Inventory Management & Control System

P-295

PROJECT REPORT

Dissertation Submitted in partial fulfilment of the requirements for the Degree of

MASTER OF COMPUTER APPLICATIONS

of the Bharathiar University

By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Kumaraguru College of Technology

COIMBATORE - 641 006.

Certificate

This is to certify that this project work entitled

"Inventory Management and Control System"

Submitted to

KUMARAGURU COLLEGE OF TECHNOLOGY
(Affiliated to Bharathiar University)

in partial fulfilment of the requirements for the award of Degree of
MASTER OF COMPUTER APPLICATIONS
is record of original work done by

Mr. M.A.PRASAD,
(Reg.No. 9438MO201)

during his period of study in the Department of Computer Science and Engineering, Kumaraguru College of Technology, Coimbatore-641006, under my supervision and guidance and this project work has not formed the basis for the award of any Degree/Diploma/Associateship/Fellowship or similar title to any candidate of any university.

Professor and Head

Staff-in-Charge

Submitted for university Examination held on 3/6/1997

3/6/97
Internal Examiner

3/6/97
External Examiner

Declaration

I hereby declare that the project work entitled

INVENTORY MANAGEMENT AND CONTROL SYSTEM

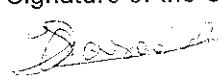
at

RAVICHANDRA SYSTEMS AND COMPUTER SERVICES LIMITED, COIMBATORE

Submitted in Partial fulfilment of the requirements for the award of the Degree of **MASTER OF COMPUTER APPLICATIONS** is a report of original work done by me during my period of study in

KUMARAGURU COLLEGE OF TECHNOLOGY
(Affiliated to Bharathiar University)
Coimbatore-641 006.

Under the Supervision of
Mr. D.RAMESH, M.E., M.I.S.T.E.,

Name of the Candidate	Register Number	Signature of the Candidate
M.A. PRASAD	***9438MO201***	

Date :
Place : Coimbatore

RAVICHANDRA

Systems and Computer Services Ltd

(A Joint Venture company of M/s. ELCOT - A Government of Tamilnadu undertaking)

Professor and Head,
Department of Computer Science & Engineering,
Kumaraguru College of Technology,
Chinnavedampatti Coimbatore 6.

03.05.1997.

Dear Sir,

This is to certify that Mr. M.A.Prasad, Final MCA student of your college has done a project work titled **"Inventory Management & Control System"** in RPG/400 under AS/400 environment during January '96 to April 1996 in our Company for his fulfillment of MCA degree . During the course of the project work his attendance rating was 80% and his conduct was good. We wish him well in life.

Thanking You,

Sincerely Yours,
for M/S.RAVICHANDRA
SYSTEMS & COMPUTER SERVICES LTD

DIRECTOR - TECHNICAL.

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SYNOPSIS

The inventory management and control system is the main part of any organization. It maintains stocks in the organization. This will give clear picture about stocks during the transaction.

In any inventory management system, the following transactions are present - Purchase and issue. There is a critical level which will be keeping as a maximum level of an inventory. Similarly there should be a re-order level.

Different type of reports are generated by system. Each report will give a clear and in - depth view of transaction. The stock validation will be done either in FIFO or in weighted average.

Inventory management and control system has been developed on the IBM AS/400 platform using the RPG/400 and CL/400 programming languages.

The system is menu driven and is very user friendly. The system has been tested with varied set of input data and has been found to work properly.

CONTENTS

1.0 INTRODUCTION

1.1 ORGANIZATION PROFILE

Ravichandra systems & Computer Services Ltd., is a rapidly developing popular software consultancy cum data processing house in South India. The origin of the same, a joint venture company with Electronics Corporation of Tamilnadu Ltd (ELCOT) is currently engaged in software development, hi-tech training and data processing. It can be traced to a medium sized multi disciplined company started in the year 1982 at the industrial city of Coimbatore.

RCS is a joint venture company with ELCOT, the agency of Government of Tamilnadu created with the objective of promoting electronic industries in the state. Realising the strength of Tamilnadu state, special priority for establishment of software projects was pursued.

Conscious of the pressing need of the hour, RCS, committed to computer and software needs constantly endeaour to see how all of them can evolve better. Therefore they continuously research and employ better methodology and tools. They strongly believe that there is always way of doing anything.

RCS has its marketing divisions in Madras, Bangalore, Calcutta, and Mumbai and they have been accomplishing their operations successfully.

Also RCS has tuned its sister concerns in Mauritius and South Africa for Software Development on IBM AS/400.

RCS comprises of a group of professionals with varied experience in the fields of information Technology, Education, Engineering, Finance Management, and System Management with an average post educational work experience of 15000 man hours.

The company has hardware and software facilities of IBM AS/400 with OS/400, COBOL/400, RPG/400, Application Development Tools, SQL/400, CICS, ILEC/400, PC SUPPORT /400, PS/2 with OS/2 & AIX and 80x86 systems with terminals under UNIX & LAN Environment and with RDBMS, WINDOWS and OOPS experience supported by a host of off-line and on-line data entry machines.

The company will further forge ahead with ISO 9001 certification by 1997-'98.

1.2 INVENTORY MANAGEMENT AND CONTROL SYSTEMS

Inventory is the physical stock of items held in any business for the purpose of future production or sales. In a production shop the inventory may be in the form of raw materials. When the items are in production process, we have the inventory as in - process inventory and at the end of production cycle inventory is in the form of finished goods.

Inventory planning is the determination of the type and quantity of inventory items that would be required at future points for maintaining production schedules. Inventory planning is generally based on information from the past and also on factors that would arise in future.

In inventory control, we are primarily concerned with the inventory cost control. The aim is to bring down the total inventory cost per annum as much as possible.

1.3 NEED FOR COMPUTERISATION

The benefits of computerization over the manual system is manyfold. The benefits can be stated as below:

SPEED - Computers enable us to do arithmetical calculations with fantastic speed and ease. It is possible to do things which so far no one could think of attempting in a manual system. Tasks involving large voluminous data processing are thus done with much accuracy and speed by the computers than by manual system.

ACCURACY - One of the greatest benefits which computers can give us is that of accuracy. Practical experience has already shown that these machines are capable

of achieving the degree of accuracy which hitherto has been unattainable in certain accounting processes into which the human brain enters at so many stages of the complete cycle of operations.

FLEXIBILITY - Flexibility in use is another important advantage of computers. Output can be obtained almost in whatever form it is most suitable.

MISCELLANEOUS - These include economies resulting from better managerial control, saving in labour because it is fully automatic.

1.4 HARDWARE ENVIRONMENT

MAINFRAMES, MIDRANGES & DESKTOPS

Mainframe systems are large, multi-user systems that historically have required a controlled environment. Environment factors included are conditioning special power hookups, under floor cabling etc. Mainframe systems require dedicated operations and systems support staff and often involve duplicated hardware. Mainframe systems have a high overhead costs. Software is of comparable complexity regardless of execution platform.

Midrange systems are multi-user systems. They also have capacity comparable to mainframe systems. The principle factors separating modern midrange systems from mainframe systems are the environmental and staff requirements. Also, where mainframes usually service the entire company, midrange systems are frequently dedicated to a single division or department. Midrange systems usually involve a much smaller support staff than mainframe systems. This is a result of more modern and simpler operating systems software. The operating systems of midrange computers are designed to run less work at the

same time than mainframe operating systems. which are simpler to install plus configure, and are also easier to operate.

Desktop systems are usually single-user systems. No special environment is required and these systems are found throughout modern orgnanisations. Desktop systems are also interconnected to share application code. This may be done because of the resource requirements of an application,or because of the applications' data access/update requirements. When data is shared between systems, it is often easier/cheaper to run related applications on the server that manages the shared data rather than on each individual desktop system.

INTRODUCTION TO AS/400

Application System/400(AS/400) is a facility of IBM midrange computers based on a single software architecture. It was launched on June 31, 1988 and is one of the world's most popular multi-user business computing system. A follow up to the highly successful system/3x lines, it is based on new applications and advanced technology. It provides mid-range users with a growth platform that features integrated database, advanced architecture and a wide range of Connectivity options.

The AS/400 is an entirely new design concept for computer systems. It provides a much higher level of function and much easier access for the user than any other prior system. In 1990 the IBM laboratory in Rochester, Minnesota, that designed and built the AS/400 systems was awarded the U.S Government's prestigious Malcolm Baldridge quality award for designing of this computer system.

AS/400 SYSTEM CONCEPTS

Layered Machine Architecture

The AS/400 systems insulates users from hardware characteristics through the Layered Machine Architecture. The layered architecture raises the level of machine interface creating high level machine instruction set that is independent of the underlying implementation. AS/400 is unusual in that the machine is defined by software, not be hardware. The instructions presented to the machine interface undergo a further process of translation before they are "understood" by the hardware. The user, however, still "sees" the same machine interface. The licensed internal code preserves this interface. Layered machine architecture means that as new hardware and software technologies emerge, they can be employed without affecting applications. The high-level machine provides the user with the ability to address 284 trillion bytes of storage.

Objects

What is an Object on AS/400? All things; programs, Control blocks, data format descriptions, system control block descriptions, space objects to house all of theses objects, attribute tables, data system commands (each one is an object), system grouping mechanisms(Queues, chains of pointers, ... etc) to name a few.

For Eg:

Libraries are objects that are collections of objects.

Every object must contain an object description information.

Object Orientation

The system's addressing structure and operations are oriented more towards the objects than towards the byte strings. All data structure in the instruction

interface are called objects. There are many types of objects, but they all have the same basic characteristics. The internal details of an object can't be seen by the user.

Specific functionally oriented machine instructions operate on objects. Once data space object has been created, the user can request that records be inserted into it. Machine resource usage is not in the programmer's domain.

Some objects are QBATCH, QINTER, PROGRAM, LIBRARY, SOURCE PHYSICAL FILE and USER PROFILE.

Objects can be of any size. There can be 16 million space segments of 16 MB each at any one time. Virtual addressing translation (VAT) is now actively supported by use of 48 bits of hardware's 64-bit capability. The main memory is like cache. The disk acts like main memory.

Space Management

The addressing capability of the AS/400 machine is 64 bits. That means 8 billion bytes worth programming capability is possible.

Each user of the system is allocated a personal, protected 16 MB virtual address space, unreachable by other users.

I/O Independence

The intricacies of the devices, control units, channels, and networks are handled by the AS/400 machine. The device dependent attributes will be

described once for all users, in separate objects called Device-Files, stored and managed at run time. All the AS/400 systems have this very highly architecture user/system interface.

Single-Level Storage

All system storage(whether main storage or disk storage) is addressed in the same way. This single, device-independent addressing mechanism means that to run program, a user calls its name. All objects are treated as if they reside in a 2^{64} bits address space.

The AS/400 system's virtual addressing is independent of an object physical location, and the type, capacity and number of disk units on the system i.e., the application programs do not require modification in order to take advantage of storage technologies. Users can leave all storage management entirely to the machine.

Hierarchy Of Microprocessors

There is a range of processors each dedicated to a particular I/O device type. What this means is that when the main system processor encounters a request for data to be written to or read from any I/O device, that request is delegated to the particular microprocessor dedicated to that I/O device. Meanwhile the system processor continuous with another application program. This design provides AS/400 with its outstanding performance in the commercial, transaction based environment. It also means that the latest microprocessor technology can be easily utilised at any time without disrupting the rest of the system.

Storage Pools

A pool is a division of main or auxiliary storage. On the AS/400 system, all main storage can be divided into logical allocations called storage pools. There are two types of pools in the AS/400 system.

* Shared Pools
* Private Pools

Benefits

You can control how much work can be done in a subsystem by controlling it, and the size of the pools. The greater the size of the pools in a subsystem, the more work can be done in the subsystem.

Using shared storage pools allows the system to distribute the storage requirements of interactive users across multiple subsystems, still allowing their job to run the same storage pool.

AS/400 MACHINE DATA LIMITS

Bytes in a record	32,766
Fields per record	8,000 fields
Key-Fields in a record	120 fields
Key-Size in bytes	256 bytes
Records in a file	16,777,215 records
Bytes in a file	2,147,483,648 bytes
Data base	size of disk storage
Logical files from one physical file	3,686 files
Physical files used in a logical file	32 files
Maximum files in a Join logical file	32 files
Maximum size of field in bytes	32,766 bytes
Maximum size of a decimal number	31 digits

OPERATING SYSTEM OS/400

OS/400 is a single integrated operating system. With the basic operating system further software components needed for providing facilities such as relational database management system, support for various communication environments, support for an interactive environment, software to implement security are also included. OS/400 is designed to support interactive use in multiple national languages for world-wide application. Textual data is stored separately from operational program code, permitting a system to operate concurrently in many languages.

Connectivity

With continuous technology updates, the gap between different platforms are being narrowed down. Standardisation of software makes it more portable.

Recent developments in communication protocols make access to different system almost transparent to the user as to which system he/she is using or accessing. There are many ways to connect workstations to the AS/400 system to a system/36, a system/370 or a system/390 or another AS/400 system through System Network Architecture (SNA) LU 6.2 protocol. The connections can be made through a local adapter (twinaxial or asynchronous) using the Token-ring Network, an Ethernet Network, or a communication line.

Distributed Processing

The individual strengths and weaknesses of the different platforms are being recognised to strengthen and co-ordinate use of multiple systems in a network. The user friendliness of the lower end computer provides excellent user interface while the larger machines takes care of all high volume transaction processing.

System Application Architecture

SAA is a collection of selected software interfaces, conventions and protocols. It provides a consistent frame work across the system/370, AS/400 and PS/2. The interfaces, conventions and protocols are designed to provide an enhanced level of consistency to the user access, programming interfaces, common support and applications.

Work Management In As/400

A unit of any work on AS/400 can be termed as a job.

Every job uses it's description (an object of type *JOBD). A job description defines JOBQ, QUTQ and it's library. There are many types of jobs; Interactive job, Batch job, spool job, Autostart job; communication job etc.

The flow of work parcels on the AS/400 is prescribed by

JOB-STEP, ROUTINE-STEP, JOB, and program object definitions with in the subsystems. The system comes with two running subsystems: one for interactive jobs and one for batch jobs.

Subsystems

A Subsystem is a single, predefined operating environment through which the system co-ordinates work flow and resource use.

The run-time characteristics of a subsystem are defined in an object called a subsystem description.

Each subsystem can run unique operations. For instance, you can set up one subsystem to handle only interactive jobs, while another subsystem handles only batch jobs. Subsystems can also be designed to handle many types of work. The system allows you to decide the number of subsystems and what types of work each subsystem will handle.

The system relies on subsystem descriptions when starting subsystems. Therefore, if you want to change the amount of work(no of jobs) coming from a job queue, for example you need only to change the job queue entry in the subsystem description.

A subsystem description consists of three parts:

- Subsystem attributes (Overall subsystem characteristics).
- Work entries (Sources of work), and
- Routing Entries.

Common User Access(Cua)

Provides transparent access to any system user in a SAA enterprise.

Graphical User Interface(Gui)

All user interface is governed by graphic display in total conformance with the latest in windows and point-and-click user interaction.

Expert System Capability

Geared towards creation and management of database model that allow expert handling of information using artificial intelligence.

MACHINE CONFIGURATION

IBM AS/400 Advanced Series Consists of:

- AS/400 Advanced System
- AS/400 Advanced Server
- AS/400 Advanced Portable

The entire AS/400 family is managed by the same operating system, thus allowing application programs to be moved, without any changes, from model to model.

AS/400 combines the benefits of both IBM standards and of openness based on industry standards, while still maintaining the highest level of system integrity and data security. Porting of UNIX and POSIX complaint applications is greatly simplified through the enhanced ILE/C (Integrated Language Environment/C language).

AS/400 family comprises of seven models. The smallest processor is the 9401 system unit. The next is the 9402 processor. There are two models of 9402. One model is designed for traditional interactive data processing. The other model is turned to provide excellent performance in client/server computing. The largest processors are the 9406 models. The 9406 models can be easily upgraded and at the top end provide substantial processing power, memory and disk storage.

CONFIGURATION OF THE MACHINE USED IN THE PROJECT

Model	9402-200
Processor	#2030
Main storage	24 MB
Disk Storage	2 GB
Maximum no of work stations	64
Communication Lines	20
LAN Adapters	2

1.5 SOFTWARE ENVIRONMENT

OPERATING SYSTEM/400

The AS/400 operating system OS/400 is conceived as a single integrated operating system. Facilities such as relational database, communications and networking facilities, on-line education are more integrated into the operating system.

OS/400 contains more and better hardware failure survivability features than operating system used in mainframe systems. OS/400 uses a single-level memory model. This means that the operating system is responsible for tracking whether data is in memory or in disk. The user simply thinks of all data as

residing in a very large virtual storage address space. Actually, the user does not even have to think of addresses, only the name and desired use of a data item is necessary. All storage allocation is done automatically by the OS/400 operating system and all data is immediately available upon request. The OS/400 is more flexible than conventional mainframe operating systems. For example, new communication hardware may be attached without regenerating the system, or even telling the system that the hardware was attached. OS/400 automatically determines many characteristics of its hardware environment.

Productivity Allocation Development Environment

AS/400 has many functions such as interactive debug, command prompting and cross reference capability to assist in programming the machine. A programmer menu, a data dictionary and the application development tools are integrated with the operating system to form an application development environment. This environment permits the rapid development of new applications and the easy maintenance of existing programs.

DB2/400 Support

The OS/400 database management system known as DB2/400 is integrated into both the licensed internal code and the operating system.

Electronic Customer Support

Provides an integrated set of service and support functions to assist user self sufficiency. This is a set of applications that interfaces with standard communication facilities for access to remote support systems.

***Support For* PCs**

The client Access/400 family is replacing the PC support/400 product. OS/400 provides the platform for the distributed client serving environment.

OS/400 *Graphical Operations*

Graphical Operations introduces a graphical user interface for selected functions of OS/400. It presents an iconic interface using PC's attached to AS/400.

Security

Comprehensive security to all system resources is provided. AS/400 has most efficient and unbreakable security system.

System Delivered Education

On-line education is available with AS/400 using either a host dependent terminal or a programmable workstation.

System Availability

Various recovery functions are supported to assist a user in the case of failure.

Multiple Operating Environments

In addition to the execution of the native AS/400 application OS/400 allows execution of applications migrated from System/36 or System/38.

Application Programming Interfaces

These are programs or commands supplied by OS/400 that provide access to specific routines.

Expert Cache

A disk cache tuner option is provided which allows AS/400 to take additional advantage of available main storage capacity.

Ease Of Installation And Use

The system supplied menus are provided so that the system can be set-up by someone not familiar with the control language.

Integrated Operating System

The relational database support is integrated into both the machine and the operating system and provides functions that allow for a high degree of both data integrity and programmer productivity. Both physical and logical files are supported and data are stored in physical files or tables, which are similar to traditional files. Access paths are maintained when there is a change in the data. This allows multiple users to be aware of changes in the database and to access the current information in the required sequence. Description of files can be entered by Data Description specification(DDS), Interactive Data Description utility (IDDU) or by IBM structured Query language/400. DDS supports the capability to define a Field Reference file (a form of data dictionary) which can be used to describe in one place the attributes of all data fields for use by multiple applications.

RPG/400

IBM introduced the Report Program Generator(RPG) programming language in the early 1960's. RPG fitted a niche for providing a quick solution to common business task generating reports needed within the business. Unlike other procedural languages RPG does not require the programmer to detail each

processing step required. The language has got a fixed logic cycle that automatically executes the normal cycle of read, calculate and write.

Another unique characteristic of RPG was its use of a special class of built in variables called Indicators. These indicators could be set on or off in one part of the program to determine what was to occur. It is easier for programmers to develop interactive applications. Structured design is supported. Capability to call other programs is also there. RPG programs consist of different types of lines called specifications. The different specifications is RPG are as follows:

File Specification

'F' in position 6 has to be entered for File specification entries. These entries describe the files being used in a program and defines how the files will be used within a program.

Extension Specifications

Identified by 'E' in position 6. Extension specifications when used must follow the File specifications. Required entries on Extension specification vary depending upon the complexity and layout of data the user is storing in table format and where the table data values are coming from.

Input Specification

Identified by 'I'in position 6. Input specifications come after the File specifications(and after Extension specifications when used). They describe the records with program described input files and defines the fields within the records. Every program described input files defined on the file specification must be represented by a set of input specification lines.

Calculation specification

These specifications are identified by 'C' in position 6. They center on operation or processing steps to be accomplished by the computer. Each Calculation specification must include a RPG operation and may include additional entries depending on the specific operation, unless the computer encounter an operation that specifically alters this flow of control.

Output Specification

'O' should be entered in position 6 for Output entries. These entries contain details about output of a file or files used in a program. When output is a report, one must use a record identification line and corresponding filed identification entries for each kind of line to appear on the record.

Structured Programming Techniques in RPG/400 makes the programs easy to change and debug. The sequential flow of control is inherent in RPG like any other programming language. In addition to this, RPG includes a variety of operations to allow the programmer to express both decision and iteration logic. For these operations it has 6 two letter codes for the relational comparisons involved. All the command selection or decision operations are also supported in RPG/400. This language uses the programmer's tools available on the AS/400 to maintain and debug programs.

External file description is another advantage of RPG. Externally defined files can reduce duplication of data across files. As all programs, using a given file see the same field definitions and names, externally defined files impose a standardization among programmer's efficiency as programmers need not duplicate the file definitions and names and save the effort each time needed to refer a file

within a program. And, finally if it is necessary to make changes, it needs to be made only at one place.

In Interactive applications, the dialogues between the user and the computer can be mediated through the use of display files on AS/400. These files can be defined in RPG programs and can be used for user input and output. But in the interactive programs, some kind of applications require the use of list panels, in which data from many records need to be displayed on screen for review, selection or update. RPG has a special concept called subfiles to handle these kind of program requirements.

RPG also allows us to define table data structures or arrays so that programs can extract data in a way analogous to how tables are being used. Two types of tables are there. Compile time tables in which data is hard-coded within the program or Re-run time table in which the computer can be instructed to obtain the data from a separate disk file each time a program runs. An array is also a data structure similar to table.

Apart from this, RPG allows the user to break up an application system into small self contained modules of code by including the CALL operation and in this way it supports the concept of modular programming. The CALL operation would be of limited value if it did not permit the call and calling program to share data. RPG uses PARM operation to indicate which field values are to be shared between programs.

So in all, RPG/400 contains the features and facilities of good programming language.

OPERATING SYSTEM AND PROGRAMMING LANGUAGE USED IN THE PROJECT

Operating system	OS/400 Version 3.0 Release 1.0
Programming Languages	RPG/400, CL/400

2.0 SYSTEM ANALYSIS

Inventory management and control system deals with stock of items which contain different type of transaction like purchase and issue. Both transactions involve interaction between the organization and its customers or suppliers. The chief purpose of the system is to execute purchase orders, maintain the stock and issue or sale of products.

Manual description of this system is given below.

2.1 DESCRIPTION OF PRESENT MANUAL SYSTEM.

The books maintained in inventory management and control system is given below:

ITEM DETAIL BOOK

This book contains all the products in the inventory. Each product is arranged in a perfect manner, i.e each product has its own subgroup and maingroup. This will be helpful to find out a product from the book.

But in computerized system all these things can be done in seconds. One file is needed to keep all these details so that appropriate product can be selected by browsing the product list.

PURCHASE DETAILS BOOK

This is a very big book which contains detail about products which are purchased. Both purchase details and item details book are interrelated so that

before product is going to be purchased it can be checked whether the product is present in item detail book. It contains detail about product such as product name, date, item cost, quantity and ordering cost etc.

STOCK MAINTENANCE BOOK

This book plays vital role in the manual inventory management and control system. Every change in the purchase book and issue or sales book will be reflected in this book. In manual inventory management and control system these three books are closely related. With the help of stock maintenance book, we can read out or create report about opening stock, stock in process and closing stock manually.

All these things are very long processes in manual system. In computerized system all these will be done in few seconds.

SALES OR ISSUE BOOK

This book contains all the detail about products which are issued. It contains all details such as quantity, rate and value etc.

PURCHASE RETURNS BOOK

Some product after purchase are returned back to supplier due to problems or defects in them. This book is used to record these types of details.

SALES OR ISSUE RETURNS BOOK

Product after issue returns back due to fault in the product. This book is used to record these type details.

2.2 FEASIBILITY STUDY

During the feasibility study it was found that in the manual system the following problems existed.

1. Since transaction entries are recorded on respective book of account, it will take long time to finish this process. i.e wastage of time.

2. In the case of accuracy, manual system is not perfect.

3. It will take atleast one or two days to prepare reports. This will aaffect the quick decision making of management. Sometimes, this led to loss of good profitable opportunities. The effort and time spent in developing a new system is less when compared to the operation of the present manual system.

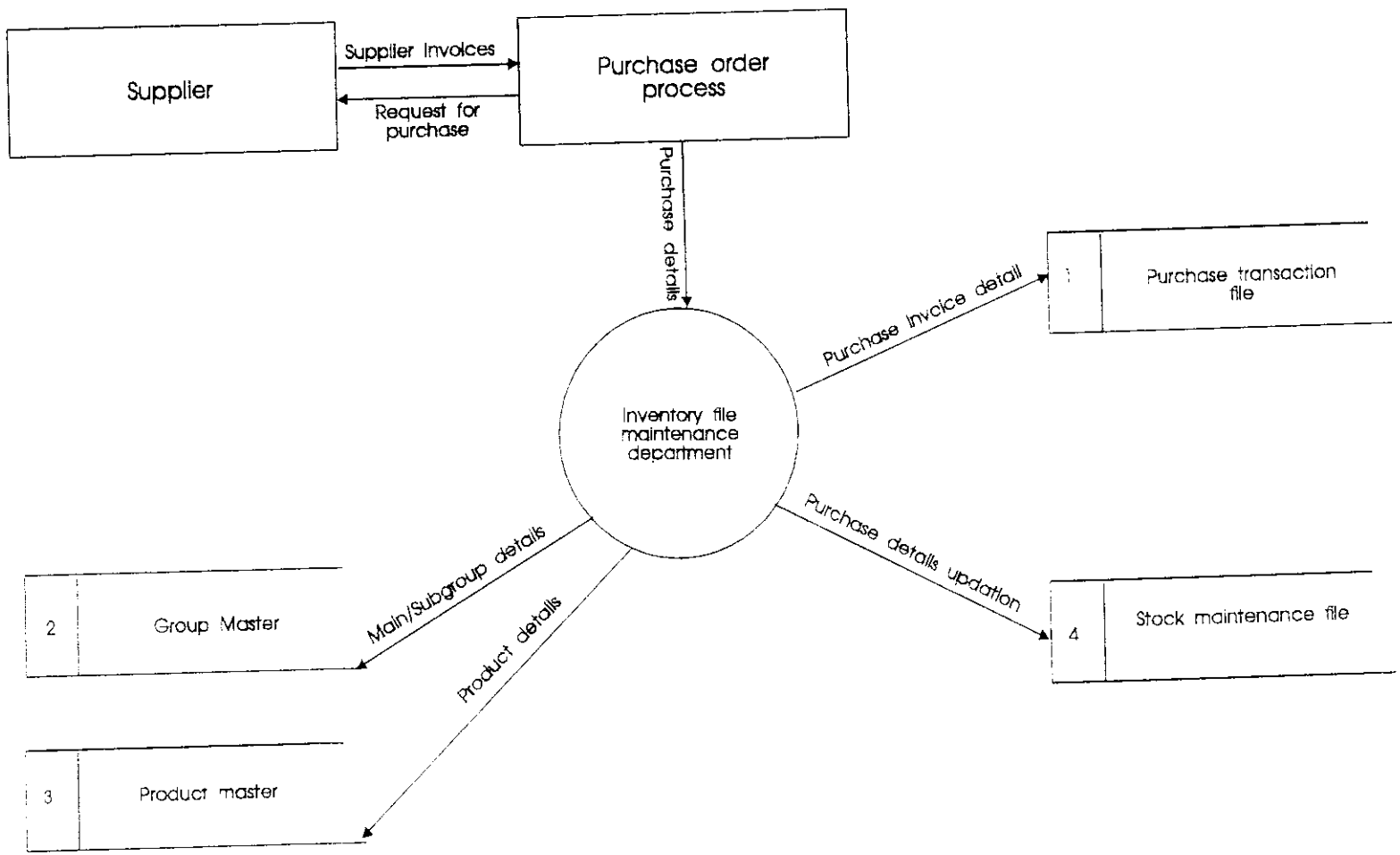
2.3 PROPOSED SYSTEM

Present manual system has many problems. Proposed system eliminates all these problems. It is developed in AS/400 environment, the powerful midrange computer, because this is the most popular business application oriented multi-user system. The programming language chosen is RPG/400, for its flexibility and versatility.

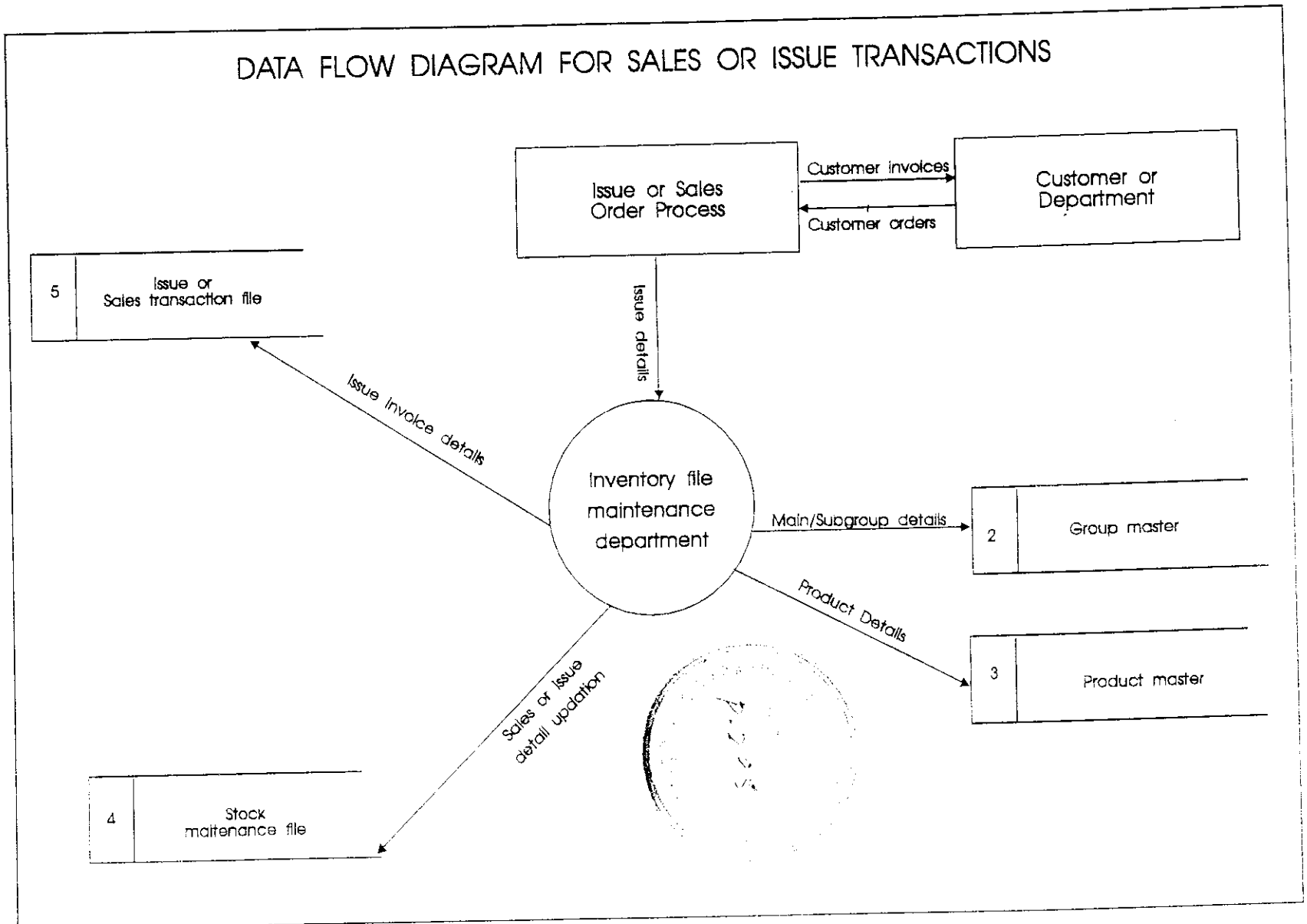
The proposed system uses powerful relational database techniques offered by AS/400. The system is very user friendly and is menu driven. Enough security is offered for the database so that only authorized persons can use the system.

The system concentrates a lot on the report generation part. The reports layout have been so designed such that the important matters can be assimilate quickly.

2.4 DATA FLOW DIAGRAM FOR PURCHASE TRANSACTION



DATA FLOW DIAGRAM FOR SALES OR ISSUE TRANSACTIONS



DATA FLOW DIAGRAM DESCRIPTION

Data Flow Diagram

Although system flow charts have been and still are widely used in computerized management information systems, they are not the ideal design tool for structured system analysis and design. The flow of the system may not be obvious to the receiver. Most systems analysts do not label the lines that connect the block of the diagram. The receiver has to guess the actions of the transform (ie., the changing of data) and guess what data are moving from block to block. In addition, system flowcharts do not show clearly the separation of various subsystems. To overcome limitations of system flowcharts , several design techniques for representing systems have come into use. One is the data flow diagram(DFD), which comes closest to the system flowchart.

Data flow diagram description for the inventory management and control system.

In this system major data flow that occur are as follows:

- The flow of information from the purchase order processing system to inventory file maintenance department.

- The flow of information from the sales order processing system to the inventory file maintenance department.

- Maintenance of transaction files and stock maintenance file.

3.0 SYSTEM DESIGN

System Analysis and design, comprises of the input design, file design and output design phases. All these phases are related to one another in some manner. So they will not be designed in separate ways. Hence this will be done only in anintegrated way.

Another thing is requirement of user. Each user has different type of requirements. Hence design of system completely depends on the requirements of user. This is a menu oriented software which helps the user to select appropriate processes they want.

3.1 INPUT DESIGN

The input to the inventory management system contains master details and transaction entries. So input screens have been designed according to these details. Each one has separate input screens.

IBM's CUA (Common User Access) is essential to designing entry screens. IBM's CUA suggests that for each and every screen designed, the function key definitions should be the same. This helps in ease of use. The screens are well laid with out any cramping of input fields. Prompts are available wherever possible, so that the user can select input values from these prompts. Thus, the screens are designed to be very user-friendly.

Validation at the screen design level helps in solving a lot of difficult problems in the later stage of programming. Keeping this fact in mind the screns

have been designed to avoid any erroneous data and any fraud from entering into the system. screens wherever needed, are designed to handle multiple record manipulation such as addition, deletion etc. This is done with the help of the subfile concept of AS/400.

3.1.1. MASTER ENTRY DESIGN

Screen To Work With Group Master

This is multiple record format screen designed by using subfile concept. It contains options such as Add, Delete, View and edit the main group and Sub group. Group master details include important input such as group code, main group name and subgroup name, etc.. A sample work with group master is given in Appendix A.

Screen To Work With Stock Master Details

This master contains input such as product name, date, quantity, rate and value, etc. This master undergoes for change as purchase or issue transaction takes place.

Screen To Work With Product Master Details

This is a multiple record format screen which contains option such as to add, delete, view and edit product details. It includes following input such as product code, product name, etc Economic order quantity and re-order level etc. A sample work screen is given in Appendix A.

3.1.2. TRANSACTIONS ENTRY DESIGN

Screen For Purchase Transaction Entry.

This screen contains all the detail about purchase transaction. Option are present to add, delete, view and edit details. It contains input such as document number, batch number, product name, quantity, rate, value, data, etc. A sample work with supplier master screen is given in Appendix A.

Screen For Issue Transaction Entry

This is a multiple record format screen which is used for issuing a product from inventory. It contains following input such as issue number, product name, date, quantity, rate, cost, holding cost, issue order. A sample issue transaction screen is given in Appendix A.

Screen For Purhcase Return Transaction Entry

This is a multiple record format screen which is used for products after purchase are returned back to supplier. It contains following input such as purchase return code, product name, quantity, rate, etc..

Screen For Sale Or Issue Return Transaction Entry

This is a multiple record format screen which is used for products after issue are returned back to inventory. This contains following input such as issue return code, product name, quantity, rate etc..

3.2 FILE DESIGN

Files are designed to store all necessary information. Different types of information are stored in the files. Different information contain same fields. This

will lead to redundancy. Hence to avoid redundancy repetition should be minimum. This will enable database to become consistent.

Following files are used to store all necessary information in inventory management system.

DATA DICTIONARY

MREF - It is the data dictionary and contains all the fields and their definitions, which are used by the system.

MASTER FILES

GRPMSTP - Contains all the information about main group and subgroup.

PRDMSTP - Contains all the information about product

STKMSTP - Gives current status of inventory.

TRANSACTION FILES

PURTRNP - Contains all the details about purchase transaction.

ISSTRNP - Contains all the detail about issue transaction.

PRRTTRNP - Contains all the details about purchase returns.

ISRTTRNP - Contains all the detail about issue returns.

3.3 OUTPUT DESIGN

Output design is a very important phase in the designing of a system. The important objective of any system is in its capability of producing high quality outputs or reports.

The following outputs or reports are produced by the system.

SALES REPORT

This report gives detail about product which are issued. There are two types of sales report- datewise report and product wise report. It displays quantity, rate, value, order, date,etc,. A sample sales report is given in appendix C.

PURCHASE REPORT

This report gives details about product which are purchased. There are two types of purchase report-datewise report and Product wise report. It displays quantity, rate, value, date, etc., at which products are purchased. A sample purchase report is given in Appendix C.

OPENING STOCK REPORT

This gives stock details at the beginning of the year. It displays product name, quantity, rate value,date, etc,. A sample report is given in Appendix C.

CURRENT STOCK

This report gives current stock details of inventory. It displays product name, quantity, rate, data and value at which product is purchased. A sample is given in appendix C.

CLOSING STOCK

This report gives stock details at end the of year. It displays product name, quantity, rate, value, date, etc,. A sample is given in Appendix C.

4.0 SYSTEM IMPLEMENTATION

The system implementation process consists of the system coding, system testing and system conversion activities.

4.1 CODING

4.1.1 UTILITIES USED

The Inventory Management and control system is developed in the RPG/400 programming language. Utilities used in this system are

- Program Development Manager (PDM)
- Source Entry Utility (SEU)
- Screen Design Aid(SDA)
- Report Layout Utility (RLU)
- Data File utility (DFU)

All the above utilities are integrated into a single tool called as the Application Development Tool(ADT).

A small description of all the unitilies is given below:

PDM

Program Development Manager is a comprehensive development tool which allows the programmer to perform all programming related activities under one single menu driven, easy-to-use and comprehensive environment.

The PDM provides a focal point within the integrated Application Development Environment for using the development tools. PDM works with lists of items to be developed and maintained. There are three main functional areas of PDM. These allow the user to :

Work with Libraries on the system,

Work with objects in a library, and

Work with members in a physical file.

SEU

SEU is a full screen editor that provides syntax checking of source statements and a member list facility for selecting members to work with. SEU can be interactively accessed via PDM lists. Highlights of SEU include:

Online syntax checking is provided thereby eliminating most errors before compilation.

A rich set of line commands is provided, for example, copy, delete, move and insert.

Editor profiles are created for each user for storing parameter values.

A split screen capability allows the user to browse/scan/copy:

Other source members

Spooled Compile listings

SDA

Using SDA, a programmer or analyst can interactively design and maintain screens and menus. Changes to the attributes, colors, and fields can be made and

immediately displayed via the testing facility of SDA. This can also prove useful when prototyping an application to allow users of the application to participate in the design phase. SDA is interactively accessible from PDM lists. SDA allows the programmer or analyst to;

- Define fields and constants for the screen format.
- Select a database file and fields from that file
- Change attributes and colors for fields and constants.
- Move, Copy and remove a ruler.
- Define cursor-sensitive help areas for a screen.

RLU

The Report Layout utility, a part of the Application Development Tools Package, allows one to create and edit source members on the AS/400 system. RLU source members in source physical files contain the printer file Data Description Specifications (DDS) for a report design that one can "Layout' using RLU. The report design looks like an actual listing one generates with a high level language (HLL) program. Using RLU, one can specify the information required for DDS and create or change the source member. One can also print the report design or compile the source members to create a printer file. Then printer file can then be used to print the report in the format designed.

DFU

DFU is used to manipulate data in a database file, such as insertion, deletion and updation.

4.1.2 DESCRIPTION OF CODING

The inventory management system has been coded or developed by using RPG/400 language, which is the most powerful languages in AS/400. The system utilize almost all the important facilities and flexible features offered by RPG/400.

This system follows a well structured form and codes are optimized as much as possible. Lots of subroutines are used in the system so that entire programs are divided into different modules. Because of this modular form repetition of codes can be avoided in the system. Also all the codes are well documented, so that it is understandable to others. This will be helpful for easy modification.

Lot of error messages are displayed in screen when system fails due to invalid operation or erroneous data. Using the journalling concept, the data entered upto the failing state can be rolled back and then committed at a later stage.

4.2 TESTING

System testing in the style of implementation, which is aimed at ensuring that the system work at all levels and is effective before live operation starts. The system test in implementation should be a definite confirmation that all are correct and an opportunity to show the users that the system works.

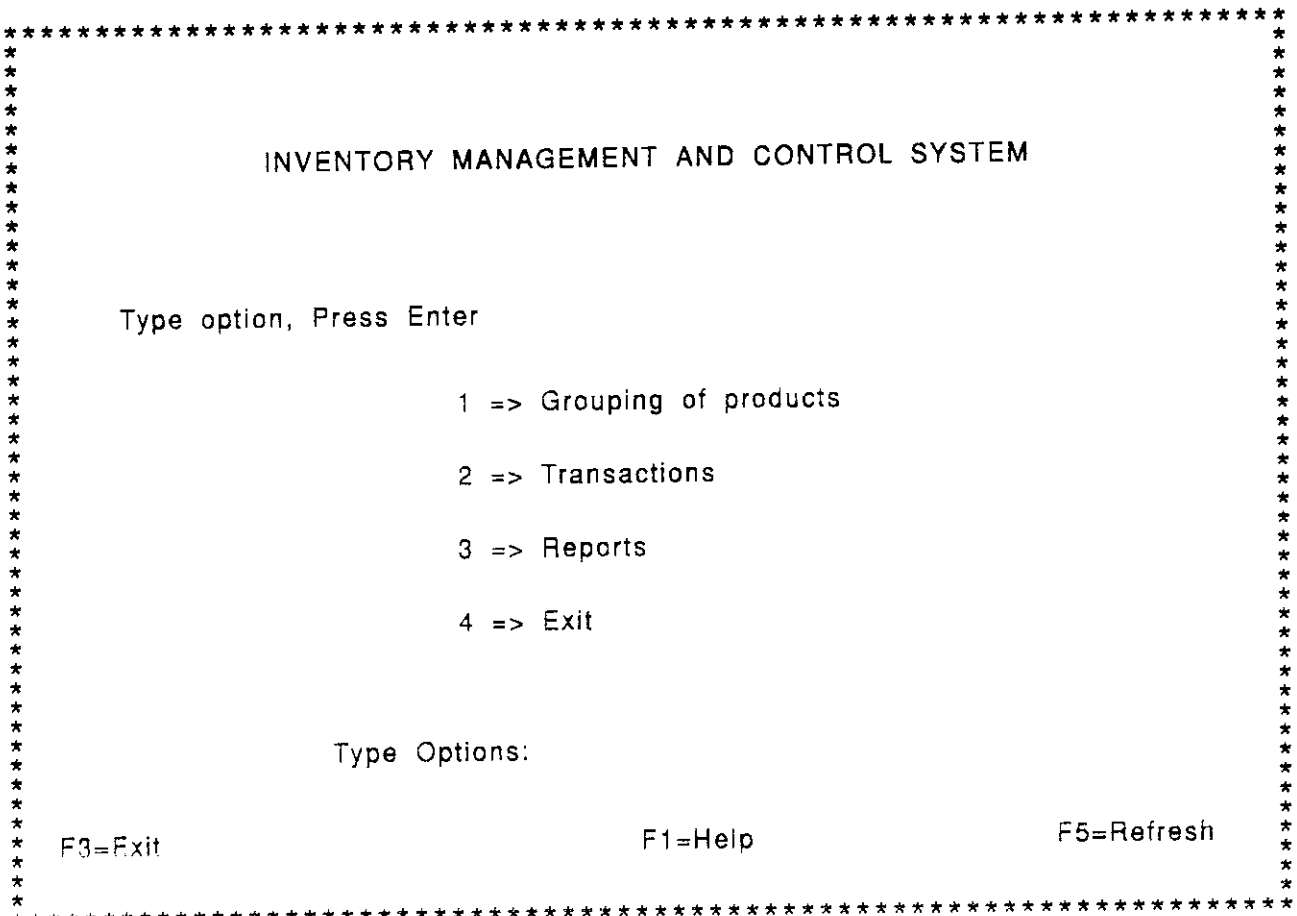
This inventory management and control system has been tested under various circumstance with different kinds of data. In all cases this was very successful. Different type validation and integrity check was performed on the system. Also it has shown very high reliability and security facilities.

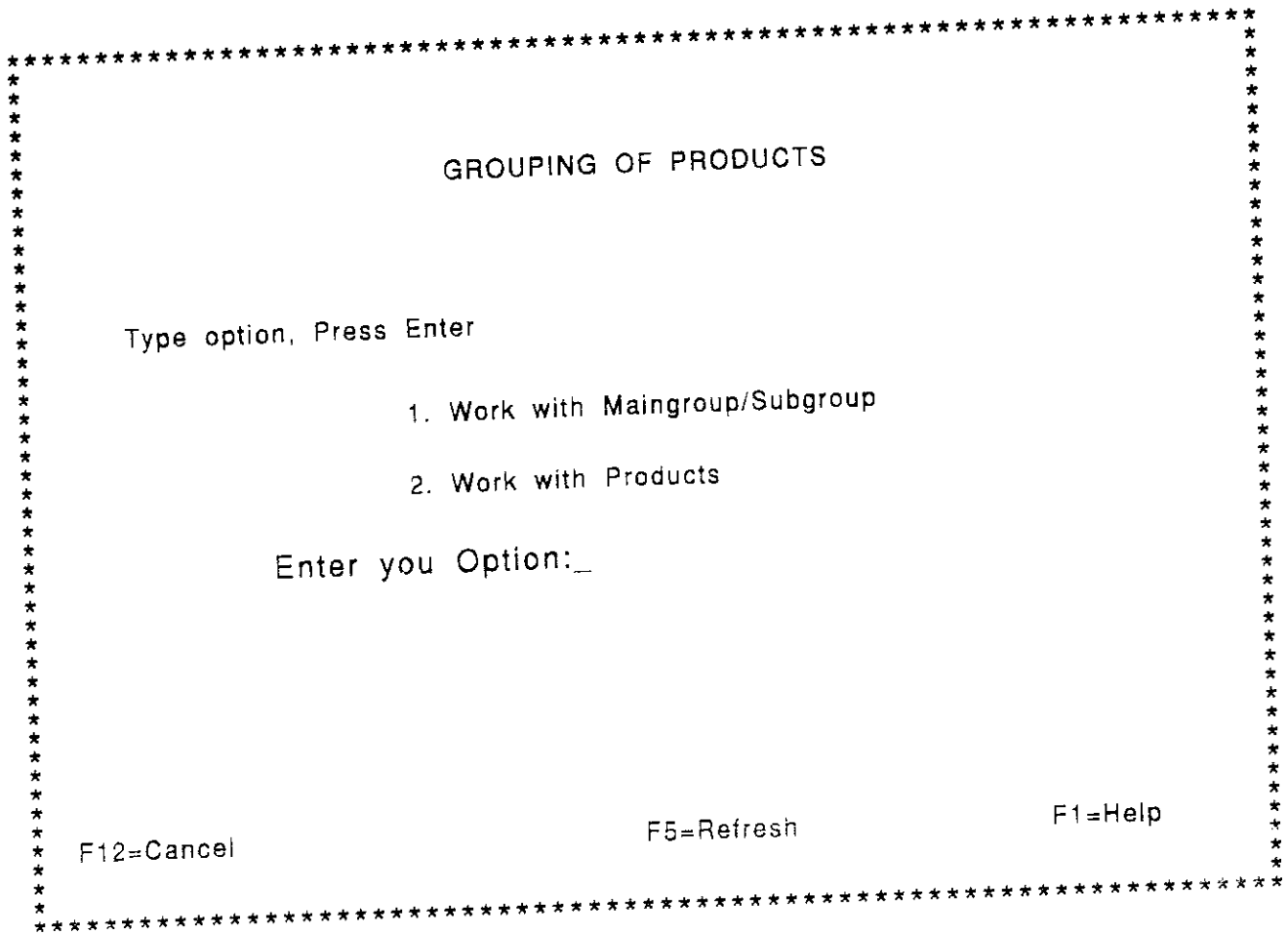
CONCLUSION AND SCOPE FOR FUTURE EXPANSION

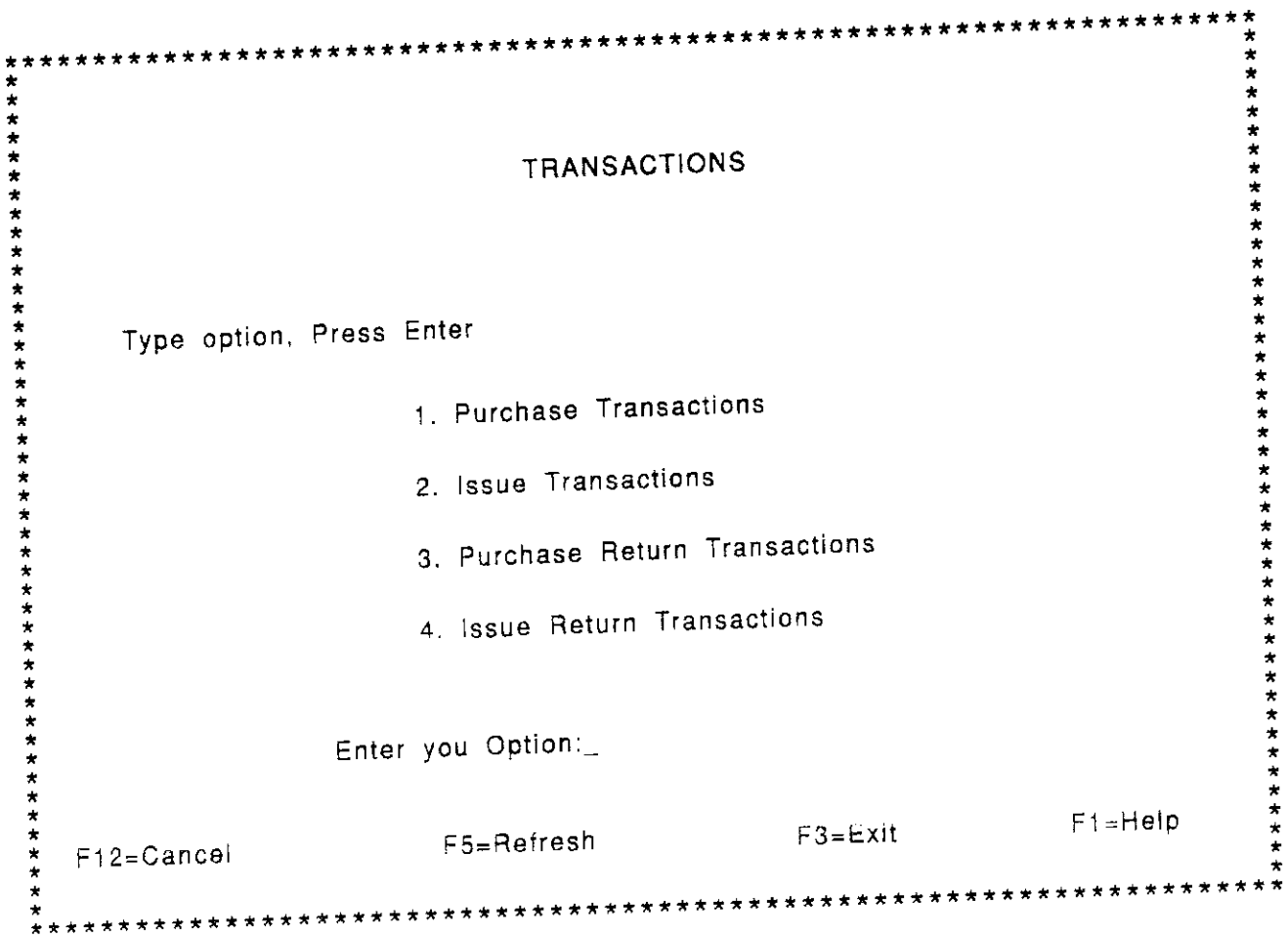
Inventory management and control system is an integral part of a business concern. It eliminates all the problems present in the manual system.

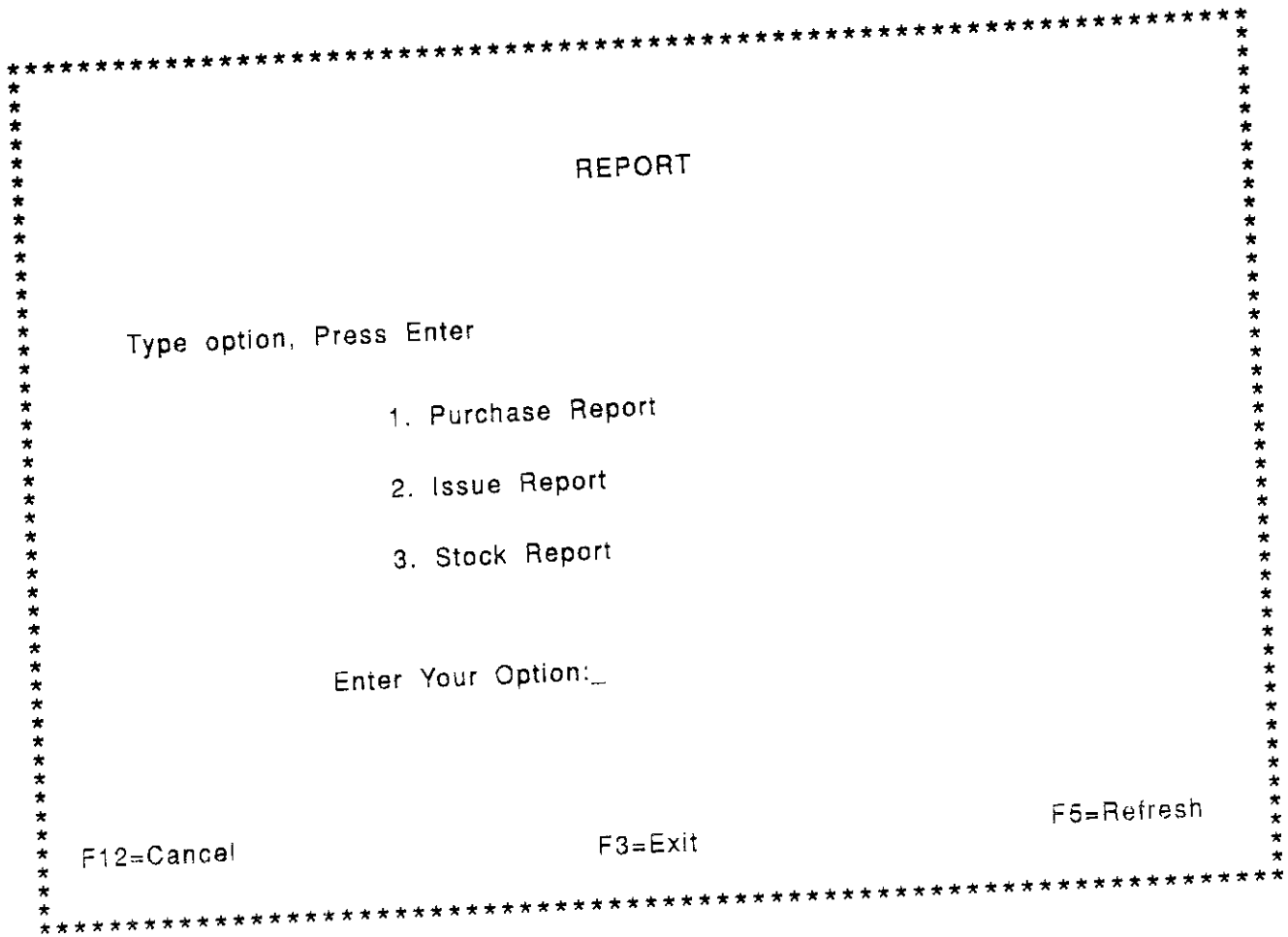
The system endeavours throughout this software to provide the user with a competent, easy to used and sophisticated package for the sound functioning of the organisation.

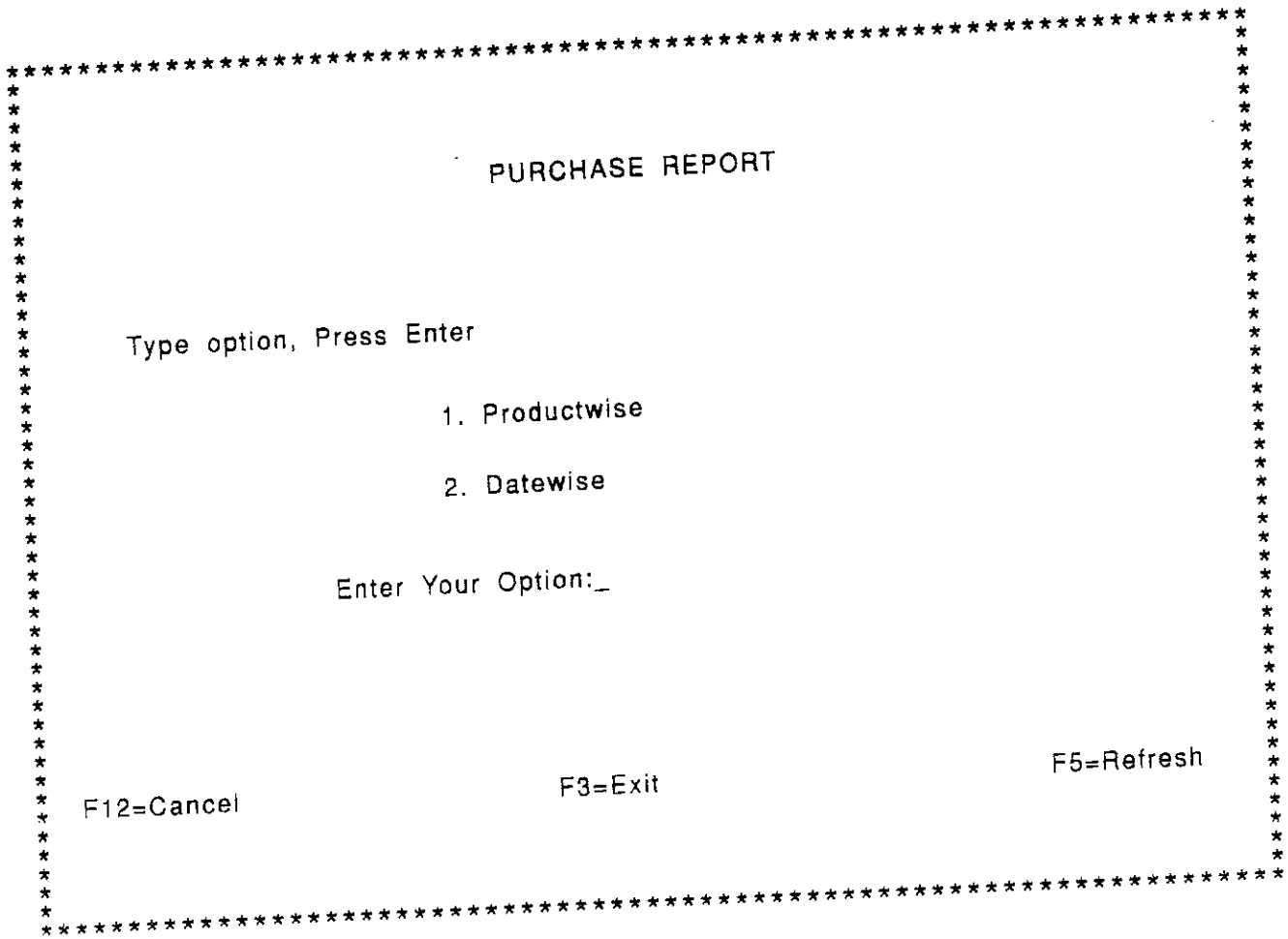
This system does not follow the mathematical models. The models of operation research can be considered for future expansion.


INVENTORY MANAGEMENT AND CONTROL SYSTEM
Type option, Press Enter
1 => Grouping of products
2 => Transactions
3 => Reports
4 => Exit
Type Options:
F3=Exit
F1=Help
F5=Refresh


GROUPING OF PRODUCTS
Type option, Press Enter
1. Work with Maingroup/Subgroup
2. Work with Products
Enter you Option:_
F12=Cancel
F5=Refresh
F1=Help


TRANSACTIONS
Type option, Press Enter
1. Purchase Transactions
2. Issue Transactions
3. Purchase Return Transactions
4. Issue Return Transactions
Enter you Option:_
F12=Cancel
F5=Refresh
F3=Exit
F1=Help


REPORT
Type option, Press Enter
1. Purchase Report
2. Issue Report
3. Stock Report
Enter Your Option:_
F5=Refresh
F12=Cancel
F3=Exit


PURCHASE REPORT
Type option, Press Enter
1. Productwise
2. Datewise
Enter Your Option:_
F12=Cancel
F3=Exit
F5=Refresh

ISSUE REPORT

Type Options, Press Enter

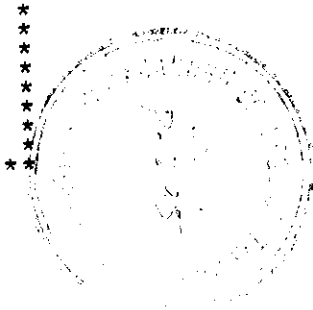
1. Productwise

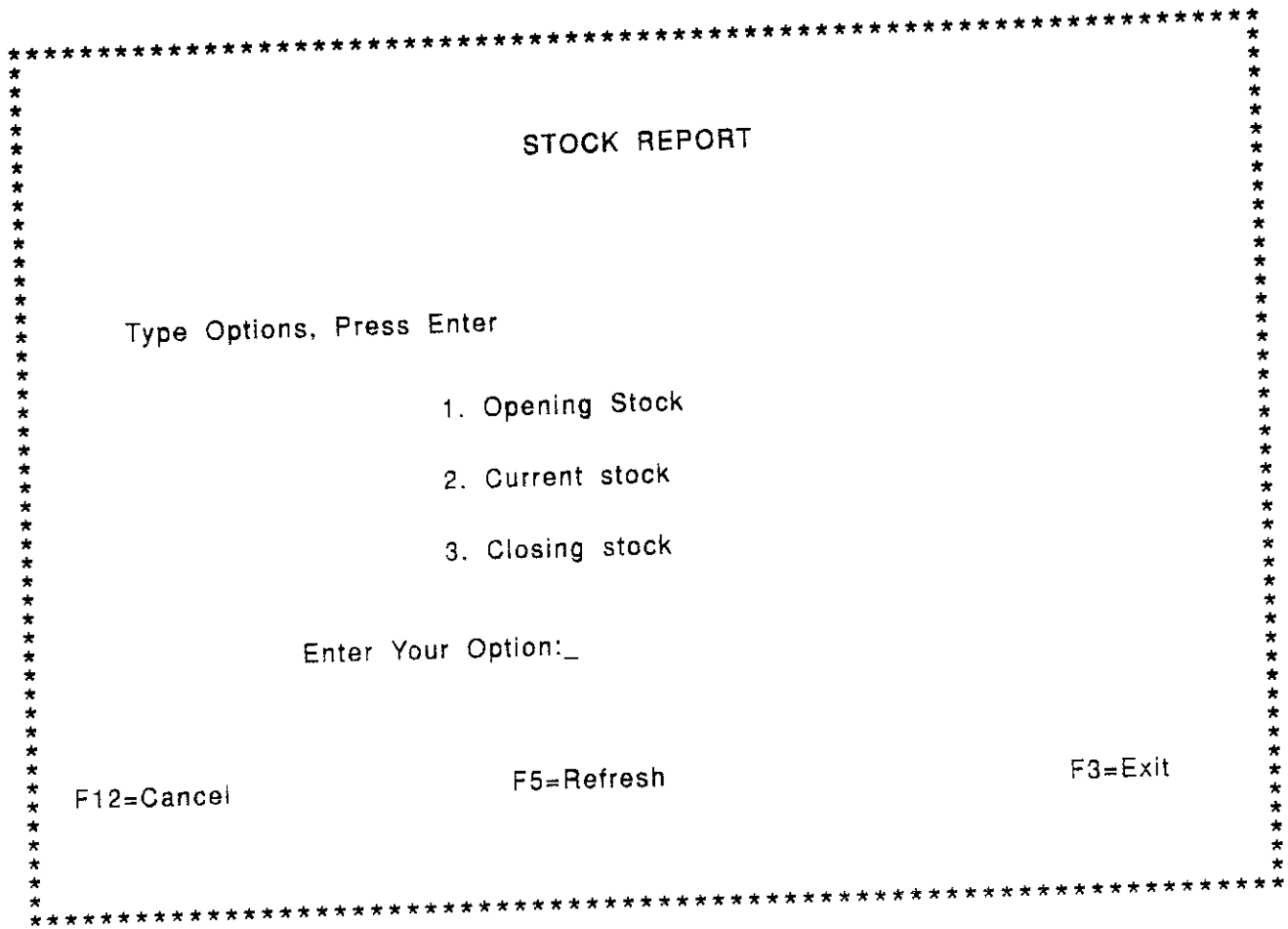
2. Departmentwise

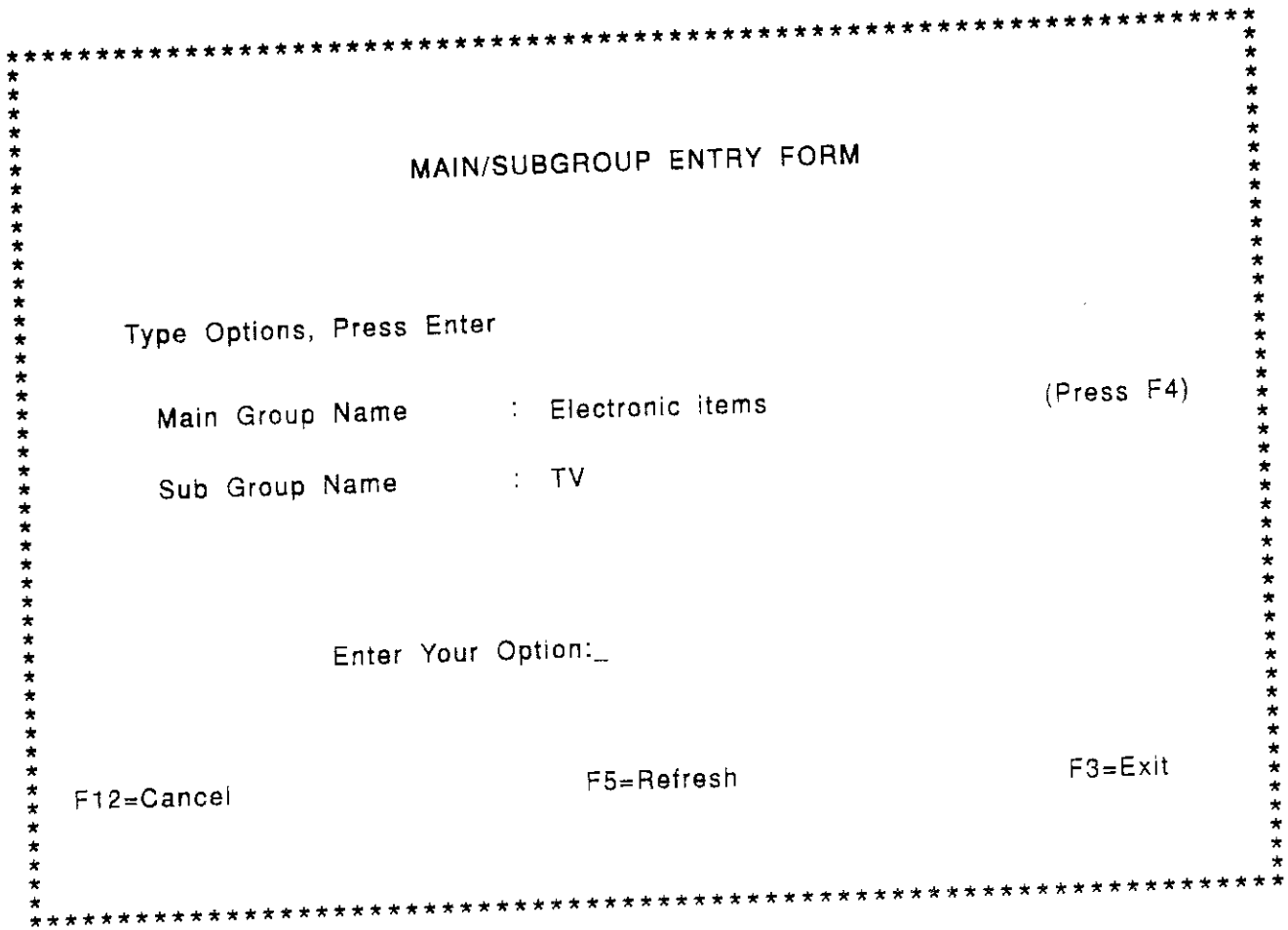
3. Datewise

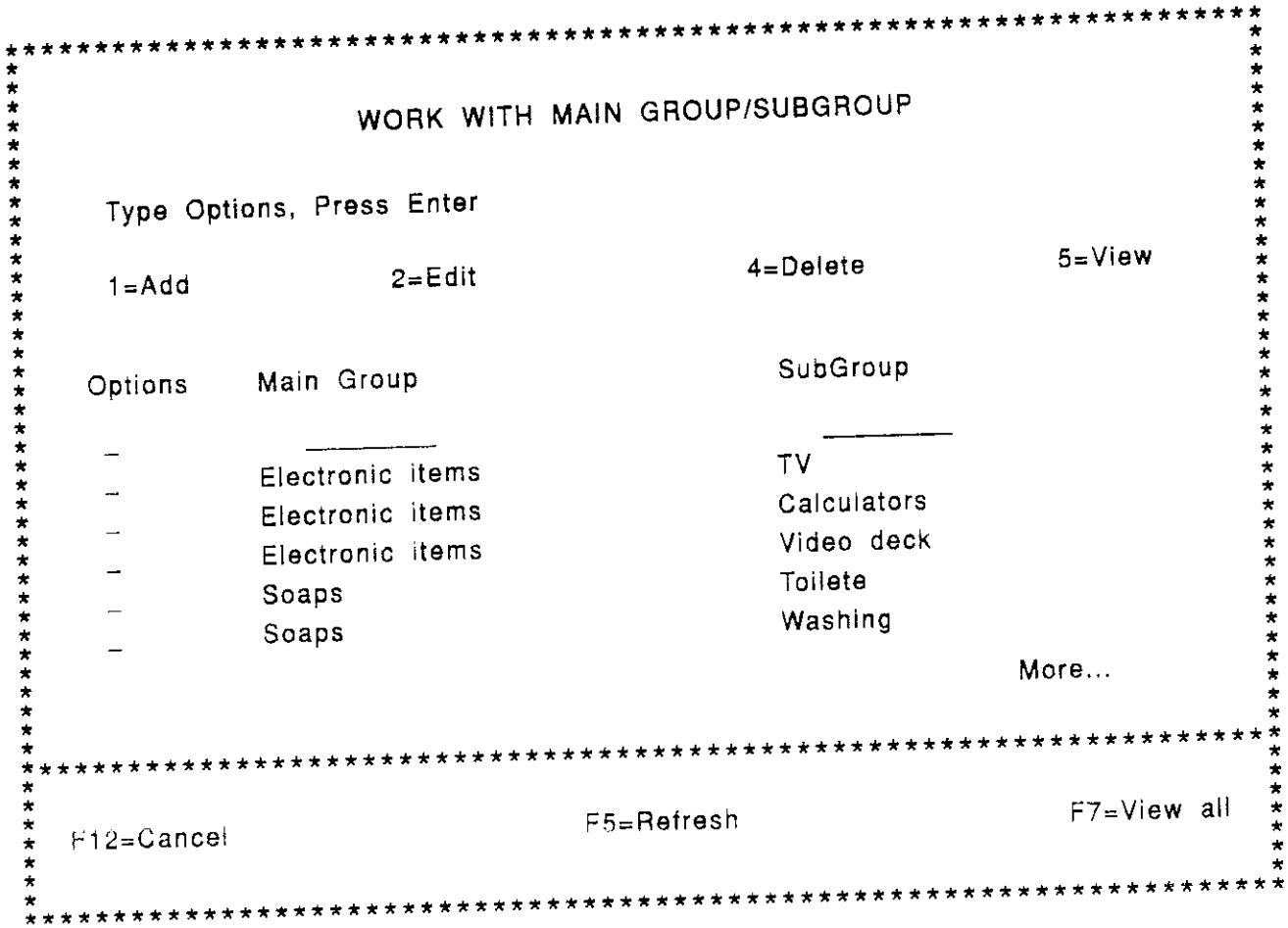
Enter Your Option:_

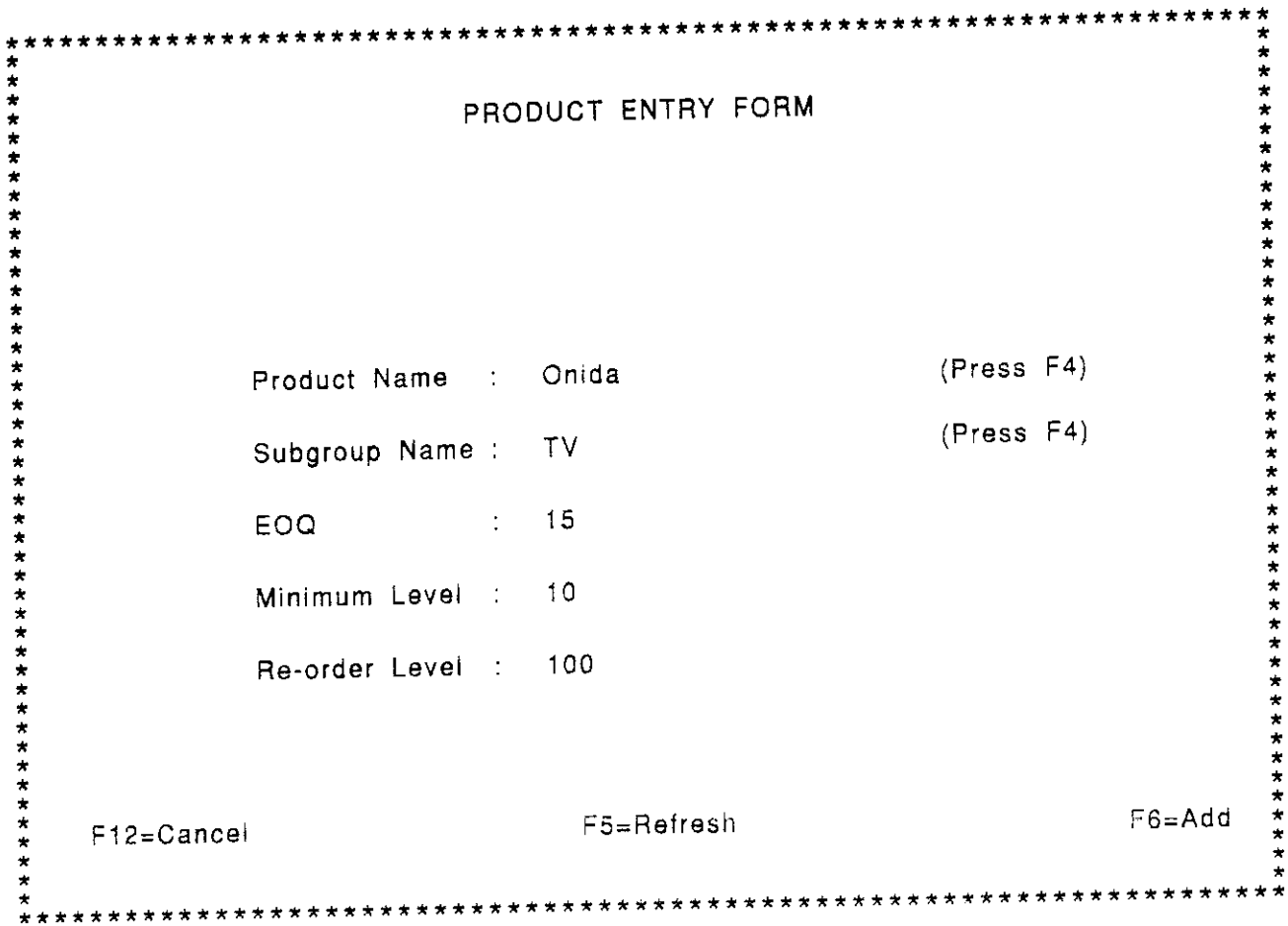
F12=Cancel F3=Exit F5=Refresh

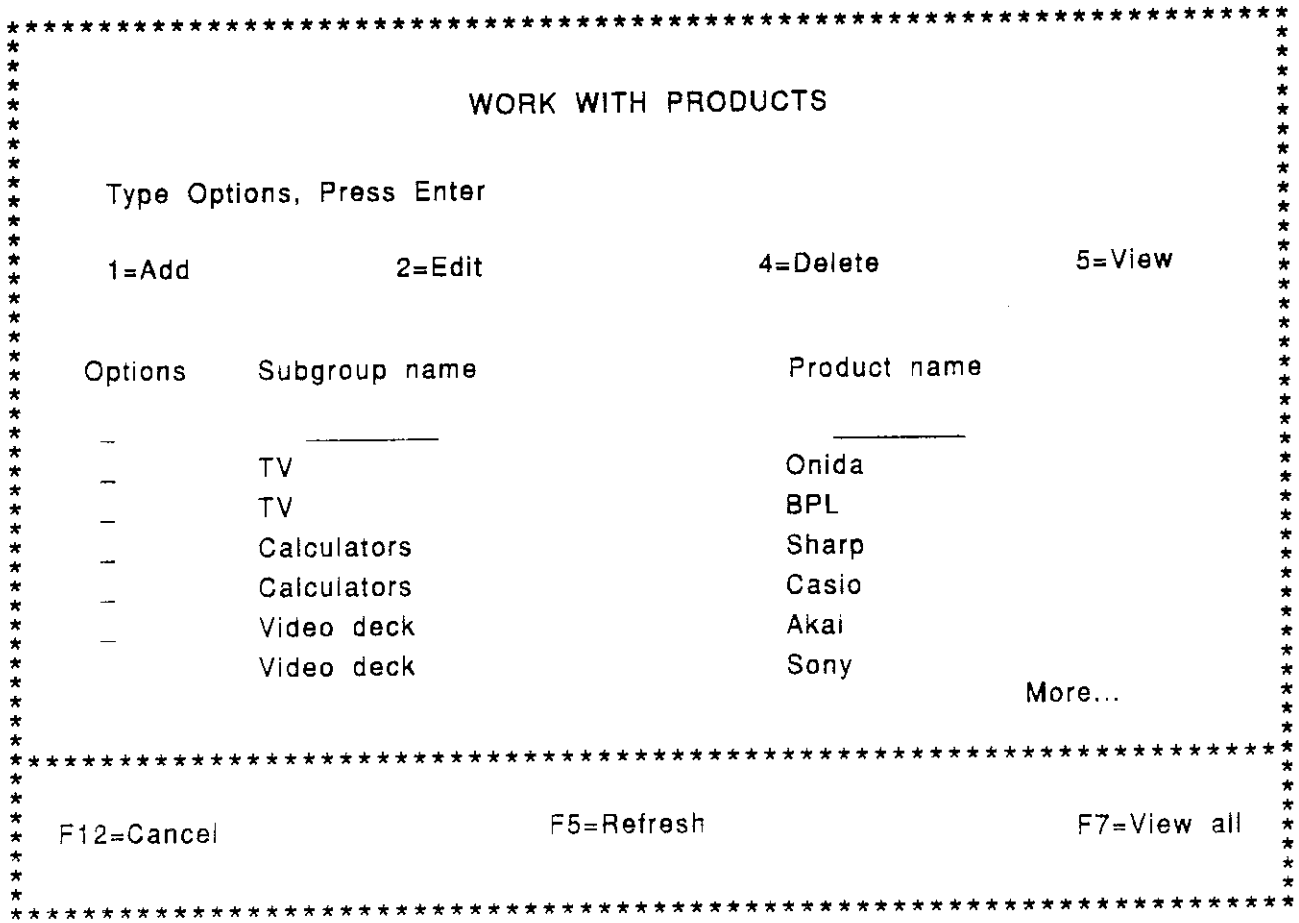


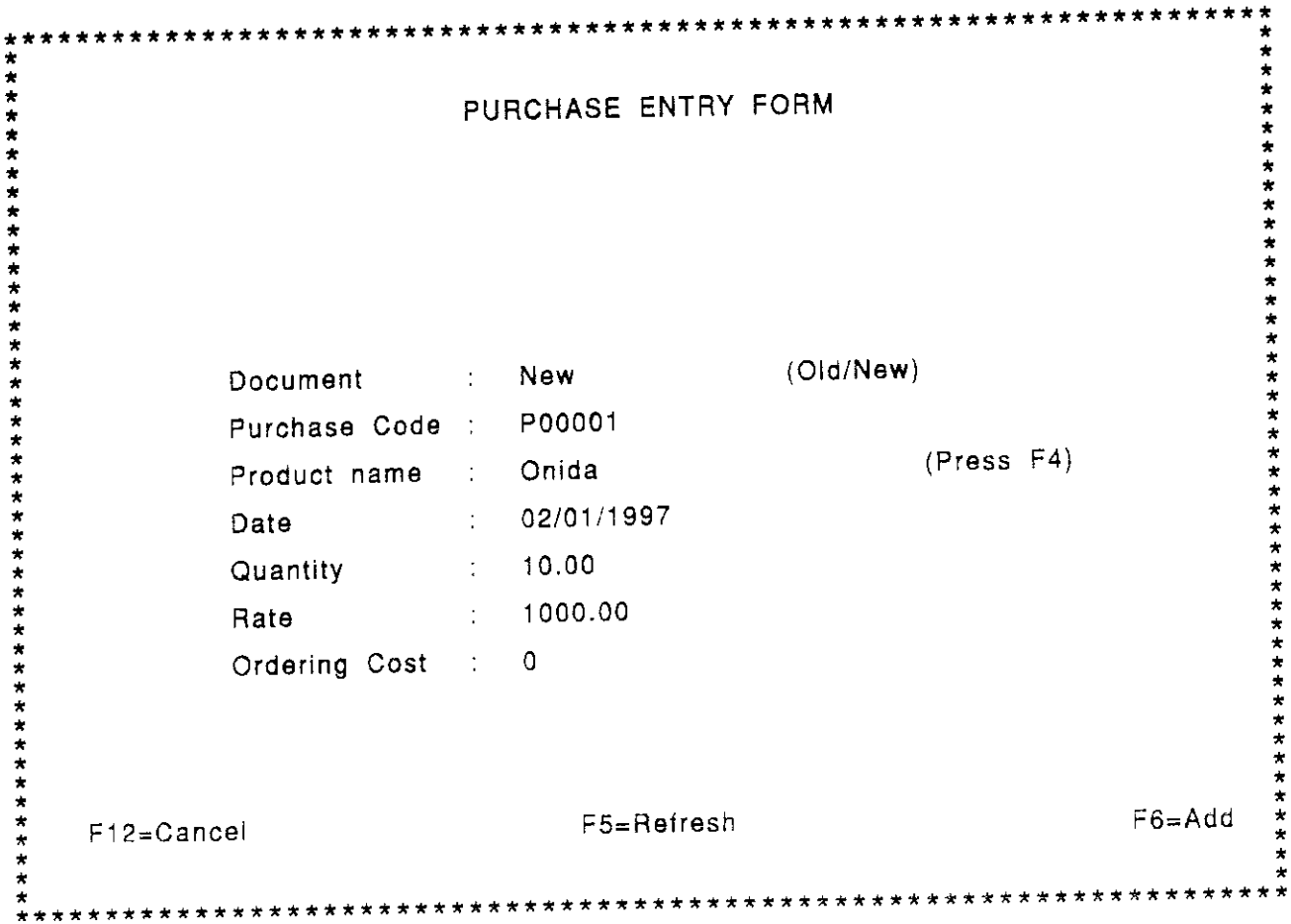

STOCK REPORT
Type Options, Press Enter
1. Opening Stock
2. Current stock
3. Closing stock
Enter Your Option:_
F12=Cancel
F5=Refresh
F3=Exit

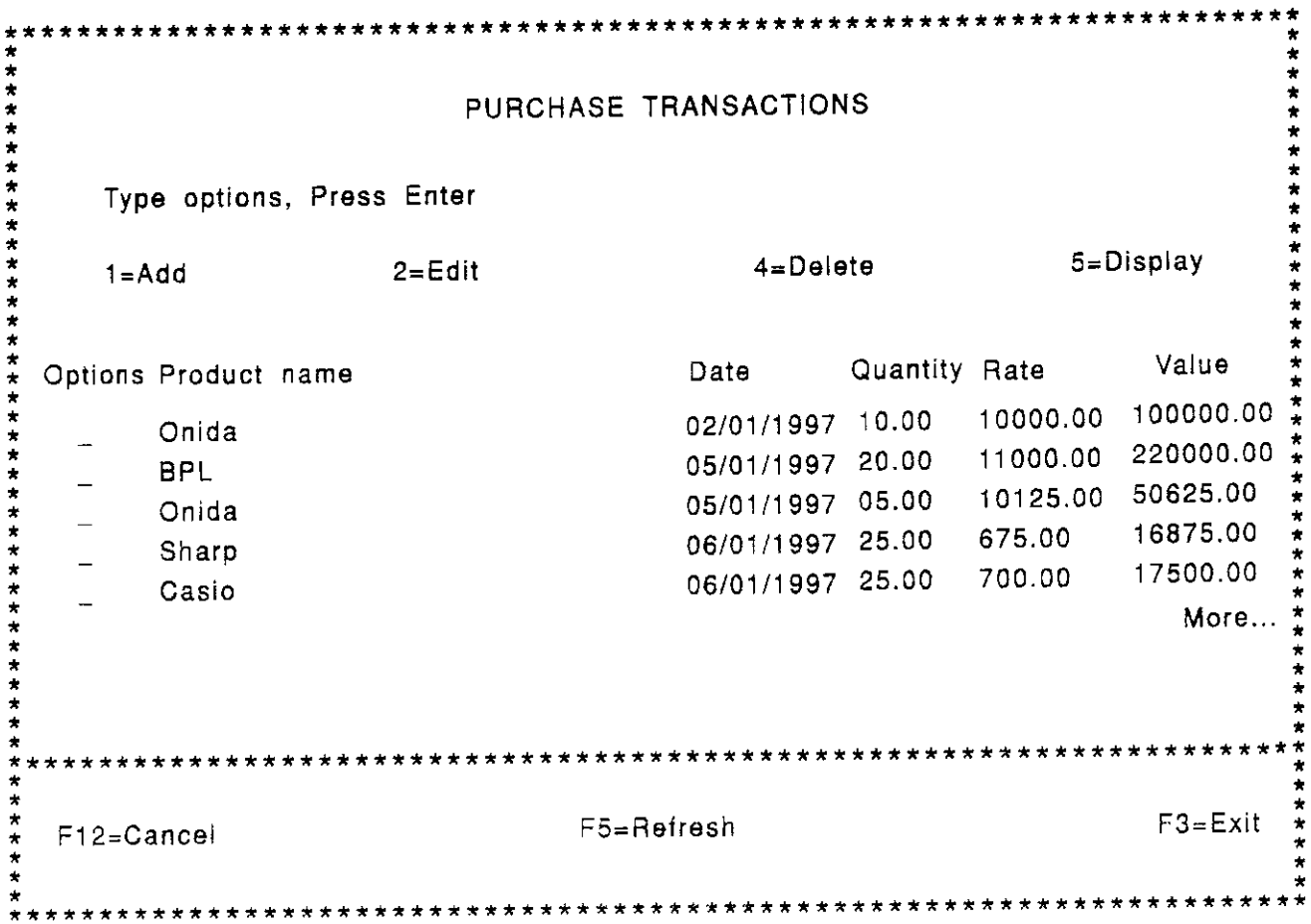

MAIN/SUBGROUP ENTRY FORM
Type Options, Press Enter
Main Group Name : Electronic items
(Press F4)
Sub Group Name : TV
Enter Your Option:_
F12=Cancel
F5=Refresh
F3=Exit

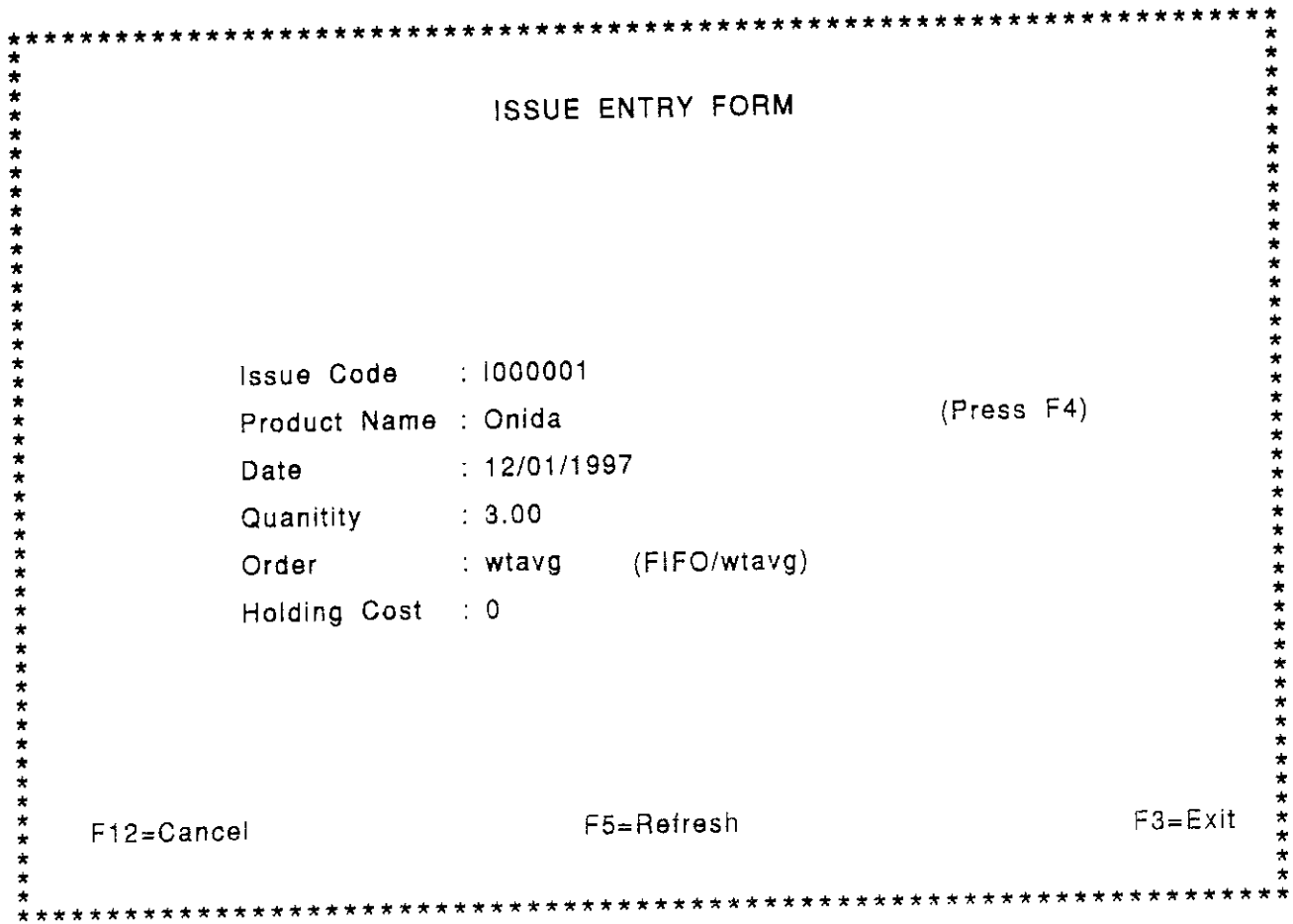

WORK WITH MAIN GROUP/SUBGROUP
Type Options, Press Enter
1=Add
2=Edit
4=Delete
5=View
Options
Main Group
SubGroup
Electronic items
Electronic items
Electronic items
Soaps
Soaps
TV
Calculators
Video deck
Toilete
Washing
More...
F12=Cancel
F5=Refresh
F7=View all

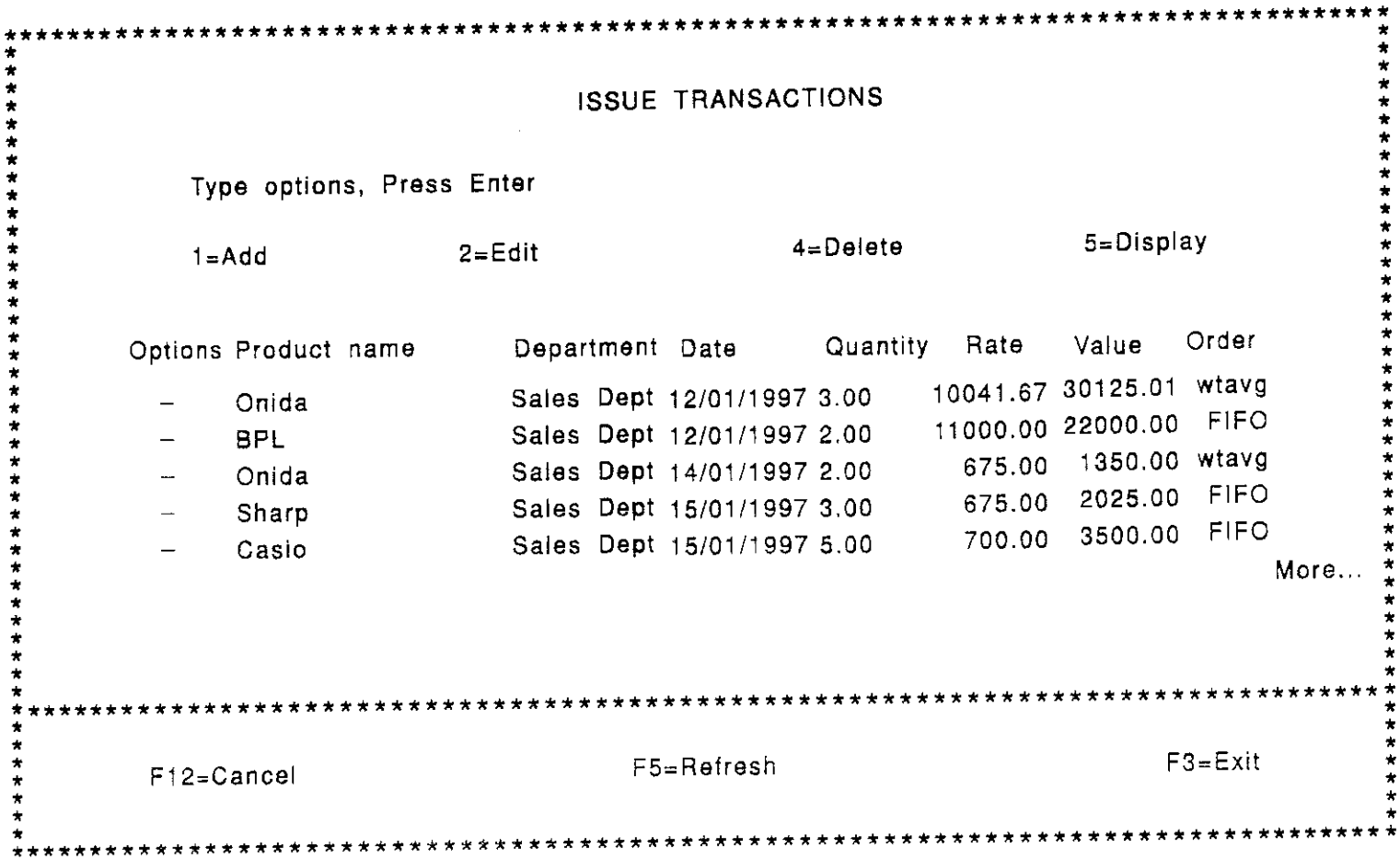

PRODUCT ENTRY FORM
Product Name : Onida
(Press F4)
Subgroup Name : TV
(Press F4)
EOQ : 15
Minimum Level : 10
Re-order Level : 100
F12=Cancel
F5=Refresh
F6=Add

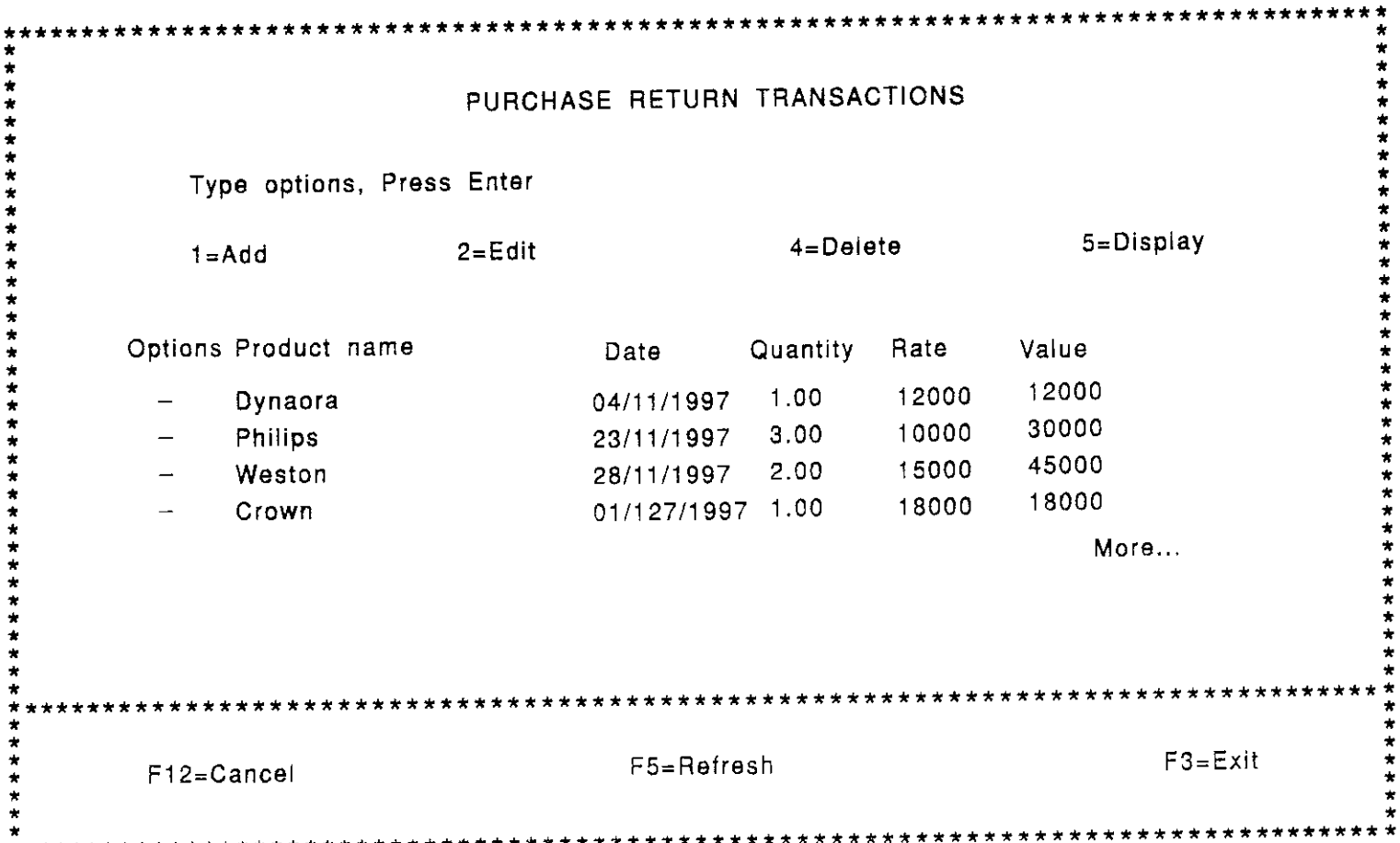

WORK WITH PRODUCTS
Type Options, Press Enter
1=Add
2=Edit
4=Delete
5=View
Options
Subgroup name
Product name
TV
Onida
TV
BPL
Calculators
Sharp
Calculators
Casio
Video deck
Akai
Video deck
Sony
More...
F12=Cancel
F5=Refresh
F7=View all


PURCHASE ENTRY FORM
Document : New (Old/New)
Purchase Code : P00001
Product name : Onida (Press F4)
Date : 02/01/1997
Quantity : 10.00
Rate : 1000.00
Ordering Cost : 0
F12=Cancel
F5=Refresh
F6=Add


PURCHASE TRANSACTIONS
Type options, Press Enter
1=Add
2=Edit
4=Delete
5=Display
Options Product name
Date
Quantity
Rate
Value
_ Onida 02/01/1997 10.00 10000.00 100000.00
_ BPL 05/01/1997 20.00 11000.00 220000.00
_ Onida 05/01/1997 05.00 10125.00 50625.00
_ Sharp 06/01/1997 25.00 675.00 16875.00
_ Casio 06/01/1997 25.00 700.00 17500.00
More...
F12=Cancel
F5=Refresh
F3=Exit


ISSUE ENTRY FORM
Issue Code : I000001
Product Name : Onida
(Press F4)
Date : 12/01/1997
Quanitity : 3.00
Order : wtavg (FIFO/wtavg)
Holding Cost : 0
F12=Cancel
F5=Refresh
F3=Exit


ISSUE TRANSACTIONS
Type options, Press Enter
1=Add
2=Edit
4=Delete
5=Display
Options Product name Department Date Quantity Rate Value Order
– Onida Sales Dept 12/01/1997 3.00 10041.67 30125.01 wtavg
– BPL Sales Dept 12/01/1997 2.00 11000.00 22000.00 FIFO
– Onida Sales Dept 14/01/1997 2.00 675.00 1350.00 wtavg
– Sharp Sales Dept 15/01/1997 3.00 675.00 2025.00 FIFO
– Casio Sales Dept 15/01/1997 5.00 700.00 3500.00 FIFO
More...
F12=Cancel
F5=Refresh
F3=Exit


PURCHASE RETURN TRANSACTIONS
Type options, Press Enter
1=Add
2=Edit
4=Delete
5=Display
Options Product name
Date
Quantity
Rate
Value
– Dynaora 04/11/1997 1.00 12000 12000
– Philips 23/11/1997 3.00 10000 30000
– Weston 28/11/1997 2.00 15000 45000
– Crown 01/127/1997 1.00 18000 18000
More...
F12=Cancel
F5=Refresh
F3=Exit

FIELD NAME, LENGTH AND DATA TYPES USED

MASTER FILES

1. GROUP MASTER

GRPCOD	6P
MANNAM	20A
SUBNAM	20A

2. PRODUCT MASTER

PRDCOD	7P
PRDNAM	20A
RODLVL	5P2
EOQ	5P2
MAXLVL	5P2

3. STOCK MASTER

STPRNM	20A
STDATE	8P
STQTY	P2
STRATE	8P2
STVALU	56 10P2
STORCT	5P2
STPRCD	6A
STDCCD	6A

TRANSACTION FILES

1. PURCHASE TRANSACTION FILES

PURPDNAM20A	
PURDATE	8P
PURQTY	6P2
PURRATE	8P2
PURVALUE	10P2
PURPDCD	10P2
PURDOCD	6A

2. SALES OR ISSUE TRANSACTION

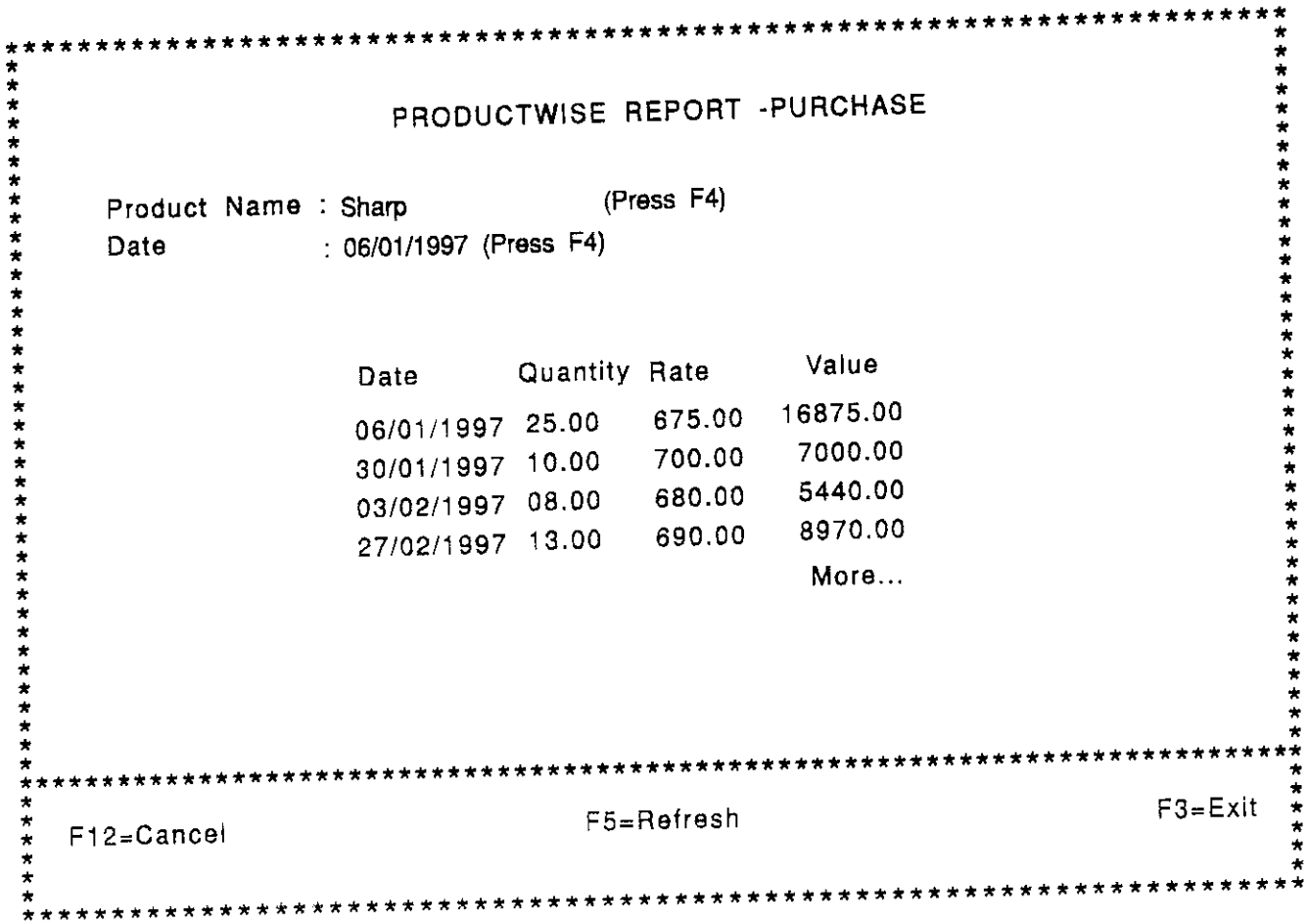
ISSPDNAM	20A
ISSDATE	8P
ISSQTY	GP2
ISSRATE	8P2
ISSVALUE	10P2
ISSCOD	6A
ISSORD	5A
ISSHDCST	5P2
ISSDPTNM	10 A

3. PURCHASE RETURN TRANSACTION FILE

PURRTCOD	6A
PURRTPNM	20A
PURRTDTE	8P
PURRTQTY	6P2
PURRTRTE	8P2
PURRTVALU	10P2

4. SALES RETURN TRANSACTION FILE

ISSRTCOD	6A
ISSRTPNM	20A
ISSRTDTE	8P
ISSRTQTY	6P2
ISSRTRTE	8P2
ISSRTVALU	10 P2


PRODUCTWISE REPORT -PURCHASE
Product Name : Sharp (Press F4)
Date : 06/01/1997 (Press F4)
Date Quantity Rate Value
06/01/1997 25.00 675.00 16875.00
30/01/1997 10.00 700.00 7000.00
03/02/1997 08.00 680.00 5440.00
27/02/1997 13.00 690.00 8970.00
More...
F12=Cancel
F5=Refresh
F3=Exit

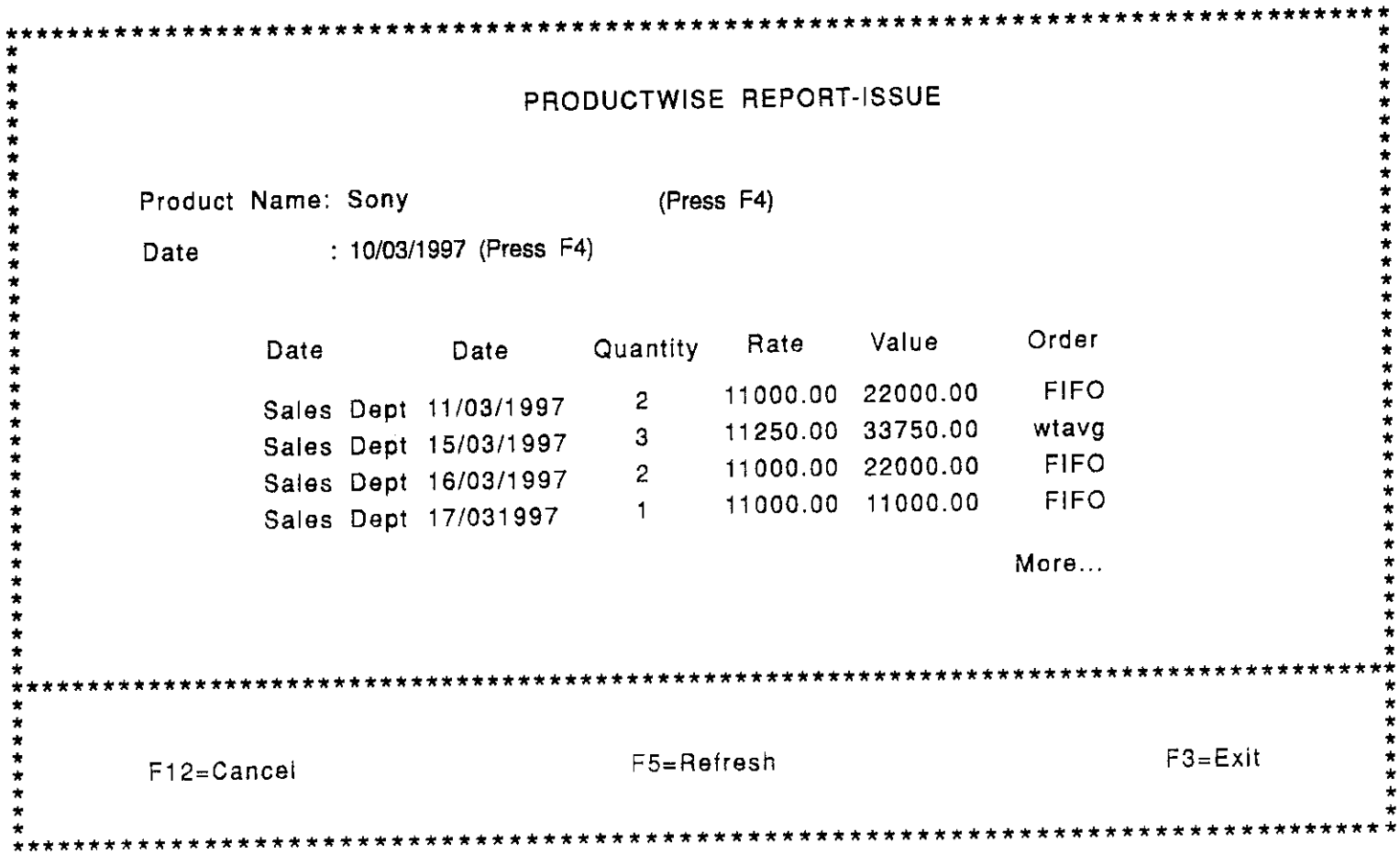
DATEWISE REPORT -PURCHASE

Date : 20/01/1997 (Press F4)
05/03/1997 (Press F4]

Product Name	Date	Quantity	Rate	Value
Sharp	20/01/1997	10.00	700.00	7000.00
Casio	23/01/1997	05.00	750.00	11250.005
Akai	24/01/1997	05.00	12000.00	60000.00
Sony	27/01/1997	8.00	11000.00	88000.00

More...

F12=Cancel F3=Exit F5=Refresh


PRODUCTWISE REPORT-ISSUE
Product Name: Sony (Press F4)
Date : 10/03/1997 (Press F4)
Date Date Quantity Rate Value Order
Sales Dept 11/03/1997 2 11000.00 22000.00 FIFO
Sales Dept 15/03/1997 3 11250.00 33750.00 wtavg
Sales Dept 16/03/1997 2 11000.00 22000.00 FIFO
Sales Dept 17/031997 1 11000.00 11000.00 FIFO
More...
F12=Cancel
F5=Refresh
F3=Exit

DEPARTMENTWISE REPORT-ISSUE

Department Name : Sales Dept (Press F4)

Date : 12/01/1997 (Press F4)

Product Name	Date	Quantity	Rate	Value	Order
Onida	12/01/1997	3.10	10041.67	30125.01	wtavg
BPL	12/01/1997	2.00	11000.00	22000.00	FIFO
Sharp	14/01/1997	2.00	675.00	1350.00	wtavg
Sharp	15/01/1997	3.00	675.00	2025.00	FIFO

More...

F12=Cancel F5=Refresh F3=Exit

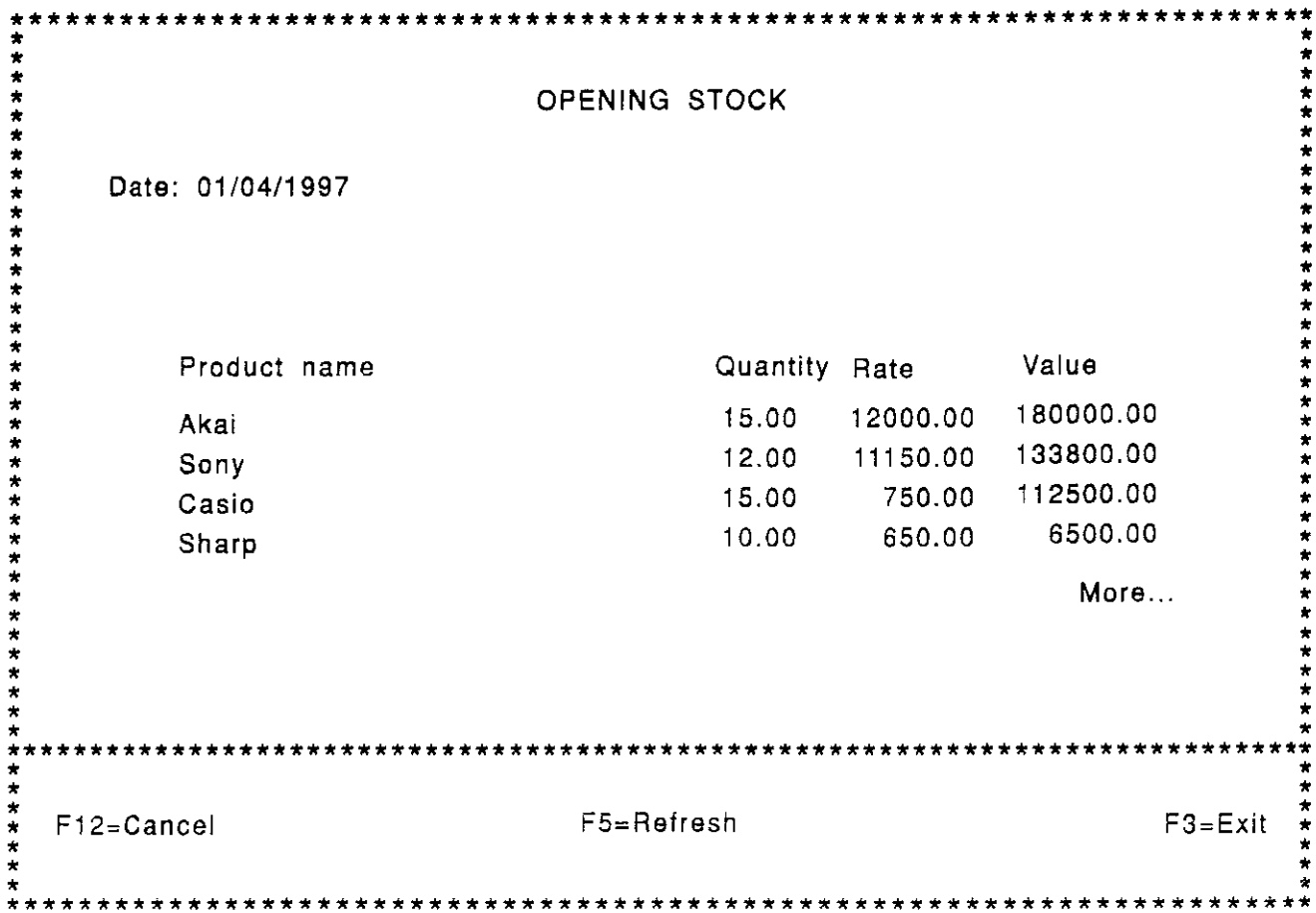
DATEWISE REPORT-ISSUE

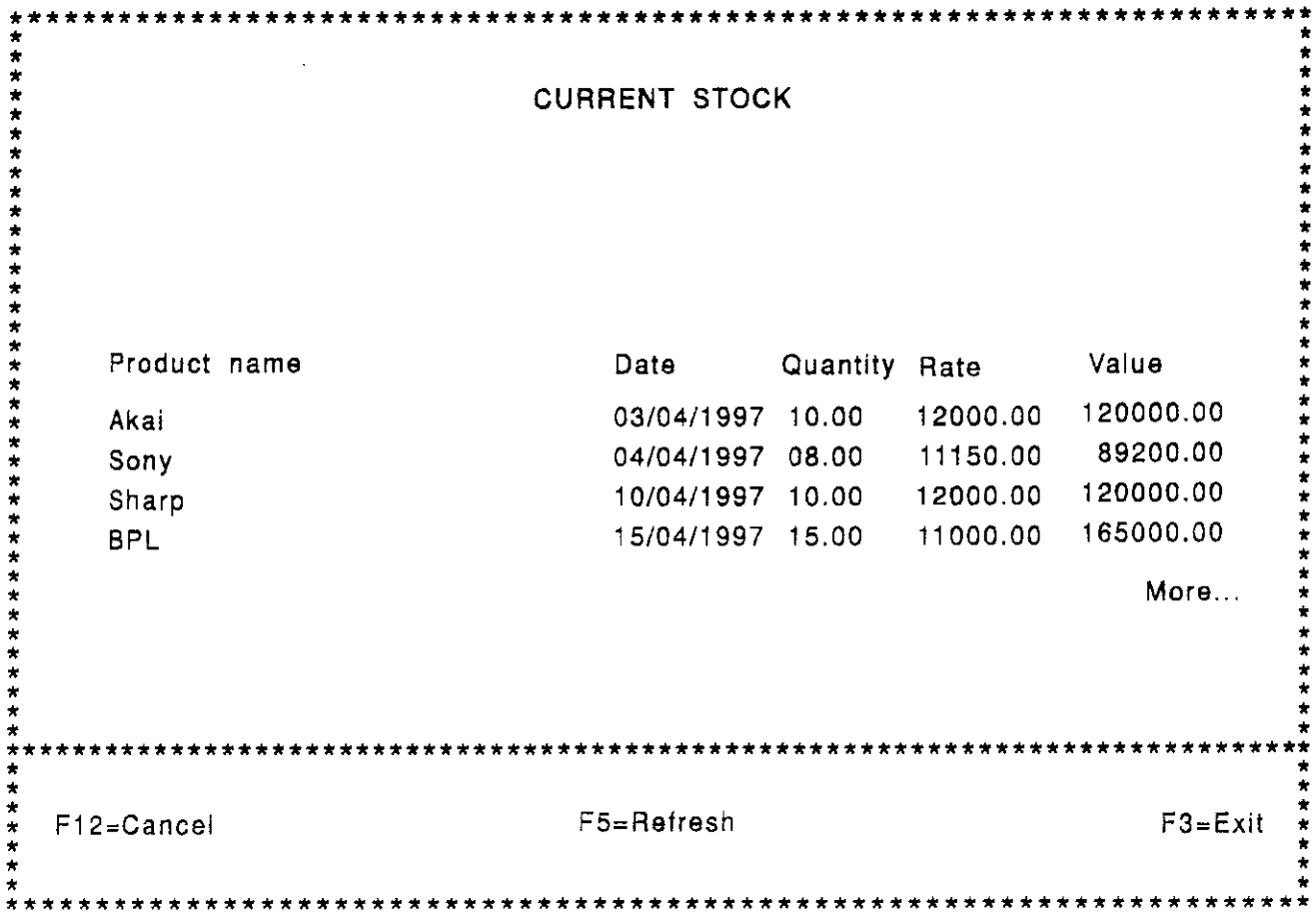
Date : 12/01/1997 (Press F4)

: 17/03/1997 (Press F4)

Product name	Date	Department	Quantity	Rate	Value	Order
Onida	12/01/1997	Sales Dept	3.00	10041.67	30125.01	wtavg
BPL	12/01/1997	Sales Dept	2.00	11000.00	22000.00	FIFO
Onida	14/01/1997	Sales Dept	2.00	675.00	1350.00	wtavg
Sharp	15/01/1997	Sales Dept	3.00	675.00	2025.00	FIFO
Sharp						More...

F12=Cancel F5=Refresh F3=Exit


OPENING STOCK
Date: 01/04/1997
Product name
Quantity
Rate
Value
Akai
15.00
12000.00
180000.00
Sony
12.00
11150.00
133800.00
Casio
15.00
750.00
112500.00
Sharp
10.00
650.00
6500.00
More...
F12=Cancel
F5=Refresh
F3=Exit


CURRENT STOCK
Product name
Date
Quantity
Rate
Value
Akai
03/04/1997
10.00
12000.00
120000.00
Sony
04/04/1997
08.00
11150.00
89200.00
Sharp
10/04/1997
10.00
12000.00
120000.00
BPL
15/04/1997
15.00
11000.00
165000.00
More...
F12=Cancel
F5=Refresh
F3=Exit

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