L900204	759.00	0	31	U	0.075	0	0	0	54	0	0	0	9005	0	1	1	3	4	0	0	0	0
6520010560876	2.31	0	31	U	0.057	0	0	0	41	0	0	0	9002	0	0	0	0	0	0	0	12	0
6520L890115	4.90	0	31	U	0.017	1	6	0	12	5	0	0	9005	0	0	0	0	2	0	0	0	0
6530002998545	26.02	0	31	U	0.038	0	0	0	27	0	0	0	9001	0	0	0	6	0	0	0	0	3
6530007893346	15.22	0	24		0.036	5	4	0	26	0	0	0	7508	1	1	1	1	1	0	3	0	2
6530011197678	56.21	0	22		0.027	3	3	0	19	0	0	0	8108	1	1	0	0	1	1	1	0	2
6530011738892	42.00	0	31		0.244	20	0	0	176	0	23	0	8401	6	9	6	11	5	11	1	18	0
6640L890031	33.13	0	31		0.008	1	2	0	6	1	0	0	8909	1	0	0	0	2	0	0	0	0
6840011220687	13.90	0	24		0.792	58	42	0	570	0	0	0	8405	17	18	0	47	35	32	34	34	24

Random Sample 2 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
7510L700011	64.40	0	31	U	0.019	0	0	0	14	0	0	0	9002	0	0	0	0	0	0	0	4	0
7530012419708	60.00	0	40	U	0.033	0	0	0	24	0	0	0	9003	0	0	0	0	0	0	6	0	0
7690L890040	23.50	0	31		0.033	3	3	0	24	0	0	0	8912	0	1	2	3	0	0	1	0	0
8940010756604	25.92	2	40		0.671	60	27	0	483	0	30	0	8005	8	9	22	28	22	35	24	35	24
P5700020002	81.95	0	31	U	0.011	0	0	0	8	0	0	0	8905	0	1	0	0	0	0	1	1	1
P5701008901	7.75	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Random Sample 3

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB
5360007542225	1.32	0	31	U	0.000	2	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0
6230001255528	5.84	1	24		0.819	71	38	0	590	-33	36	0	7111	48	9	15	28	11	47	32	21	26
6505001199321	44.79	1	18		0.123	8	5	0	89	-3	3	0	7612	4	3	0	4	6	4	7	0	3
6505001490204	7.22	1	19		0.005	1	3	0	4	2	0	0	7504	0	0	0	0	2	0	0	0	0
6505006895532	1.11	1	25		0.082	17	18	0	59	1	0	0	8310	0	0	0	0	0	0	0	0	18
6505009515533	1.02	1	19		1.386	166	195	0	998	29	0	0	7101	0	0	50	50	225	81	0	0	0
6505009634924	18.48	1	22		0.532	38	0	0	383	-38	18	8	8604	18	32	23	12	20	6	15	16	16
6505010398022	11.00	1	6		1.921	106	70	0	1383	-36	0	0	7710	58	74	32	128	54	44	62	49	64
6505010830900	20.52	1	26		4.175	313	107	0	3006	-206	144	0	7812	168	156	120	108	168	96	121	167	120
6505010920421	108.50	1	49		0.027	3	6	0	19	3	0	0	8301	0	0	0	1	1	0	0	0	0
6505011082218	33.64	1	24		0.756	55	15	0	544	-40	27	0	7604	30	30	0	25	35	30	15	30	25
6505011834861	171.98	1	58		0.044	5	2	0	32	-3	2	0	8112	2	2	2	2	1	3	1	2	0
6505012065068	14.32	1	34		1.444	120	58	0	1040	-62	0	0	8507	54	60	48	12	60	59	24	48	48
6505012394709	4.99	1	4		0.112	15	8	0	81	-7	0	0	8901	3	6	0	0	2	4	4	6	4

Random Sample 3 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EXCESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB
6505013082301	436.84	1	31		0.164	13	14	0	118	1	0	0	8909	8	0	0	12	0	8	0	0	0
6505L890C56XX	64.68	1	31	U	0.170	2	4	0	122	2	9	0	8908	6	8	5	3	4	0	0	0	6
6510001377785	8.99	0	26		0.036	6	4	0	26	-2	0	0	8909	0	0	0	0	0	1	5	2	2
6515007777340	1.27	0	24		2.479	216	157	0	1785	-59	0	0	6906	112	56	42	100	36	56	111	80	40
6515010727984	6.60	0	31		0.260	34	30	0	187	-4	0	0	8712	23	0	0	0	0	16	16	28	0
6515011324895	65.25	0	42		0.312	28	0	0	225	-28	67	38	8203	8	20	18	6	0	9	5	10	12
6515011981301	8.35	0	71		0.093	16	15	0	67	-1	0	0	7604	9	0	2	1	0	2	1	2	1
6515012448113	243.95	0	31	U	0.014	0	0	0	10	0	0	0	8908	4	0	0	0	0	0	1	0	0
6515012700535	19.00	0	50		0.052	8	0	0	37	-8	8	0	8604	0	6	0	4	0	0	6	0	0
6515L00460473	129.75	0	31	U	0.011	0	0	0	8	0	0	0	9004	0	0	0	0	0	0	2	0	0
6515L201395	291.64	0	30		0.025	2	1	0	18	-1	2	0	8307	1	1	1	1	0	1	1	1	1
6515L501451	80.50	0	31	U	0.022	0	0	0	16	0	0	0	9004	0	2	0	0	0	0	2	0	0
6515L890055	16.20	0	48		0.055	8	8	0	40	0	0	0	8902	0	0	0	0	5	0	0	2	8
6515L890624	95.00	1	31	U	0.056	3	0	0	40	-3	4	0	9007	0	3	0	2	0	0	0	0	0
6515L900362XX	30.00	0	31	U	0.300	10	0	0	216	-10	17	12	9008	0	10	8	0	0	0	0	0	0

Random Sample 3 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB
6515L900436	125.52	0	31		0.013	1	2	0	9	1	0	0	9005	0	0	0	0	0	2	0	0	0
6515L900498	23.50	0	31	U	0.044	1	0	0	32	-1	0	0	9007	0	1	0	3	0	0	0	0	0
6515LN00090XX	10.53	2	9		0.351	25	32	0	253	7	0	0	8607	13	0	11	12	0	24	10	21	15
6520011196387	10.36	0	31	U	0.033	0	0	0	24	0	0	0	9007	0	0	0	3	0	0	0	0	0
6520011993290	14.32	0	31	U	0.000	0	0	0	0	0	1	1	9009	0	5	0	0	0	0	0	0	0
6520L890125	5.00	0	31		0.081	8	8	0	58	0	0	0	9001	0	0	0	0	0	0	0	0	1
6520L900011	11.75	0	31		0.080	7	6	0	58	-1	0	0	9005	0	2	0	0	0	10	0	0	0
6530001334299	1.55	0	25		0.099	15	14	0	71	-1	0	0	7812	0	4	19	3	10	0	0	0	0
6530008368134	20.29	0	18		0.252	20	6	0	181	-14	13	0	8806	10	9	8	7	3	9	8	9	6
6550010572575	4.95	1	21		0.041	6	2	0	30	-4	5	0	8010	0	0	1	1	5	0	1	1	2
6550012691924	71.50	1	54		0.008	1	2	0	6	1	0	0	8909	0	0	1	1	0	0	0	1	0
6550L400017	42.52	1	52		0.030	5	4	0	22	-1	0	0	8407	0	0	1	0	0	3	0	0	1
6640010994066	36.85	0	31	U	0.000	0	0	0	0	0	0	0	9008	0	0	1	0	0	0	0	0	0
6640011190013	12.25	0	22		0.614	44	26	0	442	-18	21	0	7409	10	18	26	9	21	31	24	10	16

Random Sample 3 (cont)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	O	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB
6640012650113	12.75	0	64		1.490	168	113	0	1073	-55	122	0	8410	35	30	17	34	8	13	5	46	136
8940011712097	26.08	2	72		0.252	30	10	0	181	-20	20	0	8401	11	0	10	11	10	10	10	12	5
P0100396348	83.95	0	31	0	0.000	2	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0
P2425070022	222.25	0	31	0	0.007	0	0	0	5	0	0	0	9005	0	0	0	0	0	1	0	0	0
P45010RWGME	4.39	0	31	0	0.003	0	0	0	2	0	0	0	8909	0	0	0	0	0	0	0	1	0
P4512014901	3.45	0	31	0	0.000	12	0	0	0	-12	10	10	9009	0	13	0	0	0	0	0	0	0
P5439001168	2.00	0	31	0	0.022	0	0	0	16	0	0	0	9007	0	0	0	2	0	0	0	0	0

Random Sample 4

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	O	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN	DEC
6505000599019	6.46	1	16		0.052	7	6	0	37	0	0	0	6906	5	4	2	1	2	0	2	0	3
6505001050102	3.64	1	20		0.340	41	12	0	245	0	12	0	7412	24	22	11	5	4	3	20	12	3
6505001538480	0.24	1	26		7.134	906	283	0	5136	0	0	0	6906	456	124	255	240	53	234	325	238	27
6505009359861	5.01	1	54		0.134	21	19	0	96	0	0	0	6906	6	0	0	13	0	6	0	0	6
6505011007152	2.99	1	18		0.775	92	87	0	558	0	0	0	7911	1	30	60	24	12	12	24	12	30
6505011425588	5.37	1	21		0.548	46	20	0	395	0	0	0	7504	60	20	10	20	20	10	0	0	0
6505012344449	25.00	1	31		0.066	9	2	0	48	0	4	0	8904	1	8	0	7	3	0	4	0	1
6505012380067	16.16	1	45		4.688	441	79	0	3375	0	198	0	8501	150	156	156	215	72	192	108	217	36
6505012525605	168.00	1	31		0.022	2	2	0	16	0	0	0	8504	2	0	0	2	0	0	0	0	0
6505L900031	29.35	0	31	0	0.000	48	0	0	0	0	62	14	9006	0	0	30	0	0	0	0	0	0
6510002007013	0.79	0	32		0.027	6	6	0	19	0	0	0	8908	3	0	2	3	0	0	0	1	0
6510002014150	8.87	0	24		0.052	8	4	0	37	0	0	0	8004	4	1	0	0	0	0	0	0	0
6510002036010	10.90	2	26		0.055	8	12	0	40	4	0	0	6906	5	1	0	4	0	0	3	0	3
6510010862463	85.35	1	27		0.016	2	1	0	12	0	0	0	8205	1	2	2	0	0	0	0	0	1
6510010959286	13.2.	2	35		0.679	57	36	0	489	0	0	0	7810	25	25	14	24	0	33	26	33	20

Random Sample 4 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EXCESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN	DEC
6515001817425	4.02	0	17		0.074	11	10	0	53	0	0	0	7202	12	0	1	5	4	0	0	4	1
6515010450029	26.36	0	27		0.189	14	2	0	136	0	8	0	7802	7	6	0	8	8	5	6	6	8
6515010989669	51.60	0	129		0.003	1	2	0	2	1	0	0	8305	0	0	0	0	0	0	0	0	0
6515011071200	16.17	0	47		0.096	14	0	0	69	0	12	1	7110	0	8	7	0	9	0	5	3	3
6515011281407	70.03	0	18		0.129	9	4	0	93	0	0	0	8409	0	6	4	3	5	4	1	8	4
6515012052313	119.35	0	31	U	0.017	1	1	0	12	0	0	0	9004	0	0	0	0	2	0	0	0	0
6515012593001	24.00	0	37		0.036	5	0	0	26	0	5	0	8605	4	4	2	2	0	0	0	1	0
6515L103844	1.60	0	59		0.192	36	15	0	138	0	0	0	7102	6	15	0	0	0	0	1	4	20
6515L200228	70.81	0	38		0.027	4	2	0	19	0	2	0	8008	2	0	2	0	1	1	0	0	2
6515L200729	40.83	0	42	U	0.017	0	0	0	12	0	0	0	9004	0	0	0	0	2	0	0	0	0
6515L500818	89.00	0	46		0.129	12	5	0	9	0	8	0	8604	4	6	1	6	6	0	6	12	2
6515L890152	11.50	0	31		0.041	6	20	0	30	14	0	0	8906	1	1	3	2	[illegible]	2	0	1	0
6515L890350	74.50	1	31		0.011	1	1	0	8	0	1	0	8905	0	0	0	0	1	0	1	1	0
6515L890492	32.32	0	31		0.030	4	3	0	22	0	0	0	8909	0	0	1	2	0	0	0	0	0
6515L890569	255.00	0	31	U	0.011	0	0	0	8	0	0	0	9005	0	0	0	1	0	0	0	0	0

Random Sample 4 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN	DEC
6515L890583	650.00	0	31		0.095	6	0	0	68	0	8	2	9001	0	11	0	3	0	0	0	6	0
6515L890584	650.00	1	31		0.048	3	2	0	35	0	1	0	9001	0	1	4	0	0	1	0	4	0
6515L890809	95.00	0	31	U	0.028	0	0	0	20	0	0	0	9002	0	0	0	0	0	0	5	0	0
6515LFB021106IF	36.25	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6520005362150	13.60	0	31	U	0.019	0	0	0	14	0	0	0	8911	0	0	0	0	0	0	0	2	0
6525L500013	115.30	2	7		0.195	11	10	0	140	0	0	0	8702	5	5	0	0	0	0	11	14	5
6530001334299	1.07	0	25		0.107	16	21	0	77	5	0	0	7812	22	3	10	0	0	0	0	0	0
6530011282445	5.75	0	23		0.112	14	6	0	81	0	0	0	8805	0	3	4	4	6	8	4	1	1
6532000811801	7.23	0	31	U	1.481	0	0	0	1066	0	0	0	8911	0	0	0	0	0	200	0	0	0
6550012078238	15.01	1	31	U	0.017	0	0	0	12	0	0	0	8912	0	0	0	2	0	0	0	0	2
6750010420872	44.28	0	17		0.093	7	9	0	67	2	0	0	7809	1	0	0	6	6	3	3	6	3
6850L890001	94.95	0	31	U	0.071	4	4	0	51	0	0	0	9001	0	0	0	0	0	3	11	1	0
7125007645744	142.00	0	31	U	0.044	0	0	0	32	0	0	0	9002	0	0	0	0	0	0	8	0	0
7510012714062	2.96	0	31		0.307	41	37	0	221	0	0	0	6906	16	9	4	7	13	8	1	17	9
7510012714063	2.96	0	37		0.227	31	21	0	163	0	0	0	6906	21	4	17	7	10	0	14	4	5

Random Sample 4 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN	DEC
7510L700011	64.40	0	31	U	0.022	0	0	0	16	0	0	0	9002	0	0	0	0	0	0	4	0	0
7530L800002	130.00	0	31	U	0.005	0	0	0	4	0	0	0	9001	0	0	0	0	0	0	0	1	0
8115006826525	9.04	0	21		0.197	24	19	0	142	0	0	0	7502	0	0	0	25	10	3	14	4	6
P0100430002	84.86	0	31	U	0.000	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
P18014361P1	24.00	0	31	U	0.011	0	0	0	8	0	0	0	9005	0	0	0	1	0	0	0	0	0

Random Sample 5

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
6505001539745	1.50	1	25		1.710	150	106	0	1231	0	0	0	6906	60	60	48	84	48	48	36	24	48
6505002077965	16.91	1	37		0.060	8	8	0	43	0	0	0	7510	0	0	12	0	0	0	6	0	0
6505002688530	9.54	1	31		0.000	0	0	46	0	0	0	0	8310	0	0	0	0	0	0	0	0	0
6505005599811	0.48	1	23		0.137	28	42	0	99	14	0	0	8311	0	20	30	0	0	0	0	0	0
6505005843277	5.48	1	24		0.101	15	8	0	73	0	0	0	7707	5	2	4	0	2	4	4	6	8
6505006878486	6.59	1	15		0.384	30	25	0	276	0	0	0	6906	12	10	12	24	10	0	20	4	12
6505010854685	121.68	1	33		0.342	28	26	0	246	0	0	0	7906	16	4	5	10	11	6	12	12	15
6505011277946	15.60	1	32		0.479	39	41	0	345	2	0	0	8502	35	0	12	0	10	12	8	10	60
6505011313436	130.31	1	21		0.189	13	0	0	136	0	9	0	8812	0	29	3	2	4	5	5	3	8
6505011496776	2.97	1	53		0.055	10	26	0	40	16	0	0	8105	2	4	4	0	0	3	0	0	5
6505011561663	7.52	1	7		0.148	16	24	0	107	8	0	0	7407	6	0	6	18	12	0	12	0	0
6505011640581	29.20	1	31		0.948	76	22	0	683	0	48	0	8803	30	36	0	12	0	0	24	24	214
6505011783913	10.90	1	31		0.064	8	5	0	46	0	0	0	8910	0	0	3	0	0	0	2	0	8
6505011932690	167.41	1	31		0.127	8	24	0	91	16	0	0	9004	0	0	0	15	0	4	0	0	0
6505012052338	12.14	1	43		3.205	295	239	0	2308	0	0	0	8507	60	48	48	342	216	96	72	60	48

Random Sample 5 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
6505012060273	50.07	1	19		0.132	9	11	0	95	2	0	0	8801	0	0	6	0	2	0	8	6	6
6505012394660	26.35	1	40		0.732	65	65	0	527	0	0	0	8705	0	25	0	0	0	147	23	30	42
6505013165005	16.51	1	32		0.008	1	2	0	6	1	0	0	8906	0	0	1	0	1	0	1	0	0
6505L890045	120.65	1	13		0.110	7	3	0	79	0	3	0	8905	4	9	3	2	2	10	2	2	2
6510008897021	23.39	0	26		0.030	4	5	0	22	1	0	0	6906	2	0	0	0	0	0	0	2	5
6510013208812	11.90	1	31		0.611	49	44	0	440	0	8	0	8809	5	16	8	52	2	26	28	12	36
6515009351084	1.58	0	22		0.921	113	60	0	663	0	0	0	6906	24	24	48	36	24	12	36	24	24
6515010988355	11.31	0	25		0.060	8	3	0	43	0	5	0	6906	4	1	1	0	3	1	0	3	5
6515011398391	32.00	0	36	U	0.077	3	3	0	55	0	3	3	8911	0	0	3	0	0	6	0	6	0
6515013051143	151.04	1	31	U	0.005	0	0	0	4	0	0	0	8905	0	0	1	1	0	0	0	0	0
6515L500258	36.25	1	31		0.112	11	10	0	81	0	0	0	8707	1	2	0	0	0	2	10	3	7
6515L501180	16.10	1	34		0.033	5	5	0	24	0	0	0	8706	10	0	0	0	0	0	0	1	0
6515L890122	24.00	0	31	U	0.011	0	0	0	8	0	0	0	8912	0	1	0	0	0	0	0	1	0
6515L890179	20.35	0	31	U	0.017	0	0	0	12	0	0	0	9005	0	0	0	0	2	0	0	0	0
6515L890393	202.00	1	31		0.184	15	3	0	132	0	17	0	8908	4	4	9	5	5	7	7	6	

Random Sample 5 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
6515L890645	60.00	0	31		0.015	1	3	0	11	2	0	0	8912	0	0	0	0	0	0	0	2	1
6515L890648	11.90	0	31		0.021	2	5	0	15	3	0	0	9001	0	0	0	0	0	0	0	0	5
6515L900434	125.32	0	31	U	0.017	0	2	0	12	2	0	0	9005	0	0	0	0	2	0	0	0	0
6515L900515	9.29	1	31	U	0.089	3	3	0	64	0	0	0	9006	0	0	4	4	0	0	0	0	0
6515LS00015	43.68	1	6		0.025	3	0	0	18	0	5	2	8112	0	1	0	4	0	2	1	0	0
6515LS00051	43.68	2	33	U	0.005	0	0	2	4	0	0	0	9002	0	0	0	0	0	0	0	1	0
6520010479801	5.20	0	31	U	0.208	0	0	0	150	0	12	12	9005	0	0	0	10	15	0	0	0	0
6530012127417	114.80	0	31		0.022	2	2	0	16	0	0	0	8901	0	0	1	0	1	0	0	3	2
6550010054375	11.50	1	18		0.441	31	33	0	318	2	0	0	8502	5	15	20	10	5	0	21	20	20
6550010572642	2.72	1	19		0.025	5	1	0	18	0	4	0	8501	1	1	1	0	1	0	1	0	1
6550L800034CT	1292.00	0	31	U	0.067	0	0	0	48	0	0	0	9005	0	0	0	5	3	0	0	0	0
6630001451143	5.13	2	23		0.981	71	34	0	706	0	38	0	6906	111	40	18	3	15	7	18	37	28
7690012552831	1.05	0	31		0.094	9	3	0	68	0	6	0	9003	0	6	0	0	2	3	6	0	0
7690L500006	13.65	0	33		0.033	5	5	0	24	0	0	0	8603	2	0	2	0	1	0	0	1	1

Random Sample 5 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
8430L500003	5.40	0	31		0.077	12	12	0	55	0	0	0	8809	0	0	0	0	2	0	0	10	5
8940010805929	26.36	1	33	U	0.067	0	0	0	48	0	0	0	8910	0	2	0	10	0	0	5	4	0
P0199LP6285	85.00	0	31	U	0.060	10	0	0	43	0	0	0	8809	0	1	1	2	3	2	5	2	3
P18013112P1	3.00	0	31	U	0.011	0	0	0	8	0	0	0	9006	0	0	0	1	0	0	0	0	0
P3646000005	7.25	0	31	U	0.003	0	0	0	2	0	0	0	8909	1	0	0	0	0	0	0	0	0
P4520041700	44.00	0	31	U	0.014	2	0	0	10	0	1	1	8808	0	1	0	0	0	0	0	0	2

Random Sample 6

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB
6505000521367	0.70	1	19		1.022	123	74	0	736	-49	0	0	6906	47	48	0	0	96	0	25	0	48
6505001009985	0.41	1	19		2.926	351	45	0	2107	-306	288	0	7403	24	96	169	24	96	46	0	100	30
6505001150000	1.31	1	22		0.137	20	24	0	99	4	0	0	8009	0	0	0	12	0	24	0	0	0
6505001656519	188.43	1	14		0.479	30	34	0	345	4	0	0	7212	4	14	0	28	22	15	24	4	20
6505002213393	5.01	1	22		0.704	60	0	0	507	-60	47	4	8006	37	32	12	14	30	12	12	30	18
6505002833200	1.97	1	8		1.578	112	36	0	1136	-76	0	0	7307	0	72	0	72	72	72	24	24	24
6505009141742	4.76	1	16		0.068	10	18	0	49	8	0	0	8108	0	0	0	7	13	0	0	5	0
6505010376792	179.72	1	15		0.022	2	2	0	16	0	0	0	8412	1	0	0	3	0	1	1	0	1
6505010514697	11.58	1	26		14.534	1090	71	0	10464	-1019	502	0	7911	864	457	312	312	672	216	384	528	432
6505011007984	146.74	1	29		0.011	1	2	0	8	1	0	0	8204	0	0	0	0	0	1	1	1	0
6505011040398	44.20	1	31	U	0.105	10	20	0	76	10	0	0	9003	0	20	0	0	0	0	0	2	0
6505011269270	8.51	1	31	U	0.048	0	0	0	35	0	0	2	9003	0	4	0	0	0	0	0	6	0
6505011507841	9.30	1	31		0.416	39	31	0	300	-8	0	0	8708	10	6	30	0	18	12	2	24	18
6505011561749	16.79	1	52		0.049	8	4	0	35	-4	0	0	7712	0	4	0	0	0	6	0	0	0

Random Sample 6 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EXCESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
650501:1858832	12.53	1	34		3.567	296	141	0	2568	-155	126	0	8610	136	132	74	60	96	60	144	120	132
6505012005793	51.22	1	69		0.260	31	29	0	187	-2	0	0	8703	0	15	10	0	20	0	0	25	0
6505J12123155	69.55	1	54		0.140	14	9	0	101	-5	10	0	8305	6	0	0	12	10	0	0	0	7
6505012125338	22.95	1	31		0.061	5	45	0	44	40	0	0	9004	0	0	0	0	5	0	6	0	0
6505012748519	276.22	1	31		0.078	5	3	0	56	-2	2	0	9001	0	2	4	5	1	1	0	2	4
6505013038958	431.20	1	31		0.068	5	7	0	49	2	0	0	8907	3	0	0	2	4	7	3	6	0
6515001491406	4.54	0	29		0.036	6	25	0	26	19	0	0	7606	0	0	0	0	0	0	8	2	1
6515002298294	24.39	0	31		0.019	2	3	0	14	1	0	0	9001	0	0	0	0	0	0	0	2	2
6515003699100	10.68	0	31	U	0.267	0	0	0	192	0	0	0	9005	0	0	0	0	30	10	0	0	0
6515004005466	14.92	0	26		0.085	11	8	0	61	-3	0	0	8004	4	0	4	0	10	4	0	0	5
6515010095296	11.83	0	31	U	0.000	1	1	0	0	0	0	0	9008	0	0	1	0	0	0	0	0	0
6515010375590	7.26	0	21		0.260	32	20	0	187	-12	0	0	7903	7	8	7	7	0	11	4	18	9
6515011642897	101.84	0	25		0.071	5	5	0	51	0	0	0	6906	1	4	1	2	0	3	2	1	4
6515011707573	15.98	0	31		0.019	3	2	0	14	-1	0	0	8107	4	2	0	0	0	0	0	0	1
6515012403851	19.00	0	31		0.033	5	2	0	24	-3	5	0	8907	1	1	1	1	1	1	2	1	1

Random Sample 6 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
6515012513744	104.94	2	31		0.044	4	4	0	32	0	0	0	8405	2	0	1	1	0	3	1	2	0
6515012593001	24.00	0	37		0.039	5	0	0	27	-5	5	2	8605	0	5	0	4	2	2	0	0	0
6515012720222	69.50	0	31		0.003	0	8	0	2	8	0	0	8605	0	0	0	0	0	0	0	0	0
6515012724562	91.50	0	39		0.011	2	1	0	8	-1	2	0	8104	0	2	2	0	0	0	0	0	0
6515L890606	29.00	0	31		0.152	11	0	0	109	-11	39	12	9001	0	20	4	2	0	5	0	0	0
6515LFB027394	76.44	0	31	U	0.000	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
6515LS00120	16.34	1	32		0.063	8	9	0	45	1	0	0	8407	3	0	4	0	4	0	2	0	0
6520010493597	5.81	0	26		0.060	9	4	0	43	-5	0	0	8311	2	8	0	0	0	0	0	0	0
6520012196304	9.25	0	13	U	0.017	0	0	0	12	0	0	1	9004	0	0	0	0	0	0	3	0	0
6532001490562	79.19	0	31	U	0.208	0	0	0	150	0	0	0	9006	0	0	0	23	2	0	0	0	0
6532L890000	50.31	0	31		0.088	8	7	0	63	-1	0	0	8904	2	1	2	3	0	3	4	4	3
6540011462042	2.34	0	31	U	0.000	0	0	0	0	0	0	0	9008	0	0	36	0	0	0	0	0	0
654 011467800	2.34	0	31	U	0.000	0	0	0	0	0	0	0	9008	0	0	12	0	0	0	0	0	0
6550010894502	42.81	0	31		0.030	3	4	0	22	1	0	0	9001	0	0	0	1	0	1	0	4	0
6640L700034	110.00	0	31	U	0.011	0	0	0	8	0	0	0	9004	0	0	0	0	0	0	2	0	0

Random Sample 6 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	SEP	AUG	JUL	JUN	MAY	APR	MAR	FEB	JAN
73500008257416	11.57	0	31		0.123	16	17	0	89	1	0	0	8910	15	0	0	0	0	26	0	0	0
8115005115750	1.46	0	29		0.115	18	15	0	83	-3	0	0	6906	0	0	12	12	0	12	0	0	0
8940011728888	21.57	2	39		1.279	113	8	0	921	-105	159	0	8702	46	0	70	66	20	60	40	80	0
P2164680003	0.52	0	31	U	0.000	2	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0
P364600000E	39.85	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P840200LP62	65.00	0	31	U	0.000	9	0	0	0	-9	0	0	0	0	0	0	0	0	0	0	0	0

Random Sample 7

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR
650500059o789	14.24	1	31		0.078	7	16	0	56	9	0	0	9002	0	0	0	0	0	0	0	6	5
6505006601634	20.64	1	26		0.066	8	7	0	48	-1	0	0	8812	0	0	5	15	0	0	2	0	0
6505010091064	98.16	1	39		0.014	2	4	0	10	2	0	0	7606	0	0	0	0	0	3	0	2	0
6505010801988	14.32	1	22		0.241	20	9	0	174	-11	9	0	8011	12	11	10	5	0	5	5	10	0
6505010939477	96.61	1	26		0.096	7	4	0	69	-3	3	0	8609	3	3	2	3	3	2	10	2	3
6505011533164	5.99	1	24		0.066	10	4	0	48	-6	0	0	8203	0	2	4	0	0	4	8	0	0
6505011533206	8.00	1	31		0.066	10	6	0	48	-4	0	0	8504	0	0	0	0	0	4	20	0	0
6505011534296	17.99	1	47		0.077	11	17	0	55	6	0	0	8103	6	0	0	0	0	0	12	4	0
6505011588006	24.05	1	61		0.033	5	6	0	24	1	0	0	8908	0	0	0	0	0	0	8	0	2
6505011716051	17.60	1	24		0.666	49	41	0	480	-8	0	0	7709	27	14	28	9	8	10	11	27	22
6505011732073	23.12	1	25		0.422	31	33	0	304	2	0	0	8502	6	12	6	12	0	24	6	16	18
6505011770589	5.76	1	31		0.093	15	23	0	67	8	0	0	8803	0	8	2	0	0	0	4	6	6
6505012303115	9.68	1	31		0.041	6	3	0	30	-3	5	0	8105	1	0	0	3	0	3	6	0	0
6505L02110448	949.92	0	31	U	0.033	0	0	0	24	0	0	0	9008	0	0	0	3	0	0	0	0	0
6505L890011	36.00	0	31		0.033	4	2	0	24	-2	2	2	8904	2	3	0	0	0	1	2	0	2

Random Sample 7 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EXCESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR
6510009355821	3.85	0	21		0.477	58	43	0	343	-15	0	0	6906	6	10	15	14	26	17	28	16	11
6510010959283	12.67	2	59		0.419	45	38	0	302	-7	0	0	7811	18	15	18	12	22	16	0	0	22
6515002901943	47.93	0	38		0.014	2	1	0	10	-1	1	0	8903	2	0	2	0	0	0	1	0	0
6515007207277	0.38	0	23		43.230	3113	1992	0	3112 6	-112 1	1242	0	6906	720	1180	203C	780	1405	1280	600	2040	1720
6515011464257	232.64	0	24		0.055	4	5	0	40	1	0	0	7406	1	0	2	4	2	1	0	4	1
6515011955340	51.00	0	38		0.521	45	17	0	375	-28	21	0	8206	5	16	23	20	17	19	6	21	18
6515L201344XX	64.90	0	31		0.017	2	2	0	12	0	0	0	9003	0	1	0	1	0	1	0	0	1
6515L800068	5.50	0	31		0.164	22	0	0	118	-22	32	3	8902	2	8	0	10	15	0	4	14	1
6515L800201	180.00	0	31		0.011	1	2	0	8	1	0	0	8807	0	0	0	0	0	0	0	1	0
6515L890286	88.80	0	31		0.005	1	1	0	4	0	0	0	8905	0	0	0	0	0	0	0	0	0
6515L890592	600.00	1	31		0.020	2	0	0	14	-2	2	0	9001	0	0	2	0	0	0	0	0	0
6515L900154	11.50	0	31		0.071	6	36	0	51	30	0	0	9004	0	1	0	0	1	2	1	10	0
6515L900208	205.00	0	31	U	0.233	10	0	0	168	-10	12	2	9005	0	4	6	2	10	10	10	0	0
6515L900238	188.97	0	31	U	0.013	0	0	0	9	0	0	0	9006	0	0	0	0	0	2	0	0	0

Random Sample 7 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR
6515L900338	330.62	0	31		0.043	3	4	0	31	1	0	0	9004	0	0	1	2	1	1	2	2	0
6520004693499	3.88	0	31	U	0.067	0	0	0	48	0	0	0	9004	0	6	0	0	0	0	4	4	0
6520L500133	90.00	0	31		0.042	3	17	0	30	14	0	0	9003	0	0	0	0	0	8	0	0	2
6520L900028	169.50	0	31	U	0.053	2	1	0	38	-1	1	0	9006	0	2	3	0	0	3	0	0	0
6530012101348	4.74	2	31		0.942	89	10	0	678	-79	41	0	8103	10	34	26	32	33	23	18	26	38
6530L400015	12.95	0	31		0.181	24	16	0	130	-8	0	0	8904	2	2	0	2	4	0	0	45	5
6545009143510	265.54	2	31	U	0.018	0	0	0	13	0	6	6	8912	0	0	0	0	0	0	0	0	4
6640L900015	61.00	0	31	U	0.008	0	0	0	6	0	0	0	9007	0	0	0	0	1	0	0	0	0
6750L890002	12.99	0	31		0.014	2	3	0	10	1	0	0	8903	0	0	0	0	0	0	0	1	4
7510L106532	4.50	1	31		0.020	3	5	0	14	2	0	0	9001	0	0	0	0	0	0	0	0	0
7530007816216	0.48	0	19		0.017	3	5	0	12	2	0	0	9001	0	0	0	0	0	0	0	1	0
7530L101128	94.50	0	30		0.126	10	7	0	91	-3	3	0	8301	4	8	2	3	5	3	1	8	5
8435L500005	13.00	0	42		0.093	13	20	0	67	7	0	0	8710	0	2	0	0	1	4	6	7	0
8940L000017	0.00	0	5	U	0.019	4	4	0	14	0	0	0	8409	0	1	0	0	0	1	0	0	0
8940L890004	7.55	1	37		0.082	13	12	0	59	-1	0	0	8910	5	0	0	0	0	0	0	2	12

Random Sample 7 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR
8940L890007	22.63	1	37	U	0.016	0	0	0	12	0	0	0	8910	0	0	0	0	0	0	0	0	2
P0100211042	163.35	0	31	U	0.050	0	0	0	36	0	0	0	9003	0	0	0	0	0	0	0	0	12
P0107780695	2.43	0	31	U	0.011	6	0	0	8	-6	0	0	9008	0	0	0	1	0	0	0	0	0
P4200201300	1.75	0	31	U	0.006	0	0	0	4	0	0	0	9005	0	0	0	0	0	0	1	0	0
P5439025800	11.00	0	31	U	0.014	0	0	0	10	0	0	0	8906	0	0	0	0	1	0	0	0	0
P570002J524	8.00	0	31	U	0.117	10	10	0	84	0	0	10	9007	0	0	0	0	14	0	0	0	0

Random Sample 8

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR
5365004008405	0.61	0	31	U	0.000	2	1	0	0	-1	2	3	9010	0	1	0	0	0	0	0	0	0
6501P9999CEMENT	4.75	0	31	U	0.000	0	0	0	0	0	0	0	9010	0	1	0	0	0	0	0	0	0
6505001320294	2.52	1	31		0.079	12	8	0	57	-4	0	0	7902	2	3	2	2	2	2	0	7	3
6505001538372	7.02	1	31		0.030	5	7	0	22	2	0	0	8905	0	0	0	0	0	0	0	3	2
6505006601634	20.64	1	26		0.066	8	7	0	48	-1	0	0	8812	0	0	5	15	0	0	2	0	0
6505008122541	2.16	1	24		0.219	33	34	0	158	1	0	0	7105	4	6	6	8	4	10	8	8	8
6505010091064	98.16	1	39		0.014	2	4	0	10	2	0	0	7606	0	0	0	0	0	3	0	2	0
6505010416910	3.33	1	31		0.026	3	6	0	19	3	0	0	9002	0	0	0	0	2	0	2	0	0
6505010939477	96.61	1	26		0.096	7	4	0	69	-3	3	0	8609	3	3	2	3	3	2	10	2	3
6505011534524	7.98	1	20		1.493	103	11	0	1075	-92	153	0	8502	54	78	168	0	32	30	23	54	24
6505011561748	17.48	1	31		0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6505011588006	24.05	1	61		0.033	5	6	0	24	1	0	0	8908	0	0	0	0	0	0	8	0	2
6505011621235	9.10	1	50		0.047	8	5	0	34	-3	0	0	7906	0	1	4	0	0	0	3	0	2
6505011732073	23.12	1	25		0.422	31	33	0	304	2	0	0	8502	6	12	6	12	0	24	6	16	18
6505011760715	32.00	1	31		0.008	1	0	0	6	-1	4	3	8909	0	2	0	0	0	0	1	0	0

Random Sample 8 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR
6505012157755	360.50	1	21		0.173	12	10	0	125	-2	12	0	8712	4	2	10	12	2	12	2	7	8
6505012601240	60.00	1	35		0.107	9	10	0	77	1	6	0	8709	2	0	7	0	6	0	4	4	4
6505013104161	30.17	1	31		0.685	55	55	0	493	0	0	0	8910	0	6	12	12	24	18	16	12	30
6505L890101	1.54	1	31		0.400	40	48	0	288	8	0	0	9006	0	22	0	14	0	24	0	0	0
6505L900093	211.50	1	31	U	0.053	2	3	0	38	1	0	0	9006	0	0	1	1	0	6	0	0	0
6505L900126	450.00	0	31	U	0.000	12	0	0	0	-12	24	13	9010	0	6	0	0	0	0	0	0	0
6510002003190	1.53	0	31	U	0.160	0	0	0	115	0	0	0	9006	0	12	0	0	0	12	0	0	0
6510002014100	9.22	0	23	U	0.027	0	0	0	19	0	0	0	9006	0	0	0	0	0	4	0	0	0
6510009355821	3.85	0	21		0.477	58	43	0	343	-15	0	0	6906	6	10	15	14	26	17	28	16	11
6510010985804	4.76	0	22		0.011	2	3	0	8	1	0	0	8605	1	0	0	0	0	1	0	0	0
6515011904373	43.65	0	70		0.052	9	0	0	37	-9	9	1	8503	2	2	0	0	4	0	3	5	0
6515011955340	51.00	0	38		0.521	45	17	0	375	-28	21	0	8206	5	16	23	20	17	19	6	21	18
6515012196312	69.75	0	46		0.093	9	9	0	67	0	0	0	8208	2	14	11	0	0	0	0	5	0
6515012926656	18.48	0	29		0.019	3	0	0	14	-3	2	0	8302	0	2	0	0	0	0	0	2	0
6515L106699XX	88.36	0	31		0.025	3	3	0	18	0	0	0	8209	0	1	1	1	0	0	0	2	0

Random Sample 8 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR
6515L501698	80.00	0	31		0.011	1	3	0	8	2	0	0	8708	0	0	0	0	1	0	0	0	0
6515L800317CT	1300.00	0	31	U	0.013	0	0	0	9	0	0	0	9006	0	0	0	0	0	2	0	0	0
6515L890286	88.80	0	31		0.005	1	1	0	4	0	0	0	8905	0	0	0	0	0	0	0	0	0
6515L890403	375.00	0	31		0.011	1	0	0	8	-1	2	1	8908	0	2	1	0	0	0	0	0	0
6515L900495	245.10	0	31	U	0.017	0	0	0	12	0	0	0	9007	0	0	0	0	2	0	0	0	0
6520005690000	0.90	0	31	U	0.000	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
6520L500133	90.00	0	31		0.042	3	17	0	30	14	0	0	9003	0	0	0	0	0	8	0	0	2
6525010648161	13.47	2	8		0.238	17	10	0	171	-7	0	0	7208	0	8	11	6	12	4	10	8	3
6750L890002	12.99	0	31		0.014	2	3	0	10	1	0	0	8903	0	0	0	0	0	0	0	1	4
7360L500008	32.00	0	31		0.074	10	9	0	53	-1	0	0	8605	0	3	7	0	1	3	2	0	6
7520L910002	21.48	0	31	U	0.000	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
7690L910000	15.00	0	31	U	0.000	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
8435L500005	13.00		42		0.093	13	20	0	67	7	0	0	8710	0	2	0	0	1	4	6	7	0
8940L000055	0.00	0	31	U	0.067	4	0	0	48	-4	4	2	9010	0	2	0	0	0	0	0	0	0

Random Sample 8 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR	MAR
8940L890007	22.63	1	37	U	0.016	0	0	0	12	0	0	0	8910	0	0	0	0	0	0	0	0	2
P0100072002	22.36	0	31		0.003	0	0	0	2	0	0	0	8909	0	0	1	0	0	0	0	0	0
P18014361P1	24.00	0	31	U	0.006	0	0	0	4	0	0	0	9005	0	0	0	0	0	0	1	0	0
P1816766SVC	180.14	0	31	U	0.000	0	0	0	0	0	0	0	9010	0	1	0	0	0	0	0	0	0
P2129000E31	147.75	0	31	U	0.007	0	0	0	5	0	0	0	9006	0	0	0	0	0	1	0	0	0
P2425220647	7.87	0	31	U	0.041	10	0	0	30	-10	5	5	8608	0	0	0	5	0	0	0	0	0

Random Sample 9

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	D	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	MAR	FEB	JAN	DEC	NOV	OCT	SEP	AUG	JUL
6240L900001	118.00	0	31	D	0.038	1	1	0	27	0	0	0	9007	0	0	0	0	3	0	0	0	6
6505001182132	7.44	1	24		0.181	23	0	0	130	0	20	6	7512	0	8	12	0	12	0	12	10	0
6505001490317	2.27	1	21		0.047	7	7	0	34	0	0	0	7705	0	0	0	6	1	0	0	0	0
6505007540374	6.14	1	28		0.337	43	42	0	243	0	0	0	6906	22	1	14	7	6	7	6	3	8
6505009608383	7.40	1	26		0.279	35	34	0	201	0	33	0	6906	10	2	13	7	7	10	0	29	0
6505010418165	79.35	1	21		0.107	7	4	0	77	0	0	0	8710	2	4	2	6	4	4	5	0	6
6505011406454	24.46	1	31		0.348	28	19	0	251	0	11	0	8902	0	0	50	15	26	0	0	0	7
6505011479451	22.43	0	31		0.121	11	11	0	87	0	0	0	8907	4	3	0	0	12	1	6	2	2
6505011561794	6.29	1	31		0.471	44	0	0	339	0	85	47	8702	24	0	44	49	0	0	0	12	31
6505011614492	54.50	1	77		0.008	2	2	0	6	0	0	0	8804	0	2	0	0	0	0	0	0	0
6505012005790	2.60	1	20		0.553	67	51	0	398	0	49	0	8306	12	18	28	0	24	0	72	6	18
6505013082300	137.37	0	31		0.066	5	0	0	48	0	48	0	8908	0	0	12	0	0	2	0	0	0
6505L900033	413.00	1	31	D	0.085	2	2	0	61	0	0	0	9006	0	0	5	0	2	0	0	0	11
6508001161362	0.69	0	24		1.696	212	103	0	1221	0	0	0	7311	96	79	36	84	24	60	24	36	48
6510000033058	27.04	2	31		0.027	4	3	0	19	0	0	0	8910	1	0	0	2	0	0	0	0	0

Random Sample 9 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	MAR	FEB	JAN	DEC	NOV	OCT	SEP	AUG	JUL
6515000893433	0.40	0	20		3.534	428	18	0	2544	0	411	0	8910	160	36	120	160	120	160	40	80	0
6515003651820	8.82	0	22		0.353	30	23	0	254	0	0	0	6906	20	5	2	24	6	12	0	7	8
6515010780739	9.17	0	19		0.008	2	2	0	6	3	0	0	8204	0	0	3	0	0	0	0	0	0
6515012648439	255.00	0	35		0.082	7	7	0	59	0	0	0	8508	3	4	7	1	1	1	3	2	3
6515L03250464	82.56	0	31	U	0.022	0	0	0	16	0	0	0	9012	0	0	0	2	0	0	0	0	0
6515L800108	58.28	0	46		0.060	7	7	0	43	4	0	0	8208	1	0	0	4	4	3	2	0	3
6515L890315	11.20	0	31	U	0.003	1	0	0	2	0	1	0	8906	0	0	0	0	0	0	0	0	0
6515L890421	51.90	0	31	U	0.007	1	1	0	5	0	0	0	9010	0	0	0	0	0	1	0	0	0
6515L890623	92.50	1	31	U	0.033	3	3	0	24	1	0	0	9007	0	0	0	0	0	3	3	0	2
6515L900209	240.00	0	31		0.020	2	2	0	14	1	0	0	9005	0	1	0	0	0	0	0	0	1
6515L900243	34.00	0	31	U	0.026	2	0	0	19	0	2	0	9006	0	2	1	0	0	0	0	0	2
6515L900426	149.00	0	31		0.026	2	2	0	19	3	0	0	9006	0	1	2	0	0	2	0	0	0
6515L900621	22.00	0	31	U	0.011	0	0	0	8	0	0	0	9009	0	0	0	0	0	0	2	0	0
6515LS00041	43.95	1	47		0.066	7	2	0	48	0	4	0	7806	1	3	2	1	4	0	2	4	1
6520012119601	22.92	0	36		0.036	5	5	0	26	8	0	0	8702	0	0	2	0	0	0	1	0	0

Random Sample 9 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	MAR	FEB	JAN	DEC	NOV	OCT	SEP	AUG	JUL
6525012056757	95.44	2	7		0.164	9	7	0	118	0	0	0	8703	13	0	10	0	0	5	9	13	0
6530007844205	8.39	0	28	U	0.323	0	0	0	233	0	0	0	8908	0	0	0	0	0	20	24	0	40
6530LFB103564	17.29	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6550L900053	50.00	0	31	U	0.025	0	0	0	18	0	0	0	9011	0	0	0	0	3	0	0	0	0
6550L910002	3.15	0	31	U	0.533	0	0	0	384	0	0	0	9012	0	24	0	24	0	0	0	0	0
6550L92350375CT	25.00	0	31	U	0.025	0	0	0	18	0	0	0	9011	0	0	0	2	1	0	0	0	0
6630012149091	20.35	0	0	U	0.000	0	0	0	0	3	4	7	9102	0	2	0	0	0	0	0	0	0
6630012644130	25.20	0	31	U	0.011	0	0	0	8	0	0	0	9009	0	0	0	0	0	0	2	0	0
6640006180073	0.84	0	22		1.521	187	187	0	1095	25	0	0	6906	90	12	96	36	14	26	94	26	47
6640L900033	48.00	0	31	U	0.033	0	0	0	24	0	0	0	9010	0	0	0	0	0	5	0	0	0
7510L500066	2.35	0	31		0.049	8	8	0	35	5	0	0	8604	2	0	0	0	0	0	4	0	9
7610LFB035102	15.00	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7930L900009	43.00	0	31	U	0.013	8	7	0	9	0	0	0	9007	0	0	1	1	0	0	0	0	1
7930L900011	49.25	0	31	U	0.071	10	6	0	51	0	4	0	9007	0	4	5	2	0	2	0	0	4
P0100262D22	15.00	0	31	U	0.011	0	0	0	8	0	0	0	9009	0	0	0	0	0	0	2	0	0

Random Sample 9 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SEKV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	MAR	FEB	JAN	DEC	NOV	OCT	SEP	AUG	JUL
P2116699850	9.15	0	31	U	0.013	0	0	0	9	0	0	0	9010	0	0	1	0	0	1	0	0	0
P4520800188	147.00	0	31	U	0.007	0	0	0	5	0	0	0	9010	0	0	0	0	0	1	0	0	0
P5700680001	2.85	0	31	U	0.040	12	0	0	29	0	0	0	9010	0	0	1	4	0	1	0	0	0
P5701105147	13.19	0	31	U	0.000	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
P8469009010	123.07	0	31	U	0.007	0	0	0	5	0	0	0	9010	0	0	0	0	0	1	0	0	0

Random Sample 10

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	MAR	FEB	JAN	DEC	NOV	OCT	SEP	AUG	JUL
5935L900001	126.00	0	31	U	0.038	1	0	0	27	0	7	6	9008	0	0	1	0	1	0	0	6	0
6505000836541	19.50	1	28		0.474	37	0	0	341	0	39	4	7601	16	9	22	14	19	13	11	16	15
6505001262037	1.21	1	31		0.082	13	13	0	59	5	0	0	8910	2	0	0	0	0	6	14	0	6
6505002998598	2.06	1	24		1.101	138	18	0	793	0	90	0	6906	36	42	48	24	18	36	48	24	24
6505002998610	2.06	1	25		0.197	30	14	0	142	0	0	0	6906	1	1	14	6	4	8	14	6	6
6505007534773	3.82	0	31		0.007	2	2	0	[illegible]	0	0	0	9005	0	0	0	0	1	0	0	0	0
6505008902015	46.31	1	53		0.608	62	6	0	438	0	57	0	7602	12	24	24	19	11	18	18	12	6
6505010750679	10.14	1	28		2.255	174	81	0	1624	0	70	0	8612	128	72	77	60	64	68	68	62	62
6505011385692	28.17	1	41		0.274	25	25	0	197	14	22	0	8808	6	11	3	16	14	4	10	3	3
6505011394931	61.85	1	31		0.067	6	0	0	48	0	5	1	9005	0	5	1	2	0	0	0	0	0
6505012262958	6.75	1	47		0.877	84	61	0	631	0	25	0	8603	35	0	50	1	19	40	0	70	10
6505012580960	17.96	1	31	U	0.019	0	0	0	14	0	0	0	9008	0	0	0	0	0	0	0	4	0
6505012601240	60.00	1	35		0.126	11	5	0	91	0	3	0	8709	4	2	9	0	10	0	7	0	6
6505013166024	105.99	1	31		0.070	5	1	[illegible]	50	0	4	0	9006	0	5	0	4	2	4	0	1	1
6505013321292	29.15	0	31	U	0.067	6	0	0	48	0	11	5	9009	0	0	0	0	4	2	6	0	0

Random Sample 10 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PL	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	MAR	FEB	JAN	DEC	NOV	OCT	SEP	AUG	JUL
6505L900065	77.96	1	31	U	0.200	10	0	0	144	0	20	10	9010	0	0	10	0	0	20	0	0	0
6515006555751	2.00	0	28		0.321	41	3	0	231	0	30	0	6906	17	12	6	10	17	9	10	5	8
6515007540412	6.14	0	23		2.474	178	0	0	1781	0	205	19	6906	67	52	69	86	62	82	88	65	83
6515009262089	0.46	0	30		2.668	350	350	0	1921	46	0	0	7201	150	10	50	154	110	0	50	150	0
6515011399090	141.72	0	31		0.013	2	2	0	9	2	0	0	9005	0	0	0	0	0	0	0	0	0
6515012640361	13.90	0	31		0.184	17	14	0	132	0	1	0	8807	4	7	13	6	5	2	7	2	2
6515012827715	13.70	2	30		1.490	118	18	0	1073	0	99	0	8302	4	5	0	60	370	40	0	17	10
6515L03250450	44.03	0	31	U	0.017	0	0	0	12	0	0	0	9011	0	0	0	0	2	0	0	0	0
6515L110914	60.00	0	42		0.175	16	0	0	126	0	19	2	7910	3	0	9	6	7	7	4	7	4
6515L300036XX	383.20	2	37		0.030	3	1	0	22	0	1	0	8309	1	1	1	1	0	1	1	1	1
6515L400479	22.42	0	42		0.181	19	1	0	130	0	9	0	8407	5	11	5	1	8	8	2	7	10
6515L500247	82.00	0	31		0.058	5	5	0	42	0	0	0	8408	2	2	0	3	1	2	2	2	0
6515L501132	205.00	2	49		0.016	2	2	0	12	3	0	0	8703	1	0	0	0	0	0	1	1	0
6515L501180XX	15.50	1	34		0.008	1	0	0	6	0	1	0	8706	0	2	1	0	0	0	0	0	0
6515L890492	32.32	0	31		0.016	3	0	0	12	0	3	0	8909	0	3	0	0	0	0	0	0	0

Random Sample 10 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	MAR	FEB	JAN	DEC	NOV	OCT	SEP	AUG	JUL
6515L890602	450.00	1	31		0.011	1	0	0	8	0	4	0	8911	0	0	0	0	0	0	3	0	0
6515L890610	25.00	0	31		0.011	2	2	0	8	1	0	0	9001	0	0	0	0	0	0	3	0	0
6515L910027	56.15	0	31	U	0.022	0	0	0	16	0	1	1	9012	0	0	0	2	0	0	0	0	0
6520010032274	5.91	0	23		0.022	3	3	0	16	0	0	0	7707	3	1	4	0	0	0	0	0	0
6530L100120	63.30	0	31		0.005	1	1	0	4	7	0	0	8905	0	0	0	0	0	0	0	0	0
6550L900056	25.35	0	31	U	0.017	0	0	0	12	0	0	0	9011	0	0	0	0	2	0	0	0	0
6550L900060	39.40	0	31	U	0.008	0	0	0	6	0	0	0	9011	0	0	0	0	1	0	0	0	0
6640011934168	80.00	0	48		0.038	4	0	0	27	0	4	0	8610	1	3	2	0	0	0	0	2	2
6640012685486	41.76	0	38		0.011	2	2	0	8	0	0	0	8110	0	0	0	0	1	0	0	0	0
6640L700038	378.00	2	33		0.049	4	2	0	35	0	2	0	8712	0	2	2	3	1	0	2	2	1
6640L800047	95.55	0	31	U	0.071	2	2	0	51	0	0	0	8910	4	0	3	0	0	7	0	0	10
6750L500010	11.74	0	31		0.008	1	1	0	6	10	0	0	9001	1	0	0	0	0	0	1	0	0
6810L02880461	106.15	0	31	U	0.167	0	0	0	120	0	41	41	9011	0	0	0	0	20	0	0	0	0
6810L890037	33.20	0	31		0.003	0	0	0	2	1	0	0	9001	0	0	0	0	0	0	0	0	1
6910L02880442	129.75	0	31	U	0.011	0	0	0	8	0	0	0	9012	0	0	0	1	0	0	0	0	0

Random Sample 10 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EXCESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	MAR	FEB	JAN	DEC	NOV	OCT	SEP	AUG	JUL
7210012768201	51.41	0	31	0	0.013	0	0	0	9	0	0	0	9005	0	0	0	1	0	1	0	1	0
7510L900029	44.95	0	31	0	0.008	2	1	0	6	0	1	0	9011	0	0	0	0	1	0	0	0	0
8940L890009	6.47	0	31	0	0.089	2	2	0	64	0	0	0	9006	0	0	0	0	0	0	0	0	0
9999LFB100809	4.93	0	31	0	0.000	0	0	0	0	30	0	30	0	0	0	0	0	0	0	0	0	0
P9999563052	15.50	0	31	0	0.011	0	0	0	8	0	0	0	9009	0	0	0	0	0	0	2	0	0

Random Sample 11

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EXCESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
3020004156069	1.00	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6505001161039	9.25	1	22		0.027	4	4	0	19	2	0	0	7607	0	0	0	0	0	0	0	0	7
6505001263207	19.43	1	26		0.118	15	11	0	85	0	0	0	8911	4	2	12	4	0	2	6	3	0
6505010197627	2.21	1	24		1.173	102	0	0	845	0	120	16	7711	24	20	84	36	36	18	36	72	60
6505010908127	66.50	1	31		0.025	3	0	0	18	0	3	0	8703	1	1	1	1	0	0	2	0	0
6505011103956	23.94	1	31		0.378	30	0	0	272	0	36	12	8812	16	10	12	32	0	24	0	13	13
6505011472070	7.39	1	27		0.493	44	7	0	355	0	25	0	8006	0	36	12	12	12	12	24	12	12
6505011532947	0.84	1	17		1.981	234	118	0	1426	0	0	0	6906	60	36	84	99	72	60	48	96	12
6505011534296	17.99	1	47		0.055	8	8	0	40	7	0	0	8103	0	0	2	0	0	0	0	0	12
6505012503532	7.86	1	31		0.063	10	6	0	45	0	0	0	9001	10	0	0	6	0	4	0	0	0
6505L400055	17.79	1	31		0.836	67	31	0	602	0	27	0	8410	20	10	10	45	5	16	0	9	40
6505L900025	22.95	0	31	U	0.015	1	1	0	11	0	0	0	9002	0	0	0	0	0	0	0	0	0
6510013208813	204.00	1	31		0.033	3	3	0	24	0	0	0	8809	0	0	0	8	0	0	0	0	1
6515001068475	1.68	0	24		0.055	8	8	0	40	5	0	0	8103	0	0	0	0	0	0	0	0	20
6515002901940	45.77	0	48		0.022	3	2	0	16	0	0	0	8601	0	3	0	3	0	0	1	0	0

Random Sample 11 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
6515003638840	14.92	0	21		0.400	28	6	0	288	0	38	0	6906	10	1	15	22	22	8	10	0	10
6515012240126	82.23	0	31	U	0.000	0	0	0	0	0	0	0	9011	0	0	2	0	0	0	0	0	0
6515L200097	67.50	2	35		0.071	7	3	0	51	0	3	0	8005	2	0	0	6	2	4	2	0	0
6515L200487	1.05	0	38		0.310	51	3	0	223	0	39	0	8206	12	10	10	10	5	10	10	5	31
6515L200904	67.50	2	34		0.052	5	5	0	37	0	0	0	8203	2	0	2	3	0	2	4	2	2
6515L890408	74.38	0	31		0.005	1	1	0	4	3	0	0	9001	2	0	0	0	0	0	0	0	0
6515L890596	95.00	0	31		0.005	1	1	0	4	1	0	0	9001	2	0	0	0	0	0	0	0	0
6515L900421	128.00	0	31	U	0.017	0	0	0	12	0	0	0	9007	0	0	2	0	0	0	1	0	0
6515L900427XX	25.29	0	31	U	0.033	1	1	0	24	1	0	0	9005	0	0	0	0	2	0	2	0	4
6515L900585	32.50	0	31	U	0.022	4	4	0	16	0	0	0	9010	0	0	0	2	0	0	0	0	0
6515LS00202	16.94	2	34		0.049	7	3	0	35	0	5	0	8602	4	0	1	3	1	3	4	0	0
6530011101369	37.57	0	23		0.167	12	8	0	120	0	0	0	8206	4	6	5	6	4	5	6	5	6
6530011340908	53.65	0	31		0.030	4	4	0	22	0	0	0	9003	0	1	0	0	0	0	0	2	2
6545009111300	230.21	2	31	U	0.000	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
6550L01870375CT	86.00	0	31	U	0.000	0	0	0	0	0	24	24	0	0	0	0	0	0	0	0	0	0

Random Sample 11 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
6550LFB034113	48.00	0	31	U	0.000	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
6640006180072	0.96	0	20		0.142	21	15	0	102	0	0	0	8509	2	1	3	34	0	0	7	0	0
6810L890006	133.50	1	31	U	0.012	0	0	0	9	0	0	0	9002	0	0	2	0	0	0	0	0	0
7510L500130	36.52	0	6		0.041	4	3	0	30	0	0	0	8701	3	0	1	0	0	0	5	1	3
8415LFB026315IF	189.99	0	31	U	0.000	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
8940L900011	28.00	1	31	U	0.056	28	23	0	40	0	0	0	9007	0	0	0	5	0	0	5	0	0
P0100396480	58.45	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0100444002	117.59	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0100595001	64.82	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0100745091	249.52	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0202200303	5.75	0	31	U	0.000	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0332002200	233.00	0	31		0.003	0	0	0	2	0	0	0	9001	1	0	0	0	0	0	0	0	0
P1200539138	0.57	0	31	U	0.000	0	0	0	0	0	0	0	9012	0	1	0	0	0	0	0	0	0
P331802L580	47.37	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P3676000E32	4.63	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Random Sample 11 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
P4200356300	0.70	0	31	U	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P5439222500	1.00	0	31	U	0.000	0	0	0	0	0	0	0	9101	0	0	0	0	0	0	0	0	0
P6914P08746	1.00	0	31	U	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P8090251501	24.00	0	31	U	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P8467825601	84.00	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Random Sample 12

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
5330004106647	3.28	0	31	0	0.000	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6505001335421	15.50	1	38		0.279	28	22	0	201	0	0	0	7307	6	6	6	6	18	0	12	12	0
6505006895532	1.11	1	31		0.082	13	6	0	59	0	0	0	8310	0	0	12	0	0	0	0	0	0
6505007822688	41.34	1	31		0.055	7	5	0	40	0	0	0	8911	0	0	0	0	5	0	5	5	0
6505008122541	2.16	1	24		0.241	36	16	0	174	0	0	0	7105	4	6	12	6	6	8	4	10	8
6505010941636	9.77	1	44		0.255	37	32	0	184	0	0	0	7606	0	0	0	16	20	12	8	8	8
6505011464174	35.55	1	30		14.427	1140	633	0	1038 7	0	468	0	8408	552	360	360	520	344	432	324	432	646
6505011534303	209.60	1	31	0	0.000	2	0	0	0	0	6	4	0	0	0	0	0	0	0	0	0	0
6505011638085	19.50	1	28		0.074	10	2	0	53	0	6	0	8001	3	3	4	3	3	0	7	0	0
6505012240148	4.64	1	31		0.022	3	3	0	16	10	0	0	8907	0	0	0	0	0	0	0	0	0
6505012403815	157.84	1	31		0.132	11	11	0	95	9	0	0	8704	18	0	0	0	0	0	0	0	29
6505012492131	42.60	1	98		0.008	2	2	0	6	0	0	0	8804	0	0	0	0	0	0	3	0	0
6505013026664	10.95	1	31		0.027	4	4	0	19	22	0	0	7705	0	0	0	0	0	10	0	0	0
6505L890021	189.10	1	31		0.014	1	1	0	10	0	0	0	8903	0	0	0	1	0	0	0	1	0

Random Sample 12 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
6510009269167	4.73	2	23		0.156	19	13	0	112	0	0	0	6906	1	4	3	12	5	2	2	7	6
6510L910003	24.60	0	31	U	0.000	1	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
6515002259719	28.43	0	31		0.003	0	0	0	2	0	0	0	8910	0	0	0	0	0	0	0	1	0
6515007551113	8.18	0	22	U	0.058	0	0	0	42	0	0	0	8910	0	0	0	0	2	4	0	2	10
6515011562402	29.91	0	20	U	0.033	6	0	0	24	0	9	3	8007	2	3	2	0	1	2	0	0	2
6515012309931	36.40	0	26	U	0.000	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6515L201239	126.00	2	36		0.066	6	6	0	48	0	0	0	8303	3	0	1	1	2	0	1	6	7
6515L890335	92.50	0	31		0.003	0	0	0	2	1	0	0	8906	0	0	0	0	0	0	0	0	0
6515L890349	74.50	0	31		0.011	1	1	0	8	2	0	0	8905	1	0	0	0	0	1	1	0	0
6515L890405	4.98	0	31		0.126	20	0	0	91	0	27	5	8907	0	0	8	6	1	10	9	1	5
6515L900279XX	52.80	0	31	U	0.033	10	7	0	24	0	3	0	9010	0	0	1	2	0	0	0	0	0
6515L900580XX	61.70	0	31	U	0.187	10	3	0	135	0	4	0	9008	0	3	4	9	7	5	0	0	0
6515L910088	84.50	0	31	U	0.000	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0
6515L910147	19.25	0	31	U	0.000	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
6515LFB032417	50.82	0	31	U	0.000	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0

Random Sample 12 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
6520004693499	3.88	0	22		0.052	5	5	0	37	1	0	0	9004	0	0	0	6	0	0	0	0	4
6520010700443	297.01	0	31		0.030	2	0	0	22	0	3	1	8909	0	3	1	0	0	2	5	0	0
6525010456410	98.91	2	5		0.022	2	2	0	16	0	0	0	8410	0	0	0	3	0	0	0	0	0
6545010948412	11.28	2	23	U	0.953	0	0	0	686	0	0	0	8910	0	0	0	307	0	10	0	1	0
6550010965307	31.93	1	39		0.014	2	2	0	10	2	0	0	8707	2	0	0	0	0	0	3	0	0
6750001538907	3.02	0	31	U	0.000	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0
6910LFB001103	1730.00	0	31	U	0.000	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
7510L500130	36.52	0	6		0.041	4	3	0	30	0	0	0	8701	3	0	1	0	0	0	5	1	3
7610L890002	1.05	0	31	U	0.300	0	0	0	216	0	50	50	9002	0	0	0	0	0	50	0	9	0
8115006826525	9.85	0	21		0.175	21	11	0	126	0	0	0	7502	4	0	8	0	0	0	0	0	25
P0100316332	34.92	0	31	U	0.017	0	0	0	12	0	0	1	9011	0	0	1	0	0	0	0	0	0
P0100751061	2.50	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0127801091	15.96	0	31	U	0.000	0	0	0	0	0	0	0	9012	0	3	0	0	0	0	0	0	0
P180106P016	14.65	0	31	U	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Random Sample 12 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
P18012N6040	1.45	0	31	U	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P18015926G1	45.00	0	31	U	0.033	0	0	0	24	0	0	0	9005	0	0	0	0	0	0	0	4	4
P18018133P1	42.00	0	31	U	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P3610429201	400.00	0	31	U	0.000	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
P4501188616	347.95	0	31	U	0.000	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
P5439993113	21.00	0	31	U	0.000	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P5446608144	0.76	0	31	U	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Random Sample 13

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
5962004584462	3.67	0	31	U	0.000	0	0	0	0	0	0	0	9012	0	2	0	0	0	0	0	0	0
6505000599017	4.63	1	18		0.153	18	9	0	110	0	0	0	6906	4	5	4	10	4	6	7	2	4
6505000664875	15.81	1	31	U	0.011	1	0	0	8	0	1	0	8903	0	0	0	0	1	1	1	0	0
6505007822688	41.34	1	31		0.055	7	5	0	40	0	0	0	8911	0	0	0	0	5	0	5	5	0
6505010357222	8.98	1	31	U	0.158	0	0	0	114	20	0	0	9009	0	0	0	0	19	0	0	0	0
6505010430230	1.12	1	27		4.879	366	269	0	3513	0	0	0	7805	168	168	156	168	168	216	48	113	72
6505010503547	29.66	1	31	U	0.000	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6505010739536	1.61	1	20		0.356	52	27	0	256	0	0	0	8409	9	7	5	7	26	13	0	10	10
6505011113194	53.20	1	30	U	0.027	0	0	0	19	0	0	0	8602	4	0	0	0	0	0	2	4	0
6505011434643	0.99	1	20		0.934	113	106	0	672	0	0	0	7205	36	0	24	24	36	54	24	30	24
6505011437659	226.41	1	39		0.085	7	0	0	61	0	7	0	8109	3	4	0	4	0	0	4	1	7
6505011752332	39.48	1	23		0.014	2	2	0	10	0	0	0	8502	1	0	0	0	0	1	3	0	0
6505L800029	69.47	1	40		0.077	7	2	0	55	0	4	0	8809	4	2	3	2	0	0	1	2	4
6505L900078XX	118.80	1	31	U	0.020	2	1	0	14	0	1	0	9008	0	1	0	0	0	2	0	0	0
6505L900095	165.00	1	31		0.143	9	9	0	103	3	0	0	9006	0	4	4	10	0	0	0	12	0

Random Sample 13 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
6505L92640383CT	8.90	0	31	U	0.241	0	0	0	174	0	0	0	9001	8	8	0	8	16	0	8	8	8
6515006198305	56.47	0	36		0.055	5	5	0	40	2	0	0	7803	0	0	0	12	0	0	8	0	0
6515010165357	20.48	0	31		0.019	3	2	0	14	0	0	0	7706	0	2	0	0	2	0	1	0	1
6515012547649	8.21	0	21		0.896	63	20	0	645	0	36	0	7404	14	28	23	25	24	39	23	30	41
6515012615870	104.94	1	26		0.058	4	0	0	42	0	5	1	8607	4	5	0	0	0	3	0	0	8
6515L201467	130.65	0	31	U	0.033	0	0	0	24	0	0	0	9008	0	0	0	0	0	5	0	0	0
6515L890495	26.77	0	31		0.033	4	4	0	24	1	1	1	8909	3	0	5	0	0	0	4	0	0
6515L890648	11.90	0	31		0.014	2	2	0	10	3	0	0	9001	5	0	0	0	0	0	0	0	0
6515L890709	42.00	0	6		0.622	34	0	0	448	0	41	6	9001	28	16	20	22	8	26	30	0	9
6515L900326	51.00	0	31	U	0.086	0	0	0	62	0	0	0	9006	0	0	0	0	14	0	0	4	0
6515L910037	50.00	0	31	U	0.000	0	0	0	0	0	0	0	9101	0	0	0	0	0	0	0	0	0
6520010636875	21.55	0	31	U	0.044	0	0	0	32	0	0	0	9010	0	0	0	4	0	0	0	0	0
6520010985815	20.87	2	31	U	0.000	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0
6520L03040440	2.25	0	31	U	0.000	0	0	0	0	0	0	0	9011	0	0	6	0	0	0	0	0	0
6810L910020	12.70	0	31	U	0.000	1	1	0	0	0	0	0	9011	0	0	4	0	0	0	0	0	0

Random Sample 13 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
6910007296161	29.41	0	31	U	0.033	0	0	0	24	0	0	0	9009	0	0	0	0	4	0	0	0	0
7210012768201	51.41	0	31	U	0.017	0	0	0	12	0	0	0	9005	0	1	0	1	0	1	0	0	1
7530L900014	7.00	0	31	U	0.017	5	5	0	12	3	0	0	9009	0	0	0	0	2	0	0	0	0
7610LFB033317	6.95	0	31	U	0.000	0	0	0	0	0	50	50	0	0	0	0	0	0	0	0	0	0
F0517611001	12.75	1	31		0.090	12	11	0	65	0	0	0	8808	8	3	0	0	0	4	2	2	8
P0100088091	54.35	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0100823091	52.87	0	31	U	0.003	0	0	0	2	0	0	0	9002	0	0	0	0	0	0	0	0	0
P0100902091	43.38	0	31	U	0.000	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
P0102012066	250.00	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0102100886	54.50	0	31	U	0.000	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0179200501	0.31	0	31	U	0.000	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P0202791400	28.00	0	76	U	0.016	0	0	0	12	0	0	0	8609	2	0	1	1	1	0	1	0	0
P0321006563	31.55	0	31	U	0.000	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P097061702A	41.00	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P2125007593	2.42	0	31	U	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Random Sample 13 (cont)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	O	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	JAN	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY
P2401057582	7.25	0	31	0	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P3610854580	316.71	0	31	0	0.008	0	0	0	6	0	0	0	9009	0	0	0	0	1	0	0	0	0
P4501068599	169.68	0	31	0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P601900EL2B	1.90	0	31	0	0.000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P6313008820	1.00	0	31	0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Random Sample 14

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR
5935010173290	1.62	0	29	U	0.011	3	0	0	8	0	0	0	9009	0	0	0	1	0	0	0	0	0
6505000221328	5.15	1	19		0.110	16	3	0	79	0	12	0	7010	4	1	14	0	4	3	1	3	3
6505001059704	1.37	1	58		0.455	84	60	0	328	0	0	0	8810	24	0	0	48	36	12	6	0	0
6505001174912	7.76	1	31	U	0.005	1	1	0	4	0	0	0	9005	0	0	0	0	0	0	0	1	0
6505001376154	11.91	1	24		0.115	14	5	0	83	0	12	0	6906	0	6	0	7	17	6	0	0	6
6505001486969	2.54	1	21		0.592	72	47	0	426	0	0	0	7507	18	18	24	31	29	12	24	24	0
6505001538220	2.26	1	24		0.008	2	2	0	6	4	0	0	8812	0	0	0	0	0	0	0	3	0
6505006874545	21.19	1	18		1.047	70	70	0	754	157	0	0	8606	5	8	0	0	46	288	0	0	13
6505007282009	13.06	1	21		1.512	106	91	0	1089	0	0	0	7106	30	60	36	60	48	36	72	24	42
6505007335246	164.75	1	38		0.214	19	1	0	154	0	25	7	6906	8	0	8	10	2	0	0	12	12
6505011040399	6.50	1	18		0.192	23	23	0	138	4	0	0	7104	13	0	15	10	10	0	10	10	0
6505011449724	41.55	1	18		3.844	258	189	0	2768	0	0	0	8802	72	108	84	144	144	120	204	95	156
6505011554064	33.57	1	17		0.838	55	47	0	603	0	0	0	8812	78	12	12	30	19	47	42	12	18
6505011648737	2.50	1	58		0.044	8	6	0	32	0	0	0	8405	0	3	0	3	0	6	0	0	0
6505012194562	2.01	1	31		0.071	11	11	0	51	11	0	0	8903	0	2	3	0	0	0	21	0	0

Random Sample 14 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR
6510L910001	29.92	0	31	U	0.000	0	0	0	0	0	0	0	9011	0	2	0	0	0	0	0	0	0
6515001450011	14.92	0	29		0.005	1	1	0	4	0	0	0	8301	0	0	1	0	1	0	0	0	0
6515010095298	16.02	0	18		0.058	7	6	0	42	0	0	0	8905	2	1	0	1	1	1	2	3	0
6515011393414	126.86	0	31		0.011	1	1	0	8	0	0	0	8111	1	0	0	0	0	1	1	0	0
6515011621703	12 96	0	41		0.052	7	3	0	37	0	0	0	7210	3	3	1	0	3	1	0	1	0
6515012865281	47.25	0	31		0.148	12	12	0	107	1	0	0	8810	2	0	0	0	4	0	42	4	0
6515L104599	18.23	0	53	U	0.017	0	0	0	12	0	0	0	9008	0	0	0	0	2	0	0	0	0
6515L106585	5.70	0	78		0.041	8	8	0	30	6	0	0	8501	0	0	0	0	0	0	0	0	0
6515L110781XX	5156.00	2	60		0.011	1	1	0	8	4	0	0	7906	0	0	0	0	0	0	1	0	1
6515L200128	4.30	0	30		0.644	60	10	0	464	0	25	0	8102	0	30	20	10	0	10	25	0	30
6515L400516	62.00	0	35		0.014	2	2	0	10	1	0	0	8907	0	0	0	0	0	2	0	2	0
6515L890321XX	129.00	1	31	U	0.016	4	2	0	12	0	1	1	8906	0	0	1	1	1	1	1	0	0
6515L890503	31.50	0	31		0.003	0	0	0	2	2	0	0	8910	0	0	0	0	0	0	0	0	0
6515L890613	92.50	1	31		0.008	1	1	0	6	1	0	0	8911	0	2	0	1	0	0	0	0	0

Random Sample 14 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR
6515L890764	35.70	0	31		0.037	3	0	0	27	0	16	0	9003	0	0	0	0	0	0	0	0	0
6515L900508	4.00	0	31	U	0.033	0	0	0	24	0	0	0	9008	0	0	0	0	4	0	0	0	0
6515L900582	304.00	0	31	U	0.011	1	1	0	8	0	0	0	9009	0	0	0	1	0	0	0	0	0
6515L910090	622.50	0	31	U	0.000	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
6515LS00015	43.68	1	6		0.027	3	3	0	19	0	0	0	8112	0	0	0	2	1	0	4	0	2
6520009357171	2.72	0	21		0.055	8	8	0	40	11	0	0	7306	0	0	5	9	0	0	3	3	0
6520010032427	5.70	0	20		0.047	7	7	0	34	1	0	0	8501	10	0	0	1	1	5	0	0	0
6520010473577	13.54	0	65		0.016	3	0	0	12	0	2	0	6906	0	2	2	0	0	0	2	0	0
6525011015640	46.66	0	31	U	0.003	2	0	0	2	0	0	0	8801	0	0	0	0	0	0	0	0	0
6530L890029	29.50	0	18		1.712	115	65	0	1233	0	39	0	8905	48	44	34	56	60	20	64	87	49
6540011462642	2.34	0	31	U	0.300	0	0	0	216	0	0	0	9008	0	0	0	0	36	0	0	0	0
6550010086010	23.03	1	25		0.011	2	2	0	8	0	0	0	8705	0	0	0	0	0	2	0	0	0
6640L800048	266.50	0	31		0.014	1	1	0	10	1	0	0	8901	0	0	0	0	0	0	0	1	1
6640L890029	52.00	1	30		0.030	4	3	0	22	0	0	0	8908	0	0	1	0	0	1	1	0	2
6810L890039	19.60	0	31	U	0.025	0	0	0	18	0	0	0	8912	1	0	6	0	0	0	0	0	2

Random Sample 14 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR
7220LFB027324	345.60	0	31	U	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7510L106644XX	21.00	0	30		0.008	1	1	0	6	1	0	0	8909	0	0	0	0	0	1	0	0	2
7690L500037	6.25	0	25		0.036	5	1	0	26	0	1	0	8704	0	7	3	0	0	0	1	1	0
8125L890000	59.08	0	31		0.052	5	3	0	37	0	2	0	8906	1	2	1	2	2	1	1	2	0
8520L100000	44.52	1	31	U	0.008	0	0	0	6	0	0	0	8906	0	0	0	0	0	0	0	0	3
P18016529P1	10.00	0	31	U	0.000	3	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0

Random Sample 15

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR
6505001199321	130.34	1	18		0.096	6	6	0	69	2	0	0	7612	8	0	0	3	0	4	6	4	7
6505001429206	9.06	1	21		0.230	28	26	0	166	0	4	4	6912	7	0	11	8	0	0	1	2	0
6505003685934	1.30	1	31		0.047	10	4	0	34	0	0	0	9002	0	3	0	0	0	3	0	2	0
6505005840412	53.09	1	28		1.803	139	13	0	1298	0	120	0	6906	60	86	36	84	54	54	76	6	36
6505009857301	4.29	1	16		1.556	98	0	0	1120	0	107	24	6906	25	145	48	25	6	0	5	69	79
6505010141579	11.32	1	24		0.047	7	5	0	34	0	0	0	7808	3	0	0	4	10	0	0	0	0
6505010395846	1.96	1	28		8.362	644	271	0	6021	0	276	0	8604	264	252	144	324	156	144	364	216	252
6505010749346	42.50	1	71		0.041	7	7	0	30	0	0	0	8608	2	1	3	0	4	1	1	1	0
6505010920419	92.10	1	39		0.101	9	4	0	73	0	6	0	8308	0	5	0	7	5	0	0	0	5
6505011245361	46.48	1	39		0.025	4	4	0	18	4	0	0	8202	9	0	0	0	0	0	0	0	0
6505011533758	12.21	1	31	U	0.050	2	0	0	36	0	2	0	9004	0	4	3	0	0	0	3	0	2
6505011534211	6.05	1	31		0.082	13	13	0	59	1	0	0	8702	0	0	5	5	0	0	0	5	5
6505011562192	6.00	1	74		0.044	9	0	0	32	0	9	6	6906	1	0	0	2	6	0	1	1	1
6505011715237	534.00	1	31		0.016	1	1	0	12	4	0	0	8806	2	0	0	0	0	0	0	0	0
6505011908688	30.00	2	29		4.110	321	161	0	2959	0	144	0	8505	108	144	72	192	120	120	168	72	120

Random Sample 15 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR
6505012994202	15.06	1	31		0.229	17	17	0	165	35	0	0	9005	0	0	0	0	0	0	0	48	0
6505L890015	55.00	0	31	U	0.019	2	0	0	14	0	3	1	9005	0	0	2	0	0	0	0	2	0
6510004798679	6.54	2	47		0.121	17	14	0	87	0	0	0	7501	0	3	4	3	1	4	3	0	22
6510011077575	3.46	0	32		0.093	15	10	0	67	0	0	0	6908	0	4	5	5	2	3	12	0	3
6510012463769	68.00	0	31		0.030	4	3	0	22	0	0	0	8904	2	0	0	0	0	2	3	0	0
6515003344900	8.03	0	22		0.184	23	23	0	132	26	0	0	6906	5	0	2	0	0	0	0	0	0
6515004005465	16.23	0	23		0.074	9	5	0	53	0	0	0	8004	2	3	0	3	0	3	4	3	3
6515010087103	45.92	0	21		0.285	20	10	0	205	0	9	0	8303	6	10	4	1	7	8	6	15	12
6515010604280	4.77	0	31		0.014	3	0	0	10	0	3	0	8609	5	0	0	0	0	0	0	0	0
6515012313525	130.55	0	31	U	0.005	1	1	0	4	0	0	0	8912	1	0	1	0	0	0	0	0	0
6515L00013583	294.00	0	31	U	0.000	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
6515L501394	270.75	0	35		0.052	4	1	0	37	0	2	0	8704	1	2	1	1	1	2	2	3	3
6515L890414	91.08	1	31		0.036	3	3	0	26	0	0	0	8908	2	4	0	0	0	0	2	0	4
6515L890658	13.30	0	31	U	0.033	0	0	0	24	0	0	0	9008	0	0	0	0	4	0	0	0	0
6515L900157	11.50	0	31	U	0.013	40	40	0	9	2	0	0	9007	0	0	1	0	0	1	0	0	0

Random Sample 15 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR
6515L900518	147.60	0	31		0.387	26	20	0	279	0	6	0	9007	0	18	20	16	0	4	0	0	0
6515L900642	13.68	0	31	U	0.044	0	0	0	32	0	0	0	9009	0	0	2	2	0	0	0	0	0
6515LN00059XX	16.24	1	4		0.038	5	5	0	27	0	0	0	8508	0	0	0	0	0	3	0	0	0
6530011642926	45.90	0	71		0.036	6	5	0	26	0	0	0	6906	2	1	1	1	0	1	0	0	1
6530012725119	17.21	0	31		0.115	15	3	0	83	0	9	0	7503	2	3	1	3	1	6	2	4	5
6532000797902	0.28	0	25		7.671	967	210	0	5523	0	650	0	7401	300	200	200	200	200	200	200	300	200
6550001049319	9.25	2	22		0.186	23	17	0	134	0	0	0	6906	7	1	8	0	6	3	4	5	13
6640011253927	3.47	0	31		0.022	5	5	0	16	3	0	0	8912	8	0	0	0	0	0	0	0	0
6640L400063	139.00	0	31		0.025	2	0	0	18	0	6	4	8411	2	2	1	2	0	0	1	0	0
6750L900023	10.80	0	31	U	0.040	3	3	0	29	0	0	0	9007	0	0	3	0	0	3	0	0	0
6760L900000	24.50	0	31	U	0.027	1	0	0	19	0	1	0	9007	0	1	0	0	0	3	0	0	0
6810L900002	75.00	1	31		0.237	16	4	0	171	0	0	0	9003	0	9	15	3	6	8	8	2	10
6850009857166	0.89	2	19		6.992	475	376	0	5034	0	0	0	7612	50	0	484	1166	186	50	250	50	0
7350L500001	25.20	0	48		0.030	4	4	0	22	1	0	0	8504	1	0	4	0	0	2	0	0	0
7510L900041	3.50	0	31		0.013	2	0	0	9	0	12	11	9007	0	1	0	0	0	1	0	0	0

Random Sample 15 (cont.)

STOCK NUMBER	PRICE	DTD ITM	AVG PLT	U	DDR	CNTRL LVL	SERV	EX CESS	ECON LVL	ECON RET	Due In	Due Out	Hist Beg Date	DEC	NOV	OCT	SEP	AUG	JUL	JUN	MAY	APR
7530L900014	7.00	0	31	U	0.022	5	5	0	16	3	0	0	9009	0	0	0	2	0	0	0	0	0
7930L900006	27.00	0	31	U	0.020	8	0	0	14	0	10	2	9007	0	0	2	0	0	1	0	0	0
8105001179791	37.35	0	23		0.079	7	7	0	57	18	0	0	8806	2	0	5	0	0	2	2	2	6
8410011220111	10.85	0	31	U	0.833	0	0	0	600	0	0	0	9004	0	0	0	0	0	0	0	116	84
P3610854580	316.17	0	31	U	0.011	0	0	0	8	0	0	0	9009	0	0	0	1	0	0	0	0	0

Appendix E: Expert and System Decisions

Random Sample 1 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	ok	ok
2	ok	ok	ok
3	ok	ok	ok
4	ok	ok	ok
5	ok	ok	ok
6	ok	ok	ok
7	check date	check date	check date
8	delete	delete	delete
9	check date	check date	check date
10	check date	check date	check date
11	ok	ok	ok
12	ok	ok	ok
13	ok	ok	ok
14	delete	delete	delete
15	ok	ok	ok
16	ok	ok	ok
17	ok	delete	delete
18	ok	ok	ok
19	remove U	remove U	remove U
20	ok	ok	ok
21	ok	ok	ok
22	ok	ok	ok
23	ok	ok	ok
24	ok	ok	ok
25	delete	delete	delete
26	ok	ok	ok
27	delete	delete	delete
28	ok	ok	ok
29	ok	ok	ok
30	delete	delete	delete
31	ok	ok	ok
32	ok	ok	ok
33	ok	ok	ok
34	remove U	remove U	remove U
35	ok	ok	ok
36	ok	ok	ok
37	ok	ok	ok
38	delete	delete	delete
39	ok	ok	ok
40	ok	ok	ok
41	delete	delete	delete
42	ok	ok	ok
43	ok	ok	ok

Random Sample 1 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
44	ok	ok	ok
45	ok	ok	ok
46	ok	ok	ok
47	delete	delete	delete
48	delete	delete	delete
49	delete	delete	delete
50	delete	delete	delete

Random Sample 2 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	delete	delete	delete
2	delete	delete	delete
3	check date	check date	check date
4	check date	check date	check date
5	ok	ok	ok
6	ok	ok	ok
7	check date	check date	check date
8	ok	ok	ok
9	ok	ok	ok
10	ok	ok	ok
11	ok	ok	ok
12	ok	ok	ok
13	ok	ok	ok
14	ok	ok	ok
15	delete	ok	ok
16	check date	check date	check date
17	ok	ok	ok
18	check date	check date	check date
19	ok	ok	ok
20	ok	ok	ok
21	ok	delete	delete
22	ok	ok	ok
23	ok	ok	ok
24	ok	ok	ok
25	ok	ok	ok
26	ok	ok	ok
27	ok	delete	delete
28	delete	delete	delete
29	ok	ok	ok
30	ok	ok	ok
31	remove U	remove U	ok
32	ok	ok	ok
33	ok	ok	ok
34	delete	delete	delete
35	remove U	remove U	remove U
36	remove U	remove U	remove U
37	delete	delete	delete
38	delete	ok	ok
39	ok	remove U	remove U
40	ok	ok	ok
41	ok	ok	ok
42	ok	ok	ok
43	ok	ok	ok
44	ok	ok	ok
45	delete	delete	delete
46	delete	delete	delete
47	ok	ok	ok
48	ok	ok	ok

Random Sample 2 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	p report	p report	p report
50	delete	delete	delete

Random Sample 3 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	delete	delete	delete
2	ok	ok	ok
3	ok	ok	ok
4	delete	check date	check date
5	ok	delete	delete
6	ok	check date	check date
7	ok	ok	ok
8	ok	ok	ok
9	ok	ok	ok
10	check date	check date	check date
11	ok	ok	ok
12	ok	ok	ok
13	ok	ok	ok
14	ok	ok	ok
15	ok	check date	check date
16	remove U	check date	check date
17	ok	delete	delete
18	ok	ok	ok
19	ok	ok	ok
20	ok	ok	ok
21	ok	ok	ok
22	delete	delete	ok
23	ok	ok	ok
24	delete	delete	delete
25	ok	ok	ok
26	delete	remove U	remove U
27	ok	ok	ok
28	ok	ok	ok
29	ok	ok	ok
30	check date	check date	check date
31	ok	ok	ok
32	ok	check date	check date
33	ok	ok	ok
34	ok	ok	ok
35	delete	delete	delete
36	ok	ok	ok
37	ok	ok	ok
38	ok	ok	ok
39	ok	ok	ok
40	ok	check date	check date
41	ok	ok	ok
42	ok	ok	ok
43	ok	ok	ok
44	ok	ok	ok
45	ok	ok	ok
46	delete	delete	delete
47	delete	delete	delete
48	delete	delete	delete

Random Sample 3 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	p report	p report	p report
50	delete	delete	delete

Random Sample 4 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	ok	ok
2	ok	ok	ok
3	ok	ok	ok
4	ok	ok	ok
5	ok	ok	ok
6	ok	ok	ok
7	ok	ok	ok
8	ok	ok	ok
9	check date	check date	check date
10	ok	ok	ok
11	ok	ok	ok
12	delete	delete	delete
13	check date	check date	check date
14	ok	ok	ok
15	ok	ok	ok
16	ok	ok	ok
17	ok	ok	ok
18	delete	delete	delete
19	ok	ok	ok
20	ok	ok	ok
21	delete	ok	ok
22	ok	ok	ok
23	ok	ok	ok
24	ok	ok	ok
25	delete	ok	ok
26	ok	ok	ok
27	ok	ok	ok
28	check date	check date	check date
29	ok	ok	ok
30	ok	ok	ok
31	ok	ok	ok
32	ok	ok	ok
33	delete	delete	delete
34	delete	delete	delete
35	delete	delete	delete
36	ok	ok	ok
37	ok	ok	ok
38	ok	ok	ok
39	ok	remove U	remove U
40	delete	remove U	remove U
41	ok	ok	ok
42	delete	remove U	remove U
43	delete	delete	delete
44	ok	ok	ok
45	ok	ok	ok
46	delete	delete	delete
47	delete	delete	delete
48	ok	ok	ok

Random Sample 4 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	p report	p report	p report
50	delete	delete	delete

Random Sample 5 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	ok	ok
2	check date	check date	check date
3	delete	delete	delete
4	check date	check date	check date
5	ok	ok	ok
6	ok	ok	ok
7	ok	ok	ok
8	check date	check date	check date
9	ok	ok	ok
10	check date	check date	check date
11	check date	check date	check date
12	ok	ok	ok
13	ok	ok	ok
14	check date	check date	check date
15	ok	ok	ok
16	check date	check date	check date
17	check date	check date	check date
18	check date	check date	check date
19	ok	ok	ok
20	delete	delete	delete
21	ok	ok	ok
22	ok	ok	ok
23	ok	ok	ok
24	remove U	remove U	remove U
25	remove U	remove U	ok
26	ok	ok	ok
27	check date	delete	delete
28	delete	delete	delete
29	delete	ok	ok
30	ok	ok	ok
31	delete	delete	delete
32	delete	delete	delete
33	ok	ok	ok
34	check date	check date	check date
35	ok	ok	ok
36	delete	delete	delete
37	ok	ok	ok
38	ok	ok	ok
39	check date	check date	check date
40	ok	ok	ok
41	ok	ok	ok
42	ok	ok	ok
43	ok	ok	ok
44	ok	ok	ok
45	delete	delete	ok
46	remove U	remove U	remove U
47	delete	delete	delete
48	delete	delete	delete

Random Sample 5 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	p report	p report	p report

Random Sample 6 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	ok	ok
2	ok	ok	ok
3	check date	check date	check date
4	check date	check date	check date
5	ok	ok	ok
6	ok	ok	ok
7	check date	check date	check date
8	check date	check date	check date
9	ok	ok	ok
10	check date	delete	delete
11	check date	check date	check date
12	delete	delete	remove U
13	ok	ok	ok
14	ok	ok	ok
15	ok	ok	ok
16	ok	ok	ok
17	ok	ok	ok
18	check date	excess	excess
19	ok	ok	ok
20	check date	check date	check date
21	check date	delete	delete
22	check date	delete	delete
23	ok	ok	ok
24	ok	ok	ok
25	delete	ok	ok
26	ok	ok	ok
27	ok	ok	ok
28	delete	ok	ok
29	ok	ok	ok
30	check date	check date	check date
31	ok	ok	ok
32	delete	delete	delete
33	delete	ok	ok
34	ok	ok	ok
35	delete	delete	delete
36	check date	check date	check date
37	delete	ok	ok
38	delete	remove U	remove U
39	ok	ok	ok
40	ok	ok	ok
41	ok	ok	ok
42	ok	ok	ok
43	ok	ok	ok
44	delete	delete	delete
45	delete	ok	ok
46	ok	ok	ok
47	ok	ok	ok
48	delete	delete	delete

Random Sample 6 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	delete	delete	delete

Random Sample 7 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	delete	delete	delete
2	ok	ok	ok
3	check date	check date	check date
4	ok	ok	ok
5	ok	ok	ok
6	ok	ok	ok
7	ok	ok	ok
8	check date	check date	check date
9	check date	check date	check date
10	ok	ok	ok
11	ok	check date	check date
12	ok	check date	check date
13	ok	ok	ok
14	ok	ok	ok
15	ok	ok	ok
16	ok	ok	ok
17	ok	ok	ok
18	ok	ok	ok
19	ok	ok	ok
20	ok	ok	ok
21	ok	ok	ok
22	ok	ok	ok
23	ok	ok	ok
24	delete	delete	delete
25	delete	delete	delete
26	delete	ok	ok
27	excess	excess	excess
28	ok	remove U	remove U
29	ok	ok	ok
30	ok	ok	ok
31	ok	remove U	remove U
32	ok	ok	ok
33	ok	remove U	remove U
34	ok	ok	ok
35	ok	ok	ok
36	delete	remove U	remove U
37	ok	ok	ok
38	delete	delete	delete
39	delete	delete	delete
40	delete	delete	delete
41	ok	ok	ok
42	ok	ok	ok
43	ok	ok	ok
44	delete	delete	delete
45	delete	delete	delete
46	delete	delete	delete
47	delete	delete	delete
48	delete	delete	delete

Random Sample 7 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	p report	p report	p report

Random Sample 8 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	ok	ok
2	ok	ok	ok
3	ok	ok	ok
4	check date	delete	delete
5	ok	ok	ok
6	check date	check date	check date
7	check date	check date	check date
8	check date	check date	check date
9	ok	ok	ok
10	ok	ok	ok
11	delete	delete	delete
12	delete	delete	delete
13	ok	ok	ok
14	check date	check date	check date
15	ok	ok	ok
16	ok	ok	ok
17	check date	check date	check date
18	check date	check date	check date
19	check date	check date	check date
20	check date	check date	check date
21	ok	ok	ok
22	ok	ok	ok
23	ok	ok	ok
24	ok	ok	ok
25	ok	delete	delete
26	ok	ok	ok
27	ok	ok	ok
28	ok	ok	ok
29	ok	ok	ok
30	ok	ok	ok
31	ok	delete	delete
32	ok	ok	ok
33	delete	delete	delete
34	ok	ok	ok
35	ok	ok	ok
36	delete	ok	ok
37	ok	ok	ok
38	ok	ok	ok
39	delete	delete	delete
40	ok	ok	ok
41	delete	ok	ok
42	delete	ok	ok
43	ok	ok	ok
44	ok	ok	ok
45	delete	delete	delete
46	delete	delete	delete
47	delete	delete	delete
48	delete	delete	delete

Random Sample 8 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	p report	p report	p report

Random Sample 9 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	remove U	remove U
2	ok	ok	ok
3	check date	check date	check date
4	ok	ok	ok
5	ok	ok	ok
6	ok	ok	ok
7	ok	ok	ok
8	ok	ok	ok
9	ok	ok	ok
10	check date	check date	check date
11	ok	ok	ok
12	ok	ok	ok
13	check date	remove U	remove U
14	ok	ok	ok
15	ok	ok	ok
16	ok	ok	ok
17	ok	ok	ok
18	ok	ok	ok
19	ok	ok	ok
20	ok	ok	ok
21	ok	ok	ok
22	delete	delete	ok
23	ok	ok	ok
24	check date	remove U	remove U
25	ok	delete	delete
26	ok	remove U	remove U
27	ok	ok	ok
28	ok	remove U	remove U
29	ok	ok	ok
30	ok	ok	ok
31	ok	ok	ok
32	ok	ok	ok
33	delete	delete	delete
34	ok	ok	ok
35	ok	ok	ok
36	ok	ok	ok
37	ok	ok	ok
38	ok	remove U	remove U
39	ok	ok	ok
40	ok	ok	ok
41	ok	ok	ok
42	delete	delete	delete
43	remove U	remove U	remove U
44	remove U	remove U	remove U
45	delete	delete	delete
46	delete	delete	delete
47	delete	delete	delete
48	delete	delete	delete

Random Sample 9 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	p report	p report	p report
50	delete	delete	delete

Random Sample 10 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	remove U	remove U
2	ok	ok	ok
3	check date	check date	check date
4	ok	ok	ok
5	ok	ok	ok
6	ok	delete	delete
7	ok	ok	ok
8	ok	ok	ok
9	check date	check date	check date
10	ok	ok	ok
11	ok	ok	ok
12	delete	delete	delete
13	ok	ok	ok
14	ok	ok	ok
15	ok	remove U	remove U
16	ok	ok	ok
17	ok	ok	ok
18	ok	ok	ok
19	ok	ok	ok
20	delete	delete	delete
21	ok	ok	ok
22	ok	ok	ok
23	ok	ok	ok
24	ok	ok	ok
25	ok	ok	ok
26	ok	ok	ok
27	ok	ok	ok
28	check date	check date	check date
29	ok	ok	ok
30	ok	ok	ok
31	ok	ok	ok
32	ok	ok	ok
33	ok	ok	ok
34	ok	ok	ok
35	delete	delete	delete
36	ok	ok	ok
37	ok	ok	ok
38	ok	ok	ok
39	ok	ok	ok
40	ok	ok	ok
41	ok	ok	ok
42	ok	delete	delete
43	ok	ok	ok
44	delete	delete	delete
45	ok	ok	ok
46	ok	remove U	remove U
47	ok	ok	ok
48	delete	delete	delete

Random Sample 1 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	p report	p report	p report
50	delete	delete	delete

Random Sample 11 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	delete	delete	delete
2	check date	delete	delete
3	ok	ok	ok
4	ok	ok	ok
5	ok	ok	ok
6	ok	ok	ok
7	ok	ok	ok
8	ok	ok	ok
9	check date	check date	check date
10	ok	ok	ok
11	ok	ok	ok
12	ok	delete	delete
13	check date	check date	check date
14	ok	delete	delete
15	ok	ok	ok
16	ok	ok	ok
17	ok	ok	ok
18	ok	ok	ok
19	ok	ok	ok
20	check date	check date	check date
21	delete	delete	delete
22	delete	delete	delete
23	ok	remove U	remove U
24	ok	remove U	remove U
25	ok	ok	ok
26	ok	ok	ok
27	ok	ok	ok
28	ok	delete	delete
29	delete	ok	ok
30	delete	ok	ok
31	p report	p report	p report
32	ok	ok	ok
33	ok	remove U	remove U
34	ok	ok	ok
35	delete	delete	delete
36	ok	remove U	remove U
37	delete	delete	delete
38	delete	delete	delete
39	delete	delete	delete
40	delete	delete	delete
41	delete	delete	delete
42	delete	delete	delete
43	delete	delete	delete
44	delete	delete	delete
45	delete	delete	delete
46	delete	delete	delete
47	delete	delete	delete
48	delete	delete	delete

Random Sample 11 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	delete	delete	delete

Random Sample 12 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	delete	delete	delete
2	ok	ok	ok
3	ok	ok	ok
4	ok	ok	ok
5	ok	ok	ok
6	ok	ok	ok
7	ok	ok	ok
8	delete	ok	ok
9	ok	ok	ok
10	check date	delete	delete
11	check date	delete	delete
12	check date	check date	check date
13	check date	excess	excess
14	check date	delete	delete
15	ok	ok	ok
16	delete	ok	ok
17	delete	delete	delete
18	ok	ok	ok
19	ok	ok	ok
20	delete	delete	delete
21	check date	check date	check date
22	delete	delete	delete
23	ok	ok	ok
24	ok	ok	ok
25	ok	ok	ok
26	remove U	remove U	remove U
27	delete	ok	ok
28	delete	ok	ok
29	p report	p report	p report
30	ok	ok	ok
31	ok	ok	ok
32	check date	check date	check date
33	ok	ok	ok
34	check date	check date	check date
35	delete	ok	ok
36	delete	delete	delete
37	ok	ok	ok
38	ok	ok	remove U
39	ok	ok	ok
40	p report	p report	p report
41	delete	delete	delete
42	delete	delete	delete
43	delete	delete	delete
44	delete	delete	delete
45	delete	delete	delete
46	delete	delete	delete
47	p reoport	p report	p report
48	p report	p report	p report

Random Sample 12 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	delete	delete	delete

Random Sample 13 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	ok	ok
2	ok	ok	ok
3	ok	ok	ok
4	ok	ok	ok
5	ok	ok	ok
6	ok	ok	ok
7	delete	delete	delete
8	ok	ok	ok
9	ok	ok	ok
10	ok	ok	ok
11	ok	ok	ok
12	check date	check date	check date
13	ok	ok	ok
14	ok	ok	ok
15	ok	check date	check date
16	remove U	remove U	remove U
17	ok	ok	ok
18	ok	ok	ok
19	ok	ok	ok
20	ok	ok	ok
21	ok	ok	ok
22	ok	ok	ok
23	delete	delete	delete
24	ok	ok	ok
25	ok	remove U	remove U
26	delete	delete	delete
27	ok	ok	ok
28	delete	ok	ok
29	ok	ok	ok
30	ok	ok	ok
31	ok	ok	ok
32	reomove U	remove U	remove U
33	ok	ok	ok
34	delete	delete	delete
35	ok	ok	ok
36	delete	delete	delete
37	delete	delete	delete
38	p report	p report	p report
39	delete	delete	delete
40	delete	delete	delete
41	delete	delete	delete
42	delete	delete	delete
43	delete	delete	delete
44	delete	delete	delete
45	delete	delete	delete
46	delete	delete	delete
47	delete	delete	delete
48	delete	delete	delete

Random Sample 13 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	delete	delete	delete

Random Sample 14 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	ok	ok	ok
2	ok	ok	ok
3	ok	ok	ok
4	delete	delete	delete
5	ok	ok	ok
6	ok	ok	ok
7	delete	delete	delete
8	check date	check date	check date
9	ok	ok	ok
10	ok	ok	ok
11	check date	check date	check date
12	ok	ok	ok
13	ok	ok	ok
14	ok	ok	ok
15	check date	check date	check date
16	ok	ok	ok
17	ok	ok	ok
18	ok	ok	ok
19	ok	ok	ok
20	ok	ok	ok
21	ok	ok	ok
22	ok	ok	ok
23	delete	delete	delete
24	ok	check date	check date
25	ok	ok	ok
26	ok	ok	ok
27	remove U	remove U	ok
28	delete	delete	delete
29	check date	check date	check date
30	delete	ok	ok
31	ok	ok	ok
32	ok	ok	ok
33	delete	ok	ok
34	check date	check date	check date
35	ok	ok	ok
36	ok	ok	ok
37	ok	ok	ok
38	delete	delete	delete
39	ok	ok	ok
40	ok	ok	ok
41	check date	check date	check date
42	delete	delete	delete
43	ok	ok	ok
44	ok	remove U	remove U
45	delete	delete	delete
46	ok	delete	delete
47	ok	ok	ok
48	ok	ok	ok

Random Sample 14 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	p report	p report	p report

Random Sample 15 Decisions

Item	Expert Decision	Verified Decision	System Decision
1	check date	check date	check date
2	ok	ok	ok
3	ok	ok	ok
4	ok	ok	ok
5	ok	ok	ok
6	ok	ok	ok
7	ok	ok	ok
8	check date	check date	check date
9	ok	ok	ok
10	check date	delete	delete
11	ok	remove U	remove U
12	check date	check date	check date
13	ok	ok	ok
14	check date	delete	delete
15	ok	ok	ok
16	delete	delete	delete
17	ok	remove U	remove U
18	ok	ok	ok
19	ok	ok	ok
20	ok	ok	ok
21	ok	ok	ok
22	ok	ok	ok
23	ok	ok	ok
24	delete	ok	ok
25	ok	delete	delete
26	delete	ok	ok
27	ok	ok	ok
28	check date	check date	check date
29	ok	ok	ok
30	ok	ok	ok
31	ok	ok	ok
32	ok	ok	ok
33	check date	check date	check date
34	ok	ok	ok
35	ok	ok	ok
36	ok	ok	ok
37	ok	ok	ok
38	delete	delete	delete
39	ok	ok	ok
40	ok	ok	ok
41	ok	ok	ok
42	ok	ok	ok
43	ok	ok	ok
44	ok	ok	ok
45	ok	ok	ok
46	ok	ok	ok
47	ok	ok	ok
48	ok	ok	ok

Random Sample 15 Decisions (cont.)

Item	Expert Decision	Verified Decision	System Decision
49	delete	delete	delete
50	delete	delete	delete

Appendix F: VP Expert Listing

```
ACTIONS

COLOR = 15

WOPEN 1,3,5,17,70,3
ACTIVE 1



DISPLAY "       Welcome to the Monthly Stock Status Manager Tutorial"
DISPLAY" "
DISPLAY"                    VERSION 1.0"
DISPLAY " "
DISPLAY "                   Developed for"
DISPLAY"          2950 ABW Hospital Medical Logistics Branch"
DISPLAY " "
DISPLAY " "
DISPLAY "                      by       "
DISPLAY " "
DISPLAY "                 Thomas G. Hibson"
DISPLAY " "
DISPLAY "          Air Force Institute for Technology (AFIT)"
DISPLAY " "
DISPLAY "                   23 July 1991~ "
CLS

DISPLAY "This tutorial goes along with the Monthly Stock Status Manager"
DISPLAY "program written in dBase.  This tutorial will ask you questions"
DISPLAY " about an inventory item and recommend an action based on the"
DISPLAY " information provided by you."
DISPLAY " "
DISPLAY " "
DISPLAY " "
DISPLAY " "
COLOR = 1
DISPLAY "


When you are ready to start this tutorial, press any key...~""

CLS
WCLOSE 1
COLOR = 8
```

```
ans = yes

CLS

WHILETRUE  ans = yes
THEN DISPLAY "First I need to obtain some information which I need and
do not have."
    FIND nomen
    FIND mnth
    FIND begin_dt
    FIND curr_date
    FIND econ_lvl
    FIND due_out
    FIND cntrl_lvl
    FIND past_deman
    five = 5
    eleven = 11
    FIND ddr
    CLS
    DISPLAY "The following questions will determine what action to be
taken."
    FIND action
    CLS
    DISPLAY "Management action for (nomen) is (*action).

Press any key to continue...~"
    CLS
    RESET ALL
    FIND more_data
END


display "Thank you for letting me help you.~";


RUNTIME;
EXECUTE;
BKCOLOR = 1;
ENDOFF;

RULE more_data  !converts user answer to data structure used in rules
If ans = yes
THEN more_data = true
ELSE more_data = UNKNOWN;

RULE dtd     !converts user answer to data structure used in rules
IF dtd = yes
THEN dtd_cd = 1
ELSE dtd_cd = 0;

RULE consumpt !converts user answer to data structure used in rules
```

```
IF consumpt = yes
THEN consump = high
ELSE consump = low;

RULE man_cd   !converts user answer into data structure used in rules
IF man_cd = yes
THEN u = u
ELSE u = 0;

RULE enter_date  !is item less than six months in system
IF five > = (curr_date - begin_dt)
THEN item_date = new CNF 90    !item is less than six months in system
ELSE item_date = old CNF 95  !item in system for more than six months
BECAUSE "Age of item record is important to some decisions";

RULE pipeline_time  !pipeline time for item
IF avg_plt < = 31   !31 days chosen as breakpoint for long or short
THEN pipe = short   !item has short pipeline
ELSE pipe = long    !item has long pipeline
BECAUSE "pipeline time can determine if an item will be stocked";

RULE year     !determine if item is less than one year old
IF item_date = old  !is item more than six months old
  AND eleven > (curr_date - begin_dt)  !is item less than 1 year old
THEN year = yes  !item is less than one year old
ELSE year = no;   !item is more than one year old

RULE delete  !delete items with no demands for 6 months
IF pres_deman = 0 !is item had no demands in past 6 months
  AND due_in = 0  !and there is no one who wants this item
  AND due_out = 0
  THEN action = delete CNF 95
BECAUSE "If (nomen) has not been used in past six months and there are no
due ins
or due outs, the item should be deleted.";

RULE delet_one_hit ! delete items which have one hit six months ago
IF month6 > 0
  AND month1 = 0
  AND month2 = 0
  AND month3 = 0
  AND month4 = 0
  AND month5 = 0
  AND due_in = 0
  AND due_out = 0
  AND item_date = new
THEN action = delete_one_hit CNF 92
BECAUSE "If (nomen) was used once since it was entered into the system
and
if that was six months ago, it should be deleted.";

RULE delete_low_use  !delete items with low use and short pipeline time
```

```
IF pipe = short                !is pipeline short
  AND due_out = 0
  AND due_in = 0
  AND item_date = old
  AND consump = low        !is consumption low
THEN action = delete_low_use CNF 85
BECAUSE "Management does not want to stock items which have a low
consumption,
less than .5 per month, if the item has a short pipeline time.";

RULE delete_one_time_buys
IF one_time = yes
  AND oper = 0
  AND due_in = 0
  AND due_out = 0
THEN action = delete
BECAUSE "items designated as one time buyswith nothing on hand or due in
or
due out should be deleted";

RULE p_report
IF one_time = yes
  AND due_in <> 0
  AND due_out <> 0
THEN action = p_report
BECAUSE "items designated as one time buys should be deleted.";

RULE excess
IF econ_ret > (.5 * econ_lvl)
THEN action = excess CNF 91
BECAUSE "Management has determined to exess items when economic
retention quantity
exceeds half of the economic retention level.";

RULE establish_level  !D/I exceed D/O with no level established
IF due_in > (due_out)        !do D/I exceed D/O
  AND cntrl_lvl = 0  !does item have established level
  AND contract = no  !item is not contract specific
THEN action = establish_level CNF 93
    cntrl_lvl = (ddr*60/1000+avg_plt*ddr/1000) !suggested level
BECAUSE "For some reason due in quantity exceeds due out quantity and
there
is no operating level set.  Perhaps unit pack exceeds the amount due out.";

RULE remove_u  !Three good demands, u should be removed
IF u = u                    !is item management coded
  AND item_date = new      !is item less than six months old
  AND three_dema = yes     !does item have 3 demands in last 6 months
THEN action = remove_u CNF 98
BECAUSE "Items being used consistently should be managed by the
computer.
Checking to see if the item is new, management coded, and there have been
```

```
three
demands in the last six months.";

RULE remove_u_age   !item is over 6 months old and less than 1 year
IF item_date = old  !let computer manage.   is item been in system 6 months
  AND year = yes    !item in system less than a year
  AND u = u         !item is being managed
THEN action = remove_u_age CNF 92
BECAUSE "Items that have been in the system for more than six months and
less
than a year should be managed by the computer. Checking to see if the item
is
less than a year in the system and management coded.";

RULE another_user       !someone is using item which was to be deleted
IF u = u                        !is item being managed
  AND demand = consistent         !is present demand consistent
  AND item_date = old             !does item have old history begin date
  AND pres_deman < (past_deman)   !is present demand less than past
demand
THEN action = remove_u_there_is_user CNF 80
BECAUSE "Primary user may have asked for deletion of (nomen). Checking
to see if
(nomen) is management coded, present demand is consistent, (nomen) has
been in the
system for more than six months, and the present demand is less than the
past
demand. If these conditions are met I recommend removal of the
management code.";

RULE ok !item is being used at less than requested level
IF dtd_cd <> 0     !is item date coded
  AND oper > = (cntrl_lvl) !Item is not being used as fast as thought
  AND cntrl_lvl > 0
THEN action = check_date_OK CNF 96   !ensure item won't expire on shelf
BECAUSE "(Nomen) ispossibly being used slowly and is dated. If these
conditions
are met, check the expiration date to ensure it won't expire on the shelf.";

RULE aok
IF due_in <> 0
  OR pres_deman > 0
THEN action = ok CNF 95
BECAUSE "Item is being used. Leave it in the system.";

ask infil: "What is the filename to be analyzed?
  (path:filename)  note: do not use .dbf extension";

ask ans: "Would you like to run some of your data?";
  CHOICES ans: YES, NO;

ask nomen: "What is the nomenclature of your item?";
```

```
ASK past_deman: "How many (nomen) were ordered six months to a year
ago?";
ASK pres_deman:"How many (nomen) were ordered in the past six
months?";
ASK one_time: "Does the stock number contain the any of the following
strings? LFB IF or P";
    CHOICES one_time:yes, no;
ASK contract:"Does the stock number contain the string CT?";
    CHOICES contract:yes, no;
ASK month1: "What was the demand for the month prior to as of report
month?(month 1)";
ASK month2: "What was the demand for the month prior to month 1?";
ASK month3: "What was the demand for the month prior to month 2?";
ASK month4: "What was the demand for the month prior to month 3?";
ASK month5: "What was the demand for the month prior to month 4?";
ASK month6: "What was the demand six months ago?";


ASK begin_dt: "What is the history begin date for (nomen)?";

ASK curr_date: "What is the as of date for the report?";
ASK due_out: "How many (nomen)s are due out?";
ASK due_in: "How many of (nomen)s are due in?";
ASK ddr: "What is the daily demand rate?";
ASK econ_lvl: "What is the economic retention level for (nomen)?";
ASK econ_ret: "How many are in economic retention?";
ASK man_cd: "Is (nomen) management coded?";
  Choices man_cd: yes, no;
ASK cntrl_lvl: "What is the suggested inventory level for (nomen)?";
ASK demand: "Has the demand for (nomen) been consistent the past 6
months?";
  CHOICES demand: consistent, inconsistent;
ASK three_dema: "Have there bee three demands placed on (nomen) in the
past six months?";
  CHOICES three_dema: YES, NO;
ASK consumpt: "Has the consumption of (nomen) been greater than .5 per
month?";
  Choices consumpt: yes, no;
ASK dtd: "Is (nomen) date coded?";
  CHOICES dtd: yes, no;
ASK oper: "How many items are in the operating stocks?";
ASK avg_plt: "What is the average length of the pipeline?";
```

Appendix G: dBase Listing of Expert System

Main Program Module

```
SET TALK OFF
SET ECHO OFF
* print startup screen
ins = "n"
CLEAR
@ 5,36 SAY "WELCOME"
@ 6,37 SAY "To The"
@ 8,22 SAY "MONTHLY STOCK STATUS REPORT PROGRAM"
@ 10,34 SAY "Version 1.0"
@ 12,31 SAY "Developed For The"
@ 13,19 SAY "2950 ABW Hospital Medical Logistics Branch"
@ 15,39 SAY "By"
@ 16,29 SAY "CAPT Thomas G. Hibson"
@ 17,20 SAY "Air Force Institute of Technology (AFIT)"
@ 19,34 SAY "11 June 1991"
@ 24,1 SAY "Do you wish instructions (Y/N):"
@ 24,33 GET ins
READ
* see if operator wants instructions
IF ins = "y" .OR. ins = "Y"
   CLEAR
   @ 5,15 SAY "This program determines what management actions to
initiate on"
   @ 6,15 SAY "medical inventory items. The input file should be an
unparsed"
   @ 7,15 SAY "ASCII file of the inventory leveling data. The program
creates"
   @ 8,15 SAY "an output file (dBase format) into which the input data is to
be"
   @ 9,15 SAY "parsed. The program then makes a decision on each
individual"
   @ 10,15 SAY "item and then prints action specific reports. The output
file"
   @ 11,15 SAY "contains all of the original input data, all data generated"
   @ 12,15 SAY "during the decision process, and the recommended decision.
The"
   @ 13,15 SAY "program requires free memory of approximately three (3)
times"
   @ 14,15 SAY "greater than the amount of memory used by the input file."
   @ 15,15 SAY "Just input file names when prompted and leave the printer
on"
   @ 16,15 SAY "to print the reports."
   @ 24,1 SAY "Do you wish to run the program (Y/N):"
   @ 24,39 GET ins
READ
* see if operator wishes to quit
```

```
   IF ins = "n" .OR. ins = "N"
      QUIT
   ENDIF
ENDIF
*Create new file to parse data into using pars.tmp as a template
USE PARS.TMP
COPY STRUCTURE TO PARSE.DBF
*Get input output files from user
infile="                                    "
outfile="                                   "
CLEAR
@10,10 SAY "What is the name of the input file?  (path:filename.ext)"
@11,10 GET infile
READ
DO WHILE .NOT. (FILE(TRIM(infile)) .OR. FILE(TRIM(infile)+".TXT"))
   CLEAR
   infile = "                                    "
   @10,10 SAY "File does not exist.  What is name of input file?
(path:filename:ext)"
   @11,10 GET infile
   READ
ENDDO
CLEAR
@12,10 SAY "What file should I write the results to?  (path:filename.ext)"
@13,10 GET outfile
READ
overwrite = "n"
DO WHILE (FILE(TRIM(outfile)) .OR. FILE(TRIM(outfile)+".dbf")) .AND.
(overwrite = "n" .OR. overwrite = "N")
   CLEAR
   @9,10 SAY "File already exists. Should I overwrite the file?"
   @10,10 GET overwrite
   READ
   IF overwrite = "n" .OR. overwrite = "N"
      outfile = "                                    "
      CLEAR
      @10,10 SAY "What is name of output file?  (path:filename:ext)"
      @11,10 GET outfile
      READ
   ENDIF
ENDDO
*Create new file to do decisions on using dat.tmp as a template
CLEAR
@10,10 SAY "PLEASE DO NOT DISTURB."
@11,11 SAY "I AM PARSING DATA."
SELECT B
USE DAT.TMP
COPY STRUCTURE TO &outfile
CLOSE DATABASES
SELECT A
*Parse new data from ASCII text file
USE PARSE.DBF
```

```
APPEND FROM &infile TYPE SDF
DELETE RECORD 1
PACK
*Copy parsed data to decision file
CLOSE DATABASES
USE &outfile
APPEND FROM PARSE.DBF
*delete unneeded parse file
DELETE FILE PARSE.DBF
@11,11 SAY "I AM NOW DOING DATA PREP."
*start of data manipulation
*leveling data has price times 100
REPLACE ALL price WITH price/100
*leveling data has ddr times 1000
REPLACE ALL ddr WITH ddr/1000
*create report as of date in same format as history begin date
REPLACE All curr_date WITH year_rpt*100+mnth_rpt
*correct as of report dates for turn of century
GOTO 2
IF curr_date<100
   REPLACE ALL curr_date WITH curr_date+10000
ENDIF
*AFM 167-230 defines economic retention level as 720 times ddr
REPLACE ALL econ_lvl WITH 720*ddr
*calculate economic retention quantity (operating quantity - control level)
REPLACE ALL econ_ret WITH oper-cntrl_lvl
@11,11 SAY "I AM NOW MAKING DECISIONS."
*set record pointer to zero
SET STATUS ON
i=0
GOTO TOP
*determine month of report and do the following:
*  find how many items were ordered the past six months
*  find how many items were ordered previous six months
*  Go through file incrementally to determine the following:
*     determine if consumption is low or high
*     store needed variables in memory
*     increment record pointer
*     determine management action
DO CASE
CASE mnth_rpt = 2
   REPLACE ALL pres_deman WITH aug+sep+oct+nov+dec+jan
   REPLACE ALL past_deman WITH feb+mar+apr+may+jun+jul
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
      STORE aug TO m1
      STORE sep TO m2
```

```
      STORE oct TO m3
      STORE nov TO m4
      STORE dec TO m5
      STORE jan TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
      SKIP
   ENDDO
CASE mnth_rpt = 3
   REPLACE ALL pres_deman WITH sep+oct+nov+dec+jan+feb
   REPLACE ALL past_deman WITH mar+apr+may+jun+jul+aug
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
      STORE sep TO m1
      STORE oct TO m2
      STORE nov TO m3
      STORE dec TO m4
      STORE jan TO m5
      STORE feb TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1, m2, m3, m4, m5, m6, lvl, i, outfile
      SKIP
   ENDDO
CASE mnth_rpt = 4
   REPLACE ALL pres_deman WITH oct+nov+dec+jan+feb+mar
   REPLACE ALL past_deman WITH apr+may+jun+jul+aug+sep
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
      STORE oct TO m1
      STORE nov TO m2
      STORE dec TO m3
      STORE jan TO m4
      STORE feb TO m5
      STORE mar TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1, m2, m3, m4, m5, m6, lvl, i, outfile
      SKIP
   ENDDO
CASE mnth_rpt = 5
```

```
      REPLACE ALL pres_deman WITH nov+dec+jan+feb+mar+apr
      REPLACE ALL past_deman WITH may+jun+jul+aug+sep+oct
      GOTO TOP
      DO WHILE .NOT. EOF()
         IF pres_deman/6<.3
            REPLACE consump WITH "low"
         ELSE
            REPLACE consump WITH "high"
         ENDIF
         STORE nov TO m1
         STORE dec TO m2
         STORE jan TO m3
         STORE feb TO m4
         STORE mar TO m5
         STORE apr TO m6
         STORE cntrl_lvl TO lvl
         i=i+1
         DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
         SKIP
      ENDDO
   CASE mnth_rpt = 6
      REPLACE ALL pres_deman WITH dec+jan+feb+mar+apr+may
      REPLACE ALL past_deman WITH jun+jul+aug+sep+oct+nov
      GOTO TOP
      DO WHILE .NOT. EOF()
         IF pres_deman/6<.3
            REPLACE consump WITH "low"
         ELSE
            REPLACE consump WITH "high"
         ENDIF
         STORE dec TO m1
         STORE jan TO m2
         STORE feb TO m3
         STORE mar TO m4
         STORE apr TO m5
         STORE may TO m6
         STORE cntrl_lvl TO lvl
         i=i+1
         DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
         SKIP
      ENDDO
   CASE mnth_rpt = 7
      REPLACE ALL pres_deman WITH jan+feb+mar+apr+may+jun
      REPLACE ALL past_deman WITH jul+aug+sep+oct+nov+dec
      GOTO TOP
      DO WHILE .NOT. EOF()
         IF pres_deman/6<.3
            REPLACE consump WITH "low"
         ELSE
            REPLACE consump WITH "high"
         ENDIF
         STORE jan TO m1
```

```
      STORE feb TO m2
      STORE mar TO m3
      STORE apr TO m4
      STORE may TO m5
      STORE jun TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
      SKIP
   ENDDO
CASE mnth_rpt = 8
   REPLACE ALL pres_deman WITH feb+mar+apr+may+jun+jul
   REPLACE ALL past_deman WITH aug+sep+oct+nov+dec+jan
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
      STORE feb TO m1
      STORE mar TO m2
      STORE apr TO m3
      STORE may TO m4
      STORE jun TO m5
      STORE jul TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
      SKIP
   ENDDO
CASE mnth_rpt = 9
   REPLACE ALL pres_deman WITH mar+apr+may+jun+jul+aug
   REPLACE ALL past_deman WITH sep+oct+nov+dec+jan+feb
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
      STORE mar TO m1
      STORE apr TO m2
      STORE may TO m3
      STORE jun TO m4
      STORE jul TO m5
      STORE aug TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
      SKIP
   ENDDO
```

```
CASE mnth_rpt = 10
   REPLACE ALL pres_deman WITH apr+may+jun+jul+aug+sep
   REPLACE ALL past_deman WITH oct+nov+dec+jan+feb+mar
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
      STORE apr TO m1
      STORE may TO m2
      STORE jun TO m3
      STORE jul TO m4
      STORE aug TO m5
      STORE sep TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
      SKIP
   ENDDO
CASE mnth_rpt = 11
   REPLACE ALL pres_deman WITH may+jun+jul+aug+sep+oct
   REPLACE ALL past_deman WITH nov+dec+jan+feb+mar+apr
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
      STORE may TO m1
      STORE jun TO m2
      STORE jul TO m3
      STORE aug TO m4
      STORE sep TO m5
      STORE oct TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
      SKIP
   ENDDO
CASE mnth_rpt = 12
   REPLACE ALL pres_deman WITH jun+jul+aug+sep+oct+nov
   REPLACE ALL past_deman WITH dec+jan+feb+mar+apr+may
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
```

```
      STORE jun TO m1
      STORE jul TO m2
      STORE aug TO m3
      STORE sep TO m4
      STORE oct TO m5
      STORE nov TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
      SKIP
   ENDDO
OTHERWISE
   REPLACE ALL pres_deman WITH jul+aug+sep+oct+nov+dec
   REPLACE ALL past_deman WITH jan+feb+mar+apr+may+jun
   GOTO TOP
   DO WHILE .NOT. EOF()
      IF pres_deman/6<.3
         REPLACE consump WITH "low"
      ELSE
         REPLACE consump WITH "high"
      ENDIF
      STORE jul TO m1
      STORE aug TO m2
      STORE sep TO m3
      STORE oct TO m4
      STORE nov TO m5
      STORE dec TO m6
      STORE cntrl_lvl TO lvl
      i=i+1
      DO MANACT WITH m1,m2,m3,m4,m5,m6,lvl,i,outfile
      SKIP
   ENDDO
ENDCASE
*
* adjust all econ ret less than 0 to 0
REPLACE ALL econ_ret WITH 0 FOR econ_ret<0
* adjust oper not exceed cntrl lvl
REPLACE ALL oper WITH oper - econ_ret - excess
* print reports
@11,11 SAY "I AM PRINTING REPORTS.
DO REPORTS WITH outfile
*
CLEAR
* exit program
@ 11,10 SAY "I have finnished printing the reports."
@ 12,10 SAY "Thank you for using the Monthly Stock Status Report
Program."
*
*End of Program
```

Manact Module

```
PARAMETERS m1,m2,m3,m4,m5,m6,lv1,i,outfile
USE &outfile
GOTO i
*
*determine if item is old or new
IF year_rpt*100-begin_dt>=88 .AND. year_rpt*100-begin_dt<=99
   IF mnth_rpt+12+((year_rpt-1)*100)-begin_dt<6
      item_date ="new"
   ELSE
      item_date ="old"
   ENDIF
ELSE
   IF curr_date-begin_dt < 6
      item_date = "new"
   ELSE
      item_date = "old"
   ENDIF
ENDIF
*
*determine if item has been in system for less than one year
IF curr_date-begin_dt <= 100
   year = "yes"
ELSE
   year = "no"
ENDIF
*
*start of decision process
*
*Delete all items not used in the past six months with no due ins
IF pres_deman = 0 .AND. due_in = 0 .AND. due_out = 0
   REPLACE action WITH "delete"
ELSE
*
*  Delete all items with one hit six months ago and no due ins
   IF m1 = pres_deman .AND. due_in = 0 .AND. due_out = 0 .AND.
      item_date = "new"
      REPLACE action WITH "delete"
   ELSE
*
*     Delete items with short pipelines and low consumption and in
*        system for a for minimum of six months
      IF avg_plt <= 31 .AND. consump ="low" .AND. due_in = 0 .AND.
         due_out = 0 .AND. item_date="old"
         REPLACE action WITH "delete"
      ELSE
*
*        delete items with p, lfb or if in stock number
         IF LEFT(nsn,1) = "P" .OR. AT("LFB",nsn)<>0 .OR. -
```

```
            RIGHT(RTRIM(nsn),2) = "IF"
         IF due_in = 0 .AND. due_out = 0
         REPLACE action WITH "delete"
         ELSE
            REPLACE action WITH "p report"
        ENDIF
      ELSE
*        should item be put in excess status
         IF econ_ret - due_out > .5 * econ_lvl
            REPLACE action WITH "excess"
         ELSE
*
*           Should a level be established
            IF due_in>due_out .AND. cntrl_lvl = 0 .AND.
               AT("CT",nsn) = 0
               REPLACE action WITH "establish level"
               IF ddr=0
                  REPLACE cntrl_lvl WITH due_in-due_out
               ELSE
                  REPLACE cntrl_lvl WITH ddr*60+31*ddr
               ENDIF
            ELSE
*
*              Should U code be removed for three good demands
               DO THREE WITH m1, m2, m3, m4, m5, m6, i,outfile
               IF u="U" .AND. item_date="new" .AND. three_dema="yes"
                  REPLACE action WITH "remove u"
               ELSE
*
*                 Should u be removed because item in system for
*                  longer than six months
                  IF item_date="old" .AND. year="yes" .AND. u="U"
                     REPLACE action WITH "remove u"
                  ELSE
*
*                    Should u be removed because there is another
*                         user
*                    NOTE: demand must be consistent in order to
*                       remove U
                     DO CONSIS WITH m1, m2, m3, m4, m5, m6, lvl, i,
                                    outfile
                     IF u="U" .AND. demand_con="consistent" .AND.
                           item_date="old" .AND.
                           pres_deman < .75 * past_deman
                        REPLACE action WITH "remove u"
                     ELSE
*
*                       item being used less than requested and dated
                        IF dtd_cd<>0 .AND. oper>=cntrl_lvl .AND.
                           cntrl_lvl>0
                           REPLACE action WITH "check date"
                        ELSE
```

```
*
*                                   Item  is being used

                                    IF due_in<>0 .OR. pres_deman>0 .OR.
                                       due_out <> 0
                                       REPLACE action WITH "ok"
                                    ELSE
*
*                                      action is unknown
                                       REPLACE action WITH "unknown"
                                    ENDIF
                                 ENDIF
                              ENDIF
                           ENDIF
                        ENDIF
                     ENDIF
                  ENDIF
               ENDIF
            ENDIF
         ENDIF
      ENDIF
   ENDIF
ENDIF
RETURN
```

Three Module

```
PARAMETERS m1, m2, m3, m4, m5, m6, i, outfile
USE &outfile
GOTO i
IF m1 > 0
   one=1
ELSE
   one=0
ENDIF
IF m2 > 0
   two=1
ELSE
   two=0
ENDIF
IF m3 > 0
   three=1
ELSE
   three=0
ENDIF
IF m4 0
   four=1
ELSE
   four=0
ENDIF
IF m5 0
   five=1
ELSE
   five=0
ENDIF
IF m6 0
   six=1
ELSE
   six=0
ENDIF
IF one+two+three+four+five+six >=3
   REPLACE three_dema WITH "yes"
ELSE
   REPLACE three_dema WITH "no"
ENDIF
RETURN
```

Consis Module

```
PARAMETERS m1,m2,m3,m4,m5,m6,lvl,i,outfile
USE &outfile
GOTO i
IF m1+m2=0 .OR. m2+m3=0 .OR. m3+m4=0 .OR. m4+m5=0 .OR. m5+m6=0
   REPLACE demand_con WITH "inconsistent"
ELSE
   REPLACE demand_con WITH "consistent"
ENDIF
IF m1>=lvl .OR. m2>=lvl .OR. m3>=lvl .OR. m4>=lvl .OR. m5>=lvl .OR. m6>=lvl
   REPLACE demand_con WITH "inconsistent"
ENDIF
RETURN
```

Reports Module

```
PARAMETERS outfile
USE &outfile
GOTO TOP
DO CASE
CASE mnth_rpt = 01
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM JANDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM JANPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM JANRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM JANCHKDT.FRM FOR action = "check date" TO PRINT
   REPORT FORM JANEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM JANESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM JANUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 02
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM FEBDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM FEBPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM FEBRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM FEBCHKDT.FRM FOR action = "check date" TO
PRINT
   REPORT FORM FEBEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM FEBESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM FEBUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 03
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM MARDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM MARPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM MARRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM MARCHKDT.FRM FOR action = "check date" TO
PRINT
   REPORT FORM MAREX.FRM FOR action = "excess" TO PRINT
   REPORT FORM MARESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM MARUNK.FRM FOR action = "unknown" TO PRINT
```

```
CASE mnth_rpt = 04
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM APRDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM APRPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM APRRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM APRCHKDT.FRM FOR action = "check date" TO
PRINT
   REPORT FORM APREX.FRM FOR action = "excess" TO PRINT
   REPORT FORM APRESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM APRUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 05
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM MAYDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM MAYPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM MAYRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM MAYCHKDT.FRM FOR action = "check date" TO
PRINT
   REPORT FORM MAYEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM MAYESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM MAYUNK.FRM FOR action = "unknown" TO PRINT
Case mnth_rpt = 06
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM JUNDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM JUNPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM JUNRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM JUNCHKDT.FRM FOR action = "check date" TO PRINT
   REPORT FORM JUNEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM JUNESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM JUNUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 07
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM JULDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM JULPRPT.FRM FOR action = "p report" TO PRINT
```

```
   REPORT FORM JULRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM JULCHKDT.FRM FOR action = "check date" TO PRINT
   REPORT FORM JULEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM JULESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM JULUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 08
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM AUGDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM AUGPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM AUGRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM AUGCHKDT.FRM FOR action = "check date" TO
PRINT
   REPORT FORM AUGEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM AUGESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM AUGUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 09
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM SEPDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM SEPPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM SEPRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM SEPCHKDT.FRM FOR action = "check date" TO PRINT
   REPORT FORM SEPEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM SEPESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM SEPUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 10
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM OCTDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM OCTPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM OCTRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM OCTCHKDT.FRM FOR action = "check date" TO
PRINT
   REPORT FORM OCTEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM OCTESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM OCTUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 11
   SORT ON psm.nsn FOR ACTION = "delete" TO DREPORT
```

```
   USE DREPORT
   REPORT FORM NOVDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM NOVPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM NOVRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM NOVCHKDT.FRM FOR action = "check date" TO
PRINT
   REPORT FORM NOVEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM NOVESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM NOVUNK.FRM FOR action = "unknown" TO PRINT
CASE mnth_rpt = 12
   SORT ON psm,nsn FOR ACTION = "delete" TO DREPORT
   USE DREPORT
   REPORT FORM DECDEL.FRM FOR action = "delete" TO PRINT
   CLOSE DATABASES
   DELETE FILE DREPORT.DBF
   USE &OUTFILE
   REPORT FORM DECPRPT.FRM FOR action = "p report" TO PRINT
   REPORT FORM DECRMVU.FRM FOR action = "remove u" TO PRINT
   REPORT FORM DECCHKDT.FRM FOR action = "check date" TO
PRINT
   REPORT FORM DECEX.FRM FOR action = "excess" TO PRINT
   REPORT FORM DECESTLV.FRM FOR action = "establish level" TO
PRINT
   REPORT FORM DECUNK.FRM FOR action = "unknown" TO PRINT
ENDCASE
```

Appendix H: Sample Reports

The following pages contain sample reports from the dBase III+ version of the expert system. The raw data is from verification data set number 15. If there were no decisions for a particular report, only the headings for that report were printed.

Monthly Stock Status Report

Items To Be Deleted
Based On December Leveling Data

Stock Number	Nomenclature	Price	AVG PLT	Hist Beg Date	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	NOV	OCT	SEP	AUG	JUL	JUN
**Supplier C0															
6505011245361	MAPROTILINE HCL TB50MG100	46	48	39 8202	4	0	18	4	0	0	0	0	0	0	0

Monthly Stock Status Report

Items To Be Deleted
Based On December Leveling Data

Stock Number	Nomenclature	Price	PLT	Hist Beg Date	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	NOV	OCT	SEP	AUG	JUL	JUN
**Supplier L4 6505011715237	PROGESTERONE CONTRA	534 00	31	8806	1	-3	12	4	0	0	0	0	0	0	0
6515012513525	CATH WHSTLE TIPSFR 136405	130 55	31	8912	1	1	4	0	0	0	1	0	0	0	0

Monthly Stock Status Report

Items To Be Deleted
Based On December Leveling Data

Stock Number	Nomenclature	Price	AVG PLT	Hist Beg Date	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	NOV	OCT	SEP	AUG	JUL	JUN
**Supplier LS															
6505012994202	NICARDIPINE CAPS 20MG100	15.06	31	9005	17	-18	165	35	0	0	0	0	0	0	0
6640011253927	WASH BOTTLE	3.47	31	8912	5	2	16	3	0	0	0	0	0	0	0
8410011220111	TUNIC WOMAN SZ 20R	10.85	31	9004	0	0	600	0	0	0	0	0	0	0	0

Monthly Stock Status Report

Items To Be Deleted
Based On December Leveling Data

Stock Number	Nomenclature	Price	AVG PLT	Hist Beg Date	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	NOV	OCT	SEP	AUG	JUL	JUN
**Supplier LA															
P3610854580	PCB BOARD ASSY	316 71	31	9009	0	0	8	0	0	0	0	1	0	0	0

PAGE NO 1
07/23/91

Monthly Stock Status Report

Items To Be Deleted After Other Action
Based On December Leveling Data

Stock Number	Nomenclature	AVG Price	Hist PLT	Beg Date	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	NOV	OCT	SEP	AUG	JUL	JUN

Monthly Stock Status Report

Remove U On Following Items
Based On December Leveling Data

Stock Number	Nomenclature	Hist Beg Date	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	Due In	Due Out	NOV	OCT	SEP	AUG	JUL	JUN
6505011533758	DIGOXIN TAB0 125MG 1000S	9004	2	0	36	0	0	2	0	4	3	0	0	0	3
6505L890015	SPERM WASHING MEDIUM	9005	2	0	14	0	0	3	1	0	2	0	0	0	0

Monthly Stock Status Report

Check Date On Following Items
Based On December Leveling Data

Stock Number	Nomenclature	Hist Beg Date	DTD CD	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	Due In	Due Out	NOV	OCT	SEP	AUG	JUL	JUN
6505001199321	NITROFURANTOIN CAP50MG500	7612	1	6	4	69	2	0	0	0	0	0	3	0	4	6
6505010749346	ANTIVAN TABS 1MG 25S	8608	1	7	7	30	0	0	0	0	1	3	0	4	1	1
6505011534211	WHITE PETROLATUM USP 56	8702	1	13	12	59	1	0	0	0	0	5	5	0	0	0
6515L890414	REUTER BI VALVE SPLINT	8908	1	3	3	26	0	0	0	0	4	0	0	0	0	2
6515LN00059XX	POU ACTIVE LIFE 0227-71	8508	1	5	5	27	0	0	0	0	0	0	0	0	3	0

PAGE NO 1
07/23/91

Monthly Stock Status Report

Items To Be Excessed
Based On December Leveling Data

Stock Number	Nomenclature	Price	RI	Hist Beg Date	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	NOV	OCT	SEP	AUG	JUL	JUN

PAGE NO 1
07/23/91

Monthly Stock Status Report

Establish Level On Following Items
Based On December Leveling Data

Stock Number	Nomenclature	Price	RI	AVG PLT	Hist Beg Date	SUGG CNTRL LVL	Due In	Due Out	NOV	OCT	SEP	AUG	JUL	JUN

PAGE NO 1
07/23/91

Monthly Stock Status Report

Items With Unknown Action
Based On December Leveling Data

Stock Number	Nomenclature	Price	RI	AVG PLT	Hist Beg Date	CNTRL LVL	OPER	Econ Level	Econ Ret	Excess	NOV	OCT	SEP	AUG	JUL	JUN

Bibliography

1. Barr, Avron and Edward A. Feigenbaum. *The Handbook of Artificial Intelligence*. Stanford CA: Heuristic Press, 1981.

2. Demers, W. A. "Too Many Spares." *Military Forum*, 5:60-64 (March 1989).

3. -----. "Warehouses: Room for Improvement," *Military Forum*, 6:16-17 (October 1989).

4. Department of the Air Force. *Standard Base Supply System*. AFM 67-1, Vol V, Government Printing Office, Washington DC: 1988.

5. Descartes, Rene. *Rules For the Direction of Mind*. Chicago: Encyclopedia Britannica, edited by T. L. Heath, 1952.

6. Emory, William C. *Business Research Methods*. Homewood IL: Irwin, 1985.

7. Freiling, Mike, and others. "Starting a Knowledge Engineering Project: A Step-by-Step Approach." *AI Magazine*, 6:150-164 (Fall 1985).

8. Gatton T. *Quality Assurance/Quality Control in Construction: Expert Systems Development for Multilevel Experienced Users*. Champaign IL: U.S. Army Construction Engineering Research Laboratory, Jan 1989 (AD-A204520/1).

9. Gevarter, William B. *Intelligent Machines: An Introductory Perspective of Artificial Intelligence and Robotics*. Englewood Cliffs NJ: Prentice-Hall, Inc., 1985.

10. Harris, Larry R. "Integration With Existing Systems Is Key." *Datamation*, 36:40-44 (March 1990).

11. Hicks, Richard and Ronald Lee. *VP-Expert for Business Applications*. Oakland CA: Holden-Day, Inc., 1988.

12. Holt, James R. Class lecture in EENG 593, Systems and Software Analysis. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, Aug 1990.

13. O'Keefe, Robert M. et al., "Validating Expert System Performance." *IEEE Expert*, 81-90 (Winter 1987).

14. Pearl, Judea. *Heuristics Intelligent Search Strategies for Computer Problem Solving*. Reading MA: Addison-Wesley Publishing Co., 1984.

15. Pederson, Ken. *Expert Systems Programming: Practical Techniques for Rule-Based Systems*. New York: John Wiley & Sons, Inc., 1989.

16. Pereira, F. *Candide: An Interactive System for the Acquisition of Domain Specific Knowledge.* 7 September 1984-31 January 1988. Contract No: 39-84-C-0109. Menlo Park CA: SRI International, May 1988 (AD-A196646/6).

17. Polya, G. *How to Solve It - A New Aspect of Mathematical Method.* Princeton NJ: Princeton University Press, 1985.

18. Reitman, Walter R. *Cognition and Thought An Information-Processing Approach.* New York: John Wiley & Sons, Inc., 1965.

19. Rescher, Nicholas. *The Logic of Decision and Action.* Pittsburgh: University of Pittsburgh Press, 1966.

20. Schoen, Seymour and William G. Sykes. *Putting Artificial Intelligence to Work: Evaluating and Implementing Business Applications.* New York: John Wiley & Sons, Inc., 1987.

21. Shaw, M.J. "Applying Inductive Learning to Enhance Knowledge-Based Expert Systems," *Decision Support Systems, 3*:319-332 (December 1987).

22. Siegel, Harry M. "From the Chair," *The Inference Engine, 2*:1 .(Dec 1990).

23. Simon, Herbert A. *The Sciences of the Artificial.* Cambridge MA: The MIT Press, 1981.

24. Survey Research Center Institute for Social Research. *Interviewer's Manual.* Ann Arbor: The University of Michigan, 1976.

Vita

Captain Thomas G. Hibson was born on 20 May 1959 in Warwick, Rhode Island. He graduated from Shrewsbury High School in Shrewsbury, Massachusetts in 1977 and attended St. Lawrence University graduating with a Bachelor of Science degree in chemistry in 1981. After graduation he worked as an inorganic chemist for GCA Corporation in Bedford, Massachusetts where he performed numerous chemical analyses to determine hazardous concentrations of heavy metals in environmental samples. He left GCA Corp. in the spring of 1983 to pursue a Master of Science Degree in computer science from Worcester Polytechnic Institute in Worcester Massachusetts. In March 1985, he received his commission in the USAF as a graduate of OTS. His first assignment was as a Munitions Accountable Supply Officer (MASO) with the 3098th Aviation Depot Squadron at Kirtland AFB, New Mexico. He was reassigned as the Dedicated Aircraft Supply Support (DASS) Officer at Bitburg AB, Germany in April 1987. While in this position, he completed a Master of Science Degree in Management with Troy State University European Program in October 1988. In October 1988 he was assigned as the Base Fuels Management Officer until entering the School of Systems and Logistics, Air Force Institute of Technology, in May 1990.

Permanent Address: 109 Prospect Street
Shrewsbury, MA 01545

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September 1991	Master's Thesis

4. TITLE AND SUBTITLE
HEURISTICS FOR HOSPITAL INVENTORY MANAGEMENT

5. FUNDING NUMBERS

6. AUTHOR(S)
Thomas G. Hibson, Capt, USAF

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Institute of Technology, WPAFB OH 45433-6583

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GLM/LSM/91S-29

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Wright-Patterson Medical Center/SGLS
Wright-Patterson AFB OH 45433

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This study investigated the reasoning strategies used by hospital logistics management experts and was conducted at the Wright-Patterson AFB (WPAFB) Medical Center. An expert system was developed to verify the captured strategies. The particular area of interest of this study was the reasoning strategies involved in the reconciliation of the Monthly Stock Status Report within the Medical Logistics Branch. A literature review revealed there were few guidelines as to when and what action to pursue when reconciling the Monthly Stock Status Report. Though there were no references in the literature on expert systems that dealt with this particular report, there were many references to the development of such an expert system. The research was done in three phases. The first phase was knowledge acquisition which is when the researcher interviewed the expert and did the initial formulation of the reasoning strategy. During the second phase, the researcher developed an expert system which was then validated in the third phase. The validation revealed the expert system made the same decision as the human expert over 95% of the time in the validation data sets. It was therefore concluded the reasoning strategies were captured.

14. SUBJECT TERMS
Medical Computer Applications
Artificial Intelligence
Logistics Management

15. NUMBER OF PAGES
198

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

AFIT Control Number AFIT/GLM/LSM/91S-29

AFIT RESEARCH ASSESSMENT

The purpose of this questionnaire is to determine the potential for current and future applications of AFIT thesis research. Please return completed questionnaires to: AFIT/LSC, Wright-Patterson AFB OH 45433-6583.

1. Did this research contribute to a current research project?

   a. Yes b. No

2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?

   a. Yes b. No

3. The benefits of AFIT research can often be expressed by the equivalent value that your agency received by virtue of AFIT performing the research. Please estimate what this research would have cost in terms of manpower and/or dollars if it had been accomplished under contract or if it had been done in-house.

   Man Years _____ $_____

4. Often it is not possible to attach equivalent dollar values to research, although the results of the research may, in fact, be important. Whether or not you were able to establish an equivalent value for this research (3 above), what is your estimate of its significance?

   a. Highly Significant b. Significant c. Slightly Significant d. Of No Significance

5. Comments

_____ _____

Name and Grade Organization

_____ _____

Position or Title Address