AUTO-CODED SALES AND INVENTORY CONTROL

(SUPERMARKET AS A CASE STUDY)

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIRMENTS FOR THE AWARD OF A POST GRADUATE DIPLOMA IN COMPUTER SCIENCE.

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CERTIFICATION

This is to certify that this project carried out by Mrs. Bolanle K. Saliu meets the requirements for the award of a Post-Graduate Diploma in Computer Science of the Federal University of Technology, Minna, Niger State.

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DEDICATION

To my husband, Dele for his love,

care and understanding.

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ACKNOWLEDGEMENT

ABSTRACT

The supermarkets in Nigeria today, process transactions manually. As a result, customers are often delayed, the processing is cumbersome and inaccurate information is generated. In addition, very vital informations such as the quantity of items sold in the day and quantity remaining in stock is difficult to obtain.

From the study conducted within this project, it is deduced that the use of computers with the keyboard coding system will greatly improve operation and hence solve a number of problems. The software to be used for the system is developed locally. The design of this system is based on a number of factors, the most important of which are the requirements for improvements, obtained during the investigation of the existing system of operation. The other factors considered are:

(i) Workability of the system

(ii) Financial implication of using the system

(iii) The availability of the technology required for the system.

Prior to the development of the new system, the current manual system was studied using the observation and interview techniques to bring out facts vital for improvement. More emphasis was placed on the following important aspects of the operation in the design of the system:

(i) Sales Transaction at the cash point.

(ii) Control of inventory.

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(iii) Information availability and accessibility.

The new system is developed to use codes in processing sales transaction, and automatically record the information generated in a file. Files can be updated as required and retrieval of information is prompt. Other facilities included are as follows:

(i) Facility to edit records in a file

(ii) Facility to delete records from a file

(iii) Facility to add more records to a file

(iv) Generation of periodic reports

(v) Facility to view items details

(vi) Calculation of recorder point and economic order quantity.

The system is well documented and maintainance can be easily effected.

CHAPTER ONE

INTRODUCTION

According to history, the early farmers practiced subsistence farming. Individual farmers produce crops enough for themselves and their families alone. Later, excess was produced when people started specialising on the type of crops they produce and other kinds of jobs such as weaving, building and so on were being handled by some others. The excess was exchanged for other things by a mechanism called Trade by Barter. A yam farmer exchanged his yams for guinea corn produced by another farmer; or for clothes produced by a weaver. Soon, this mechanism became ineffective as a result of population growth, and this led to the introduction of money which is then used for exchange of goods and services between producers and consumers. This distribution system that uses money is known as merchandising or trading.

Trading can be grouped broadly into two categories. These are wholesale and retail. Wholesale is the sales of goods in relatively large quantities to be retailed by others called retailers. Retail on the other hand is the sale of goods in small quantities directly to consumers.

Retailing is much more complex than wholesaling and has undergone a lot of changes since trading was introduced. The rate of this change is directly related to the stage and speed of economic development of the area concerned. Today, different form of retailing exists. There are the self service retail centres among which are supermarkets, departmental stores, discount houses and automatic vending centres. It could also be by direct

marketing which is selling through mails, by telephone or door to door.

Retail centres that are prominent in Nigeria include supermarkets and departmental stores. There are the Jonapal Departmental stores and the Systems Supermarkets among others in Minna. Bigger stores such as the Leventis stores and U.T.C stores are also found in other parts of the country.

In these stores, items are arranged in shelves with each carrying a price tag. Items of same categories are placed together for easy identification. A number of cash points are provided at the sales floor. There is enough space to move around the store. Shopping baskets and trolleys are also provided for customers to carry the items picked for purchase, to the cash point. A store house is also provided to maintain the stock. Security personnel are provided within the supermarket as well as at the exist door.

In a normal transaction, a customer looks through the shelves and picks the items to purchase. The items are taken to the cash point where the cashier enters the prices to the machine and calculates the amount to be paid for the items. The customer pays the amount, collects the items with a pay slip and a shopping bag and leaves the supermarket. At the exit door, the pay slip is checked against items in the bag by the security guard.

Supply of goods may be directly from manufacturers or through distributors. Each supply is accompanied by an invoice and a receipt is obtained when payment is made. The receipt and invoice are kept as important documents in preparing reports

Stock-taking is usually by physical counting of goods on shelves and instorage.

The ultimate goal of a supermarket is to be able to satisfy customers at all time, (i.e. never run out of stock) while the running cost is minimised. In fact, the aim of any business at all is to maximise profit while the overhead cost is reduced. The achievement of this goal depends on a number of factors among which is the effective management of inventory and improvement on operational procedures to reflect the technological advancement of the society.

Most supermarkets run into difficulties in achieving their goals due to improper management of inventory. Many frequently run out of stock and hance enjoys low patronage. Some stock excessively thereby increasing the overhead cost. Other supermarkets lose large amount of money to fraudulent staff due to inadequate control over the movement of goods in and out of the supermarket.

The operation whereby prices of items are entered one after the other into the adding machine to obtain a total amount a customer will pay for the items purchased is very slow. Long queues are experienced many times at the cash points of many supermarkets. Such supermarkets could lose their customers to others where fast services can be obtained.

Moreover, the machine does not keep records of items sold and hence information on quantity of goods in stock cannot be obtained from it. In addition, other vital information for decision making are seldom made available. Where the informations are available, they are almost always inaccurate as documents required for such

information may have been carelessly handled
because of the tedious and cumbersome taskes involved. When the
stock is taken, it is not properly done and so inaccurate
informations is obtained.

In the recent past a lot of improvement have been effected
to overcome the difficulties faced by supermarkets as mentioned
above.   Currently a more advanced approach is being employed.
This is the computerised system. Typically a terminal is situated
on the shop floor with a communication link to a central computer.
The terminal acts as a cash register but also transmits sales data
to the central database, thereby maintaining automatic stock
control and providing valuable information about buying trends.

Numerous methods of capturing data to the computer are
employed and this is reflected in the way the items for sale are
marked with such information as stock number and price.   Some
point of sale systems are designed to read coded information from
perforated (or punched) tags or cards refered to as kinball tags.
Kimball tags are special type of price tags used in retailing
which contain printed and punched or magnetically encoded
information. They are used to improve the control of mechandising
by means of automated tag system, which provide facilities for
punching information into the tags. Information are read by the
use of a hand held wand or pen reader. An operator waves the wand
over the sales information to be recorded and through this action
the information is read using optical character or magnetic
character recognition techniques.

Sometimes, the marking of goods is done using bar codes

rather than normal characters for ease of recognition by the reading device. A bar code consist of binary combination of thick and thin vertical black bars. the code is read typically by means of a light pen used in conjunction with a portable data capture terminal. In all the methods mentioned above the accuracy of the collection of data is the responsibility of the machine. Shelley and Hunt (1989). Many types of advanced cash register are also in use, which are linked to computers and which rely on human operators to key in sales data. For this type of cash registers, the commonly used computer systems which can also be obtained at affordable prices, can be used. The softwares to drive the system can be designed to users desire. That is an in-house software could be developed for the systems. This system will be more applicable to the Nigerian Society where the technological development is low and the cost of running and maintaining a highly sophisticated system may be too high.

In this project, the current operating systems in some selected supermarkets are studied and a software is developed base on findings from the study. the first step in the study is to determine whether a change to a new system is desired or not. To determine this, a preliminary or feasibility study is done. During this study, the problems faced by the supermarkets are examined and alternative solutions are suggested. The alternatives are assessed financially, operationally and technically, and a recommendation is made base on these assessments.

Once the feasibility study is completed, a detailed

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investigation is then embarked on to bring out the facts about the activities of the supermarkets. These facts are analysed and the requirement for improvement are compiled. A new system is then designed based on these requirements. The software is in turn developed from this design. The new system is put into used to ensure its workability, and evaluates its performance. Facility for maintainance are also included.

CHAPTER TWO

LITERATURE REVIEW

As mentioned earlier in the introduction, since trading was started, retailing all over the world has undergone tremendous changes. Cateora (1987) reported that the self service retailing was started in the United States in 1930. Sweden and Germany joined in 1938. But since the end of the Second World War, self service has been a major element in World retailing.

In 1985, about $150 billion was generated by direct selling alone in the United States, $10 billion in West Germany, $3 billion each in France and the United Kingdom and $22.4 billion in Japan. Cateora (1987). Products sold through direct marketing include books, insurance, general merchandise, housewares and cosmetics.

Discount houses are self service general merchandise stores that combine low price with high volume. this form of retailing began shortly after World War II, when there was a tremendous demand for all sorts of products that had not been available during the war. At first, discounters simply leased large, low rent buildings, purchased large quantities of nationally known, branded durable goods, laid them out all over the building and allow customers to browse without sale assistance; shoppers paid for their selection as they left the building. Discounters today operate very differently. They offer credit, have plenty of sales clerks, have attractive buildings in good locations, advertise in mass media and carry many lines of products Schewe (1987).

Departmental stores, also a self service stores, offer a

wide variety of product lines and is divided into departments to facilitate marketing and merchandise management. Typically there are departments for cosmetics, clothing, appliances, housewares and service departments such as travel agency, insurance, tax preparation and even banking and financial services Schewe 1987).

Supermarkets are self service stores that carry a full line of food and non-food products. An average supermarket today carries up to 12,000 different products. They emphasize convenience items, a minimum of service, low prices and large parking areas. Since their profit margins are very low, supermarkets must keep a close eye on overhead cost – Schewe (1987).

Superstore is a combination of general merchandise discount operation and a supermarket. Schewe (1987). While supermarkets concentrate on food and housekeeping products, superstores in addition carry other products euch as garden products, stationery, tyres, liquor, clothing and household services like laundry, banking and shoe repairs.

The combination stores, also within the category of supermarkets places more emphasis on non-food items and services such as lunch counter, pharmacies and film processing among others. Schewe (1987).

The importance of a proper management of inventory has been stressed. Rachman and Mescon (1985) defined inventory as goods held on hand for the production process or for sales to the final customers. Taylor (1986) gave a broader discription of inventory as stock on a store shelf, partially finished products at different stages of a manufacturing process, raw materials, labour

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or cash. Taylor (1986) explained that inventory control should be done not only for producers or merchandisers to meet demand at all time but also to take care of unusual situations such as strikes, while at the same time keeping watch on overhead cost of an organisation. Inventory control is defined as some way of determining the right quantity of various items to have on hand and keeping track of their locations and use within the organisation. Rachman and Mescon (1985). The same authors explained that failure to track inventory may result in workers wasting time to search for a particular item; or purchasing department being unaware of shortages in inventory or worse still, sales department might wreck relationships with customers by promising products that were not available. This further stressed the importance of controlling inventory.

A proper control of inventory was suggested using Economic Order Quantity. Safety stock was introduced to reduce the shortage cost and hence minimise the total inventory cost. Taylor (1986).

CHAPTER THREE

FEASIBILITY STUDY

A move for a change from a present system of operation in any organisation to a new system is made when problems are encountered with the current system. It is important to investigate the cause of the problems and look at a range of alternative ways of solving them. For each alternative solution, the cost and benefit analysis is done and a recommendation is made based on the assessment. This is called Feasibility Study.

The feasibility study of the current system of operation in selected supermarkets in Minna was carried out. The stores used are Jonapal Departmental store and Systems Supermarkets. The observation and interview techniques were employed for the study. The following are the major areas where problems were identified:

(a) Price tags on items on the shelves:

Items are arranged on shelves with each carrying a label on which the price is handwritten. The man-hour involved in putting the labels on the new items as well as when the need arises to replace the labels as a result of price change, is considered wasteful. Changing prices of items could cause confusion amongst the customers who patronize the supermarket. The confusion may arise from a temporary closure of the supermarket, or removal of the items for which prices are to be changed from the display shelves. In addition, the temporary closure at this period is

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likely to bring down sales and may also create a temporary loss of customers when the supermarket is eventually opened.

(b)   Payment at cash points: The cashier enters the prices on each item in to the machine and obtain the total amount to be paid by a customer.   Records of merchandise sold which are vital for inventory control and accountability are not kept. Customer delay arise when adding machine is used for calculation and the results are not always accurate.

(c) Information on inventory obtained from sales clerks: The information on the quantity of item on shelf and in stock which is vital for decision on purchasing is obtained only from the sales clerks.

Supermarkets may run out of stock due to late discovery of shortages or may stock excessively when wrong informations on inventory level are received.

(d)   Daily account rendered by cashier:- giving account of daily sales, cashiers only hand over a certain amount to the manager. No in-built mechanism to ensure that the actual amount is handed over.   Supermarkets lose a lot of money as a result of this poor accounting system.

The problems as highlighted so as to improve the operations can be solved in any of the following ways:

(a)   introduction of the use of ledger into the current system of operation. A ledger is a large book in which records of credits and debits of commercial transactions are kept.   At least two types of ledger could be kept by a supermarket; one containing the records of items pruchased by the supermarket and the other

containing records of item sold out. The later is to be filled at each transaction with data concerning the item sold to a customer while the former is filled only when the supermarket purchases new items. Usually, the following types of data are entered into the ledger:

i. Date of transaction

ii. Serial number

iii. Description of item

iv Price of item.

v Quantity pruchased

vi. Amount paid

vii. Balance (where credit is allowed)

viii. Remark.

A summary of the total quantity of each item sold as well as the overall amount of money from sales is obtained from the sales ledger each day. This is used to update the purchase ledger such that quantity of goods in stock at the end of a day can be obtained. This important information is to guide the supermarket on when and at what quantity new item will be purchased. Hence, with the use of ledger, proper accountability as well as effective management of inventory can be achieved.

(d) Changing the system entirely to a new one that uses computers:-

In order to make use of computers to process transactions in a supermarket, terminals are provided at specific points on the sales floor with communication link to the central computer situated say in the manager's office. The terminals acts both as cash register and also transmits data to the central computer.

Processing of sales transaction is completed by the terminal while the transaction is automatically recorded in the computer file. The method of data capture by the terminal depend on the method used to mark the merchandise.

Merchandise may carry a special type of price tags containing encoded information, called kimball tags. When the merchandise is sold, the tag is removed and the data it contains are processed by the computer. In addition to the price of an item, the tags may carry such information as name of the item, the manufacturer or even the supplier name.

Bar codes can also be used to mark items for case of recognition by the reading device. The codes are item inventory number. The number is looked up in the computer inventory array which reveals the price per item and other pertinent information such as the description of the item, the manufacturer as well as the supplier. The computer will compile a total for all the items read into it and produce an appropriate total amount as well as a pay slip through the terminal. At the same time, the computer updates the records of the supermarket in terms of item turnover, possible reorder points and similar accounting records.

The reading device is either a scanner pen or scanner slot. The merchandise carrying a stick-on bar code label is passed over the reading slot on the top of the scnner to generate the information needed. For bulky or odd-shaped items, the scanner pen is best while the scanner slot is used for flat bottomed or rectangular packaged products.

Codes of information may also be entered by an operator

using the keyboard which is provided as part of the terminal. When the code is entered, the information is transmitted to the central computer and transaction is immediately processed. As the codes are read into the computer, together with the quantity of an item being purchased, the amount for each item as well as total amount in each transaction is produced and displayed on the screen. A pay slip is also produced. In addition file records are immediately updated.

Assessment of Options

In order to determine the best option for recommendation, each of the options are examined and their merits and demerits highlighted.

The use of a ledger provides an improvement over the current method of operation which keeps no records. Recording data in ledger is very simple and can be handled by the present staff of the supermarket without any special training. The calculation of the total amount to be paid by a customer will be done using the machine. Information can always be retrieved as required, from the ledger for making decision. Also, the use of ledger will not add much to the overhead cost since their prices are very low.

However, a number of shortcomings are envisage with the introduction of ledger for recording sales transaction in supermarket. Such shortcomings include:

i. Delay of customers at the cash point when data on merchandise is being entered into the ledger one after the other. This may result to a reduction in the number of customers that patronizes the supermarket.

ii.   Redundancy occurs when the same type of data is entered
repeatedly into the ledger. Same item may be purchased by several
customers in a day and the data on it is recorded at each
transaction.

iii.   Tedious task involved in preparation of summary since the
individual item will be sorted out before the quantity sold and
the amount from the sales is obtained.

iv.   Production of inaccurate summarises.   Errors could arise
in summary preparation due to the complexity of sorting and
counting involved.

v.   Difficulties in storing used ledgers: As the used ledgers
pile up, problems will arise in storing them. Ledgers could be
destroyed by termites in their storage and hence information
contained in them would be lost.

When compared to the current system or a system that keep
records in ledger, the benefits of using computers to process
sales transaction in supermarkets cannot be overemphasized. Among
the advantages offered by computer processing are:

i.   High speed of processing

ii.   Accuracy of results

iii. Large storage facility

iv.   Ability to process large volume of data

v.   Automatic processing

vi.   Ease of retrieving information.

When kimball tags are used to mark merchandise,   the
transaction processing is fast and result produced are accurate.

This is because the reading and processing of data is done solely by the computer which has been designed to make little errors if at all. The computer also record the information immediately into the storage medium. this information can be retrieved as required with ease.

However, computer processing with merchandise marked with kimball tags have not removed the man-hour wasted on placing labels on items.   Apart from this, it is envisaged that supermarket staffs may react negatively to using kimball tags to mark items for computer processing, because of the sophistication and complexities involved.   The punching machines and tags are highly sophisticated and an extensive training will be required for the personnel that will operate them. The reading machine is also very sophisticated.

Customers reactions should also be considered.   it will be difficult to convince the customers especially the non-literate onces that the machines can read the data accurately and produce results that are also accurate.

Also to be considered is the technical as well as financial feasibility of introducing such a system into supermarkets given the society in which it will be used.   The technology involved in using kimball tags in supermarkets is advanced and not available in Nigeria yet.   All the equipments and softwares will have to be specially imported.   This will involve the use of foreign exchange and consequently increase overhead cost of the supermarket. Maintainance services as well as supply of materials to keep the system running will also pose some problems.

A faster processing is achieved when merchandise are marked

with Bar codes and the code reading system are used. However, as with the use of kimball tags, the bar code technology may not be feasible in Nigerian supermarkets for now, for the following reasons:

(i) The equipments necessary to run the system are highly sophisticated and are not available in the Nigerian market yet.

(ii) Bar codes are universal product code symbols and its adoption has to be a national resolution. The motion which may be from Government has to be well considered with the involvement of both the merchants and manufacturers.

(iii) The consequencies of adopting bar code system in the Nigerian supermarkets is that merchandise will carry uniform prices since the codes are universal. This may not be acceptable initially to supermarket owners who are used to fixing arbitrary prices.

(iv) Many supermarkets may not be able to afford the anticipated cost intensive bar code reading and processing machines.

(v) Customers are likely to complain of hidden prices since the prices are only represented in codes. This problem may however be solved by including clearly readable price stamps on the merchandise along with the bar codes. But this will entail duplication of information. Besides, one goal of using bar codes is to eliminate the necessity for clerks to affix prices to each and every item on the display shelves. The shelves could however carry the prices for public view.

A third option associated with the use of computer is the

keyboard coding system which involves typing the codes by a human operator. In addition to all the merits of using computers for transaction processing, this system will eliminate the use of price tags completely. Sales clerks are thus relieved of the task of placing the labels on each merchandise on the shelves. However, as with using bar code system, prices of merchandise may be displayed on the shelves for viewing. Codes are derived from the name and other vital information about the merchandise such as its size. The possibility of cashiers forgetting the codes is therefore very low. The system will provide facility for quick reminder to take care of this.

The code is used as the key field with which the information concerning the merchandise is retrieved during transaction and changes due to the transaction are recorded. The cashier enters the code as well as the quantity of the item a customer is pruchasing into the computer. The computation is automatic and the result is displayed on the screen.

The keyboard coding system will use a simpler technology compared to the kimball tags and bar code systems. The common computer consisting of the control unit, video display unit and the keyboard will be used. A micro-coputer will be appropriate for use in most supermarket or even the maintainance for those with branches at different locations.

These types of computers are readily available in the Nigerian market. Many computer firms now exist that sells, both the hardwares and softwares. Some even lease out the computers. Maintainance and repair services as well as supply of accessories such as diskettes, can also be obtained from the firms. Computers

are now available on the shelves of some electronic shops and supermarkets.

The reaction of customers when the system is introduced is also considered. It is envisaged that customers will embrace the system. Apart from the speed of processing transaction which they will find amazing, the use of computer on sales floor also insinuate some kind of sophistication to the supermarket. This in fact attract more customers and hence increase the patronage of the supermarket.

The rendering of account at the end of a day which sales clerks often find cumbersom when the manual system is used for processing transactions, is made simple with the use of computers. At each transaction, results of processing is used to update the record of each merchandise. The summary of each day's sales can be obtained with ease to cross check the account rendered.

Inventory management which have always been a major difficulty faced by supermarkets is also made easy with the use of computers with keyboard coding system. Information on level of inventory is readily available at any time. This information is to prompt the supermarket on when and at what quantity to pruchase new items. This information is accurate since records are updated immediately any transaction is processed. That is when an item is sold, quantity sold is removed from quantity in stock and this is reflected immediately in the computer record too.

RECOMMENDATION

In the course of feasibility study, the problems encountered in the day to day activities of the supermarkets were examined. Two main options were considered to solve the problems. One of the options is to record transactions in ledger while the second is the use of computers. There are three methods of capturing data into the computers. Either with the use of kimball tags or Bar codes. The third option is the keyboard coding system. Among these three methods of data capture, the keyboard coding system is found to be the most appropriate to recommend for use in Nigeria supermarket. Before a recommendation is made, each of the methods were taken through the three tests of assessing the feasibility of a proposed project. These tests are:

1.   Operational Feasibility: This is the workability of the proposed system. In order to assess the workability of a system the following operating factors are considered:

(a)   Avoidance of Complication: The proposed system should simplify operations rather than bring complication. This attribute is found in all the methods that use computer for processing. The keyboard coding system is favoured here since the codes are derived from the name of the items and are thus easy to remember. Also the task of placing labels on items are removed.

(b)   Effect on Performance:- The system should not have negative effect on performance. The keyboard coding system uses computers and hence the transaction processing

is very fast and accurate results are produced.

(c)   Occurrence of Errors:- The proposed system should reduce the occurrence of errors. The keyboard coding system is to be developed to detect any human error since computers are known to make little errors if at all. Facility will be included in the system to communicate error message and allow for correction.

2.   Technical Feasibility:- this Test is used to determine the possibility of using the available equipments, softwares and personnel for the proposed system.

The hardwares required for using the keyboard coding system si simple and readily available in the market as opposed to other systems that uses sophisticated computers;

The software to run the system is to be developed locally based on the querry language of the dbase III plus database management system; and

The present personnel of supermarkets who are able to handle the adding machine will effectively operate the computer with very little training.

3.   Financial Feasibility:- This assess the cost of implementing a proposed system viz-a-viz its benefits. the keyboard coding system is found to be most feasible financially. The computer hardwares are available at affordable prices and since the software is to be developed locally it is supposed to be affordable too. Maintainance services are also done locally at

moderate prices.

CONCLUSION

At the end of the feasibility study of the operating system in supermarket, it is deduced that a change to an improved method is inevitable. The use of computers with the keyboard coding system is to be the most feasible option in Nigeria today.

SYSTEMS ANALYSIS

In order to design a new system for use in any organisation, the current system has to be thoroughly understood in detail so as to be able to analyse it and assemble requirements for improvement. The system requirements are those features that much be included in the new systems. Determination of requirments entails identification, understanding and specification of problems for which a solution is required. Requirement determination thus consists of the following three activities:

    i.   Requirement anticipation

    ii.   Requirement investigation

    iii.   Requirement specification

Requirement Anticipation

These are the features the analyst foresee a new system may have based on experience. For the purpose of developing a new system for transaction processing in supermarket, the intention is to conduct extensive investigation and compile the requirements from the findings. However, since the new system as recommended in the feasibility study is an automated system, some general requirements can still be anticipated.

Automating a system of operation simply means using computers for processing. In general, to be able to use computers for transaction processing, the computer hardware and the software

to run it are the first set of requirements.   Details of this and other anticipated requirements will be given later in this chapter.

Requirement Investigation

The investigation of a system, also known as detailed fact finding is aimed at finding the objectives of the present system and whether they are being achieved.   The range of data types, volume of data to be processed, exception conditions and problems associated with the present system are also considered.   The first step is to acquire important facts about the system.   The facts are documented and later analysed to determine the requirements for improvement.

1.   Fact Finding

This is the collection of data about the systems requirements.   The techniques usually employed are:

(i)   Interview

(ii)   Questionaire

(iii) Record Review

(v)   Observation.

The interview and observation technique were used to collect facts about requirements for improvement in supermarket activities.   The investigation is based on all the three of activities in an organization, that is:

(i)   Transaction activities

(ii)   Decision activities

(iii) Organization wide activities.

The Transaction Activities

At the transaction level, the system capture, process and store data. In order to understand in detail, the activities at the transaction level and identify the problems existing there, the following questions were posed:

(a) What is the purpose of the organisation activity?

(b) What steps, processes or functions are performed? Who performs them?

(c) How long does each activity take?

(d) What factors govern the amount of time taken?

(e) What delays occur?

(f) How often is the activity done?

(g) Who uses the resulting information?

(h) What data are used or produced during the process?

(i) In what form are the data received or stored?

(j) What areas of transaction use specific control?

(k) What control methods are used?

Answers to these questions provided an insight to the user transaction requirements for improvement. These requirements are highlighted later in this chapter, under requirement specification.

Decision Activities

Certain activities of an organisation, leads to the production of information which are vital for decision making. this decision system may focus on the past, the present as well as the future occurrences. Processing of transaction data usually

provide information for decision making. The activities vital for decision making in a supermarket were determined after the following questions were answered:

(a) What information is used to make decisions?

(b) What is the source of the information?

(c) Which transaction process produces the data used in decision process?

(d) Which data originate from sources outside the organisation?

(e) How should data be processed to produce necessary information for decision making?

(f) How should information be presented?

Requirements compiled from the response to these questions are also given later in this chapter in requirement specification.

Organisation Wide Activities

To be able to fully satisfy all the requirements of an organisation in the design of a new system, the individual components of the organisation are studied in relation to other components. It is important to identify the interdependencies among components of the organisation. The additional activities that leads to a full understanding of the organisation wide requirements were obtained when the following questions were asked:

(a) How does interaction occur within components of the organisation

(b)   What standards are used to measure and assess
       performance?

(c)   What methods of detecting control lapses are used?

     Requirements identified from response to these questions
will also be specified later in this chapter.

2.   DOCUMENTATION OF FACTS

     In the analysis of a system, it is important to document
facts obtained from investigation so as to be able to analyse the
facts and compile requirements for improvement necessary in
designing a new system. the importance of documentation in an
information system cannot be over-emphasized. In the design of a
new system, it is the evolving product developed by the design
team and users. It is also the basis formaking changes to the
system after installation. Good documentation reduces the
conflict between users and the system designer since a well
documented system is easier for users to understand. Good
documentation means that an adequate reference is available when
problems arise and this information helps users to solve their
problems with the system.

     Documentation of procedures and decisions in fact finding
investigation can be achieved using any of the following tools:-

     (i)   Decision tree

     (ii) Decision Table

     (iii) Structured English.

Decision Trees

A decision tree is a diagram that present conditions and action of a procedure, sequentially. It shows the sequence with which conditions are considered as well as the relationships of each condition and its permisibles actions. The diagram resembles branches on a tree usually progressing from left to right. Decision trees can be used for deocumenting both quantitatives and non-quantitative activities.

Decision Tables

A decision table is a matrix of row and column that show actions and conditions. Decision rules are included in a decision table to state what procedure to follow when certain conditions exist. Decision tables are particularly used:

i. to verify the correctness and completeness of details gathered. This is achieved by the inclusions of all that relate them to the actions.

ii. to check out if redundancy and contradiction occur.

Structured English

Structured English uses narrative statements to describe a procedure. three basic types of statements are used:

i. Sequence structure: This is a simple step of action included in a process which does not depend on the existence of any condition and when encountered, the action is always performed.

ii. Decision Structure This occur when two or more actions

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can be taken depending on the satisfaction of the specified conditions.

iii. Iteration Structure This occur when the need arise for repetition of a particular action for a number of times.

For the purpose of this project, the Structured English is employed in documenting the facts obtained. All the three structures are used as activities relating to each are exists in the findings. The following profile of the system of operation is obtained from the fact finding investigation:

1. Major Processings

   i. Transaction at the cash point

   ii. Purchase of new items by the supermarket

   iii. Rendering of daily account

   iv. Writing and fixing of price tags on items on the shelves

   v. Periodic stock taking.

2. Personnel Responsibilities

   i. Cashiers – collects payments for items purchased

   ii. Purchase Manager – orders for new items

      – receives supply of items with receipt and/or invoice

      – pays for items purchased.

   iii. Account Manager

      – collects money for the day's sales from cashiers.

      – keep an account of the money collected

      – remits money to purchase manager when the need

arises.

iv. Sales Clerks

- writes and affix price tags on items on the shelves

- Counts items on shelves and in the store

- guides customers on location of items.

- double as security guards to keep an eye on customers as they move round the supermarket.

3 Details of Procssing

(a) Sales Transactions at the cash point:

i. Pick an term a customer is purchasing

ii. enter the price of the item into the machine

iii. if more than one item then

iv add the price of next item

v. Repeat step iv until all items have been treated

vi Obtain the total amount

vii. Collect the payment for the items

viii. issue receipt from the machine

ix Pack the items into shopping bag

x hand over items to the customer.

The data used for these processing is the price which is written on the price tag placed on each item. The customer is the source of the data since the processing is initiated by his or her activity.

The processings are:

i. addition of prices to obtain total amount

ii.   production of pay slip or receipt

      iii.   packaging of items.

        No   storage   facility is provided for   information   produced
from   this   processing.   The   only   destination   of   information
identified   is the account manager who receives the   total   amount
from daily sales from the cashier.

      b.   Transaction for Purchase of New Items

            i.   Place an order for new items

            ii.   Receive supply of items

         iii.   Obtain invoice of goods supplied

            iv.   Pay for the goods supplied

            v.   Obtain receipts of payment made.
The   purchase department is faced with an important decision as to
when   and at what quantity items should be purchased so as   to   be
able to manage the inventory effectively.   The following processes
provide information that guides this decision making:

      i.   Counting the items on shelves and in stock to obtain total
            quantity on hand
      ii.   Check if quantity is below reorder point
      iii   report this to purchase manager.

Note: The physical counting is done by sales clerks and reorder
            point is based on sales trend.   No laid down guidelines to
            determine the reorder point.

The data used here are:

i. quantity of item in stock

ii. invoice of items purchased

iii. receipts of payment for the items.

The sales clerks provide the information that prompts the purchase activities.

The processing are:

i. placing of order

ii. receipt of items, invoice and payment receipts

The store here are:

i. Storehouse for the items purchased

ii. Files for invoice and receipts

And the destination of information is the management of the supermarket.

c. Rendering of Daily Sales Account

i. collect amount from cashier

ii. count to ascertain actual amount claimed is rendered

iii. count all the money together to obtain total amount from the day's sales

iv. keep account of the money.

Here the data is money, provided by the cashiers, collection and counting of money are the processings involved, the store of information is the account book while the destination of the information which is the cash is either the supermarket private

safe or the bank account.

D.   Writing and fixing of Price Tags on Items

    i.   Write the prices on labels

    ii.   Attach labels to items

The data here are the prices of each item, the source of this data
is the management of the supermarket, the processing is the
writing of price on labels and placing of labels on items.   No
store for the information and the labels on which the prices   were
written are placed on items for display.

        When change of price occur, the labels are removed and are
replaced with new ones bearing the new prices.   This entail
repeating the processes.

E.   Stock Taking

    i.   Count the items on shelves and

    ii.   count the items in store

    iii. obtian the quantity of the item on hand by additng the
          quantity on shelves to that in store

    iv   Repeat the steps above for all items in the
          supermarket.

The data here is the quantity of item on hand, the sources are the
shelves and storehouse, the processing is counting of individual
items.   the information is stored in the record book such as the
ledger, and the destination of this information are the management
of the supermarket as well as the periodic summary book.

3.   ANALYSIS OF FACTS

    Now that facts about the current system of operation in

supermarkets have been obtained and documented, the next step towards the design of a new system is to analyse the findings so as to highlight the system requirements. The following issues are considered in this analysis:

(a)   Capability:-   This is the ability of the system investigated to achieve the basic purpose and objectives. A capability problem occurs when the system cannot handle transactions or processing requirements to meet desired performance levels. The only area where this kind of problem is identified in the current system used in the supermarkets studies is the transaction at the cash point. The assessment of the processing here gave the following profile:

(i)   long queues of customer waiting to make payment for items purchased at the cash point especially during the peak period.

(ii)   rush to meet up result in error in entering prices into the machine and in calculating amount a customer will pay for items purchased.

These problems could be solved in any of the following ways:

(i) By increasing capabilities: This is done by employing more people and increasing the equipments and other resources used within the system to increase the magnitude of work that can be achieved.

(ii) Lower expectations i.e to reduce the performance requirement.

(iii) Redefine nature of task: this is done by changing the

activities e.g. changing the manual system to automated system.

b.   Control:- This is a set of mechanism that ensures that the activities affecting an organisation's objectives are carried out properly.   Control problems occur when responsibilities are not fixed and when there is no set standards of performance.   Control problems also occur in transaction at cash point as well as in inventory management and rendering of daily sales accounts.   The following profile was obtained from processing assessment:

     i.   Fraudulent practices may occur at the cash points

     ii.   No in-built mechanism to detect fraud when account is being rendered.

     iii.   Supermarkets run out of stock or stock excessively due to improper control of inventory.

Control problem may be solved by:

     i.   Designing a system that will avoid control lapses.

     ii.   Designing a system to detect and report control problems.

     iii   Designing a system to detect, and fix control problems.

C.   Information Accessibility:-   This is the availability of information needed to accomplish an objective in a useful form and when it is required.   This information are often not available and when available, they are not accessible.   Inavailability and inaccessibility of information necessary for decision making affect the purchase department in the supermarket. Accountability is also affected.   This problem could be curbed when a system is designed to either:

i.   eliminate the need for the information;

ii.   ease access to information;

iii. eliminate the need for processing, or

iv.   change the method of presentation

D.   Complexity:-   This involve inter-related or excessive
number of taskes, steps or activities resulting in unacceptable or
incomplete performance. Complexity was identified in label fixing
and stock-taking activities.   The assessment of the processing in
this areas gave the following profile:

1.   Label fixing

i   writing and fixing of labels on items on shelves
      is cumbersome,

ii.   confusion occur when there is need to change the
      price of the items. Temporary closure of the
      supermarket or removal of the items from shelves
      could cause the confusion,

iii. there could be a reduction in the patronage of the
      supermarket when the   supermarket reopens.

2.   Stock Taking

i.   counting of items on shelves and in the store one
      by one is also a cumbersome task,

ii.   results of stock-taking is not always accurate,

iii. the activity is often neglected due to its tedious
      nature.

Complexity problems could be solved with the following three

alternatives:

    i.   Simplification:- this involve removal of unnecessary steps or eliminating the recording of information that will not be needed.

    ii.   Partition the activity by dividing the complex process into separate tasks.

    iii.   Resequence the activity i.e changing the order in which a process is done.

REQUIREMENT SPECIFICATIONS

This is a formulation of all the requirments necessry for new system. These requirements are those features that must be incorporated to produce the desired improvement. The current performance is compared with the objectives for acceptable system performance to bring out the requirements.

From the systems investigations, and as anticipated by the analyst, the following requirements are specified to improve the operations in supermarkets:

(a)   <u>Increase speed of processing sales transaction</u>

This could be done in either of two ways:

    i.   Increase the number of cash points. This entail adding more machine and people to the present ones such that the job could be divided within a larger number of people.

    ii.   Change the nature of processing to automated system. Automation will greatly improve the speed of processing. It involves using computers.

(b)   <u>Error Minimisation</u>: errors due to control problems which

occur in transaction processing and daily account rendering
has to be minimised. The new system should be designed such
that occurrence of these errors could be avoided. In addition
a mechanism to detect and report an error if it occur should
be included.

(c)   Availability of Information

Accurate and up to date information on inventory level and
daily sales summary should be readily available. To
achieve this, the current method of processing has to be
changed such that records of sales and purchases are kept.
In addition, these information should be kept in a way
that they could be accessed easily. The use of computer
with information kept in computer files in a direct access
medium will be very appropriate.

(d)   Removal of Tedious Tasks

As explained earlier, stock taking and placing of price
tags on items involve tedious and cumbersome activities.
These activities could be simplified by changing the
entire system of operation in the supermarket. The new
system of keyboard coding using computers will remove the
task of placing price tags on items entirely and quantity
of items in stock can always be retrieved from the
computer files.

(e)   Improved Accounting System

More often than not, management of supermarkets will

need information onsales trend and general performance of the business. This may be presented in form of reports which may be on monthly, quarterly or yearly basis. These reports are also useful for comparing the trend of sales in one period with another. This will in turn aid in detecting areas where improvement are necessary. Facility to prepare and present these reports should be included in the system.

In addition, since the new system under development is intended to be an automated system, then as mentioned earlier in this chapter, the system will be designed to use computers and hence the general requirements that are associated with the use of computers, are anticipated. They are:

1. Computer Hardware: the hardware required to run the new system consist of a central unit with the central processor, memory, disk drives and control unit; the monitor; keyboard and printer. An average supermarket can use a microcomputer e.g. IBM Personal Computer. One that can use up to five or six terminals will be appropriate for a medium size supermarket. The large supermarkets can however use a minicomputer or a mainframe for those with branches at different locations.

2. Computer Software: The software is to be developed locally using the query language provided in the dBase II plus database management system. The design of this software will be based on the requirements

mentioned earlier.

3. Capacity of the Computer: The capacity is measured
   in terms of main memory and the processor. At least
   the IBM or IBM compartible computers of the series 286
   will be required.

4. Output: Processed data has to be communicated to the
   user. This output can be obtained either through the
   video display unit or a hard copy could be produced
   with the printer. A colour monitor will be prefered
   because of its attractiveness and the fact that
   options can be highlighted in different colours for
   ease of impression.

5. Environmental Requirements: These are the facilities
   that must be provided in the environment where
   computer is istalled to keep it in operation. These
   facilities include:

   i. the computer room: the room where the computer is
      to be installed should be equiped with large
      tables and comfortable chairs for the operators.
      Doors and windows should be air-tight to prevent
      dust from entering the room. In addition,
      computers should be covered to prevent dust when
      the room is being cleaned.

   ii. temperature: As with most machines, computers
       generate heat when in operation. Thus the computer
       room should be air conditioned to cool down the
       system.

iii. humidity: the humidity of the computer room should
be kept low so as to prolong the lifespan of the
computer.

6. _Personnel Requirement:_ Since the new system is intended to
be very simple, the current personnel in most supermarmets can be
trained to operate the system.

7. _Storage Medium:_ The new system intends to keep all records
and be able to retrieve information very fast. A direct access
storage medium such as the flopping diskettes or disks are
required.

8._Maintainance Requirements:_ Maintainance services are required
so as to keep the system working for along period as well as to
meet with growth trends in computer technology.

Hardware maintainance services could be handled by computer
envineers. Computer fiems around could provide these services.

In developing the software, a consideration should be given
to anticipated changes both in hardware technology and user needs.

CHAPTER FIVE

THE DESIGN AND DEVELOPMENT OF A NEW SYSTEM

Once the requirements necessary for improving a system are identified, a new system could be developed. The development of a system is preceeded by the design of the system. The system is designed based on the requirements earlier compiled and a software is then developed from the design. Thus this chapter consist of two main parts:

1.   System design
2.   Development of software

SYSTEM DESIGN

The first step toward designing a new system is to consider the strategies for meeting requirements. The objectives of the design must be satisfied and the elements of design should also be specified. These items will be treated one after the other.

Strategies for Meeting System Requirement

The various steps that could be taken to meet the requirement for system improvement as highlighted in chapter 2 has been given. After careful consideration, the following are the specific strategies to be used in meeting the requirements for designing a new system in this project:

i.   An automated system that uses computers for processing will improve the speed of processing. The system will be designed to do the calculation automatically once the code and quantity of item are supplied to the computer.

ii.   Occurrence of error is also minimised with the use of
computers.   Facility is to be provided to detect report and allow
for correction of errors that may occur during data input.

iii. Records of all transactions is to be maintained such that
releva nt information for decision making can be made available as
required.   The direct access medium is used to store the
information for easy and fast retrieval. the file organisation is
also designed to take care of this.

iv.   Records on each and every items in the supermarket is to be
stored under a code.   Retrieval of each record for transaction
processing will use the code.   The code therefore is distinct for
each item.   There will be no need to label the items with the
prices since this information and others can be retrieved from the
computer using the code.   The only task here is to be able to
remember the code for each item. Facility for quick reminder will
also be provided.

v.   Summary of daily sales as well as other periodic report
should be available for proper accountability.   An in-built
mechanism to obtain information from files and prepare the summary
and report in a presentable format is to be provided.

Objectives for System Design

     System design is a very important stage in the development of
a new system.   The quality of the design is reflected in the
overall performance of the system that emanates from it.   For a
system design to be deemed good, the following objectives must be

satisfied:

i. The logical design elements such as input, output procedure, files and databases to meet system requirements must be specified.

ii. The new system must support the organisation performance. This can be achieved by making the design to fit the way an organisation conduct its business.

iii. The new system should meet users requirements.

iv. The system must be easy to use by staff of the organisation for which it is developed.

v. The new system must provide software specifications i.e input, output, processing functions and algorithm used to perform them.

The design of the new system to be used in supermarket operation is carefully handled to achieve these objectives.

Element of Design

These are the specific areas of the new system that are designed in order to achieve the desired goal. The elements of design in the development of a system to use in supermarket operation are as follows:

1. INPUT

In designing the input of a system, the basic things to note are the following:

a. Control of the amount of input

b. avoidance of delay in input

c. avoidance of error

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d.   simplification of the process of inputting.

when input is captured into the computer, it is stored in a file from where it can be retrieved for processing transaction. The file should be structured to include all the necessary information about the data to be stored in it. this project is using the facilities of the dbase III plus management system for this and other aspect of the system under development. the specific areas of design in input are:

i.   File Structuring

The structure of a file determine the type of data that can be stored in it. The software package with which the system is to be developed provides the facility to design the structure of the file. The file stores the data record by record. Each record contains all the data pertaining to an item or an individual or a situation. The record contains fields under which the data are stored. With the dbase III plus package, a record can contain up to 128 fields each of which can contain up to 4,000 characters. Also as many as 1 billion records can be stored in a file.

Each field of a record is described in the structure of the file. In fact, the first step in creating a file is to design its structure. Thisstructure specifies the following:

(a)   Field name

(b)   Field type

(c)   Width

(d)   Decimal

The field name is a name relevant to the type of data a field will contain in each of the records in the file.

Field Type: this specify the type of data to be entered into a

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field.   Five different types of field can be created.   These are character, numeric, date, logical and memo.   The character type allows for alphanumeric data to be entered into the field.

The numeric type takes only digits, commas and decimal points.

The date type is specified for entering dates.

The logical field type is for logical data "yes" or "no", "true" or "false".

And the memo type is specified when alphanumeric text that has larger number of characters than will be allowed under the character type is to be entered.

Width: the width of a field is the total number of character space to be reserved for the field. Apart from the date and logical types that have fixed width, each field contains variable number of characters up to a specified limit.   Eight character space is reserved for fields specified as date type while logical type fields always have one character space.

Decimal: this is used only when a field is specified as numeric. The number of decimal places is specified here.

In creating a file therefore, the dbase III plus provides a menu driven screen which aid in specifying the structure of the records in the file.   Once the structure is designed, it is saved and ready for data storage.

ii.   Screen Format

In the dbase III plus management package, once a file is

created and its structure specified, data could be entered into the file. The default screen format arranges the fields in a record row by row such that a field name is followed by a highlighted space corresponding to the number of spaces specified in its structure, on a row. The next field occupies the next row accordingly. However, the screen format could be designed to user desire for ease of capturing data. The facility for this is also provided in the software package and could be designed in a program written in the query language of the dbase III plus.

In this project a screen format will be designed to capture data into a file whose structure has been specified. The design of the screen format is included in the program that captures and stores the data.

iii. Input Validation

When data is entered into the computer, it is important to ensure its correctness in order to obtain accurate results when such data is processed.

The validation test in the data capture program ensure that only one record is stored under a code. Once the code is used, the same code cannot be used again. The system will be designed to give an error message if the code is entered again for data capture.

It is also crucial that acceptable data be entered by the user. Templates and functions are used in the design to ensure this.

During transaction processing, the design to ensure wrong

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code is not entered for an item is also inicorporated. This is done by displaying the details about the item for which code is entered on the screen. If an incorrect code is entered, this is detected immediately and a correction can be made.

2. DATA MANAGEMENT

This include the entire activities which uses the data to produce meaningful information. The design include the basic facility for the general management of data. These are facility to:

   (a) delete a record

   (b) edit data in a record

   (c) update a file with another

   (d) view records in a file

   (e) prepare summaries from the file.

The other areas of design are:

(a) Data flow: the movement of data into, around and out of the system is designed. This helps to identify missing data and those onces that are not needed.

(b) Data Processing: the form of processing to adopt is decided. The enline method which is a responsive and feedback system is found most appropriate for the new system.

(c) Data Stores: these are temporary or permanent collection of data. The capacity for storage as well as the type of storage media to be used is decided.

(d) Control: The design involve the inclusion of facility to detect problems or errors when they occur. The design will also allow for error message to be displayed on the screen and

correction can be made.

(e) Roles: the roles and responsibilities of persons and resources within the system are also designed.

3.   OUTPUT

The output are the results or information produced by the system. Output can be in printed form or they may be displayed on the screen.   In designing the output, the following points are noted:

i.   identification of specific output needed to meet
            requirements

ii.   selection of methods of presenting the information

iii.   selection of format of presentation

iv.   recipients of information

v.   types of information

vi.   layout of output.

Identification of output

The different types of output produced within the system are decided in order to design the format and presentation of the information. The output in the system are:

a.   prices of items purchased and the total amount of each
            transaction,

b.   summary of daily sales

c.   list of items in stock

d.   list of new items pruchased by the supermarket.

e.   information on quantity of an item in stock

f.   Periodic reports on sales.

Presentation of Information

The output could be presented as narrative statements, in tabular form, or graphically. The method to be adopted depend on the type of information and also on preference. The new system has a design to present the output emanating from it in tabular form. Some, such as the periodic report may however be accompanied by narative statements as well as graphics such as bar charts.

Method of Presentation

The two basic means of presenting the output will be used. All information will be displayed on the screen. Where necessary, the information will also be printed on paper.

Receipient of Information

The number and categories of people to receive the information should be decided. This is important for security of information and to decide on number of hardcopy to produce.

4.   FILE DESIGN AND ORGANIZATION

A number of files of different types may be kept in an organisation depending on the nature of business. Basically, every organisation keeps master files which are permanent files containing records vital to the running of the organisation. It contains virtually all the relevant data for the activities of the organisation.

A transaction file, also vital to the operation of an organisation, contain data about business activities taking place within a specified period of time. The transaction file is normally used to update the master file at the end of transaction period. Transaction files are therefore temporary files.

Report files are temporary files. As the name implies, they contain reports generated from transaction activities. The purpose of having a report file is either to spool reports in waiting for the printer or to retain the reports for a certain period of time.

A merge file is a combination of two or more sorted files usually transaction and report files into a single one.

The design of a new system to be used in supermarket will include the different types of file mentioned above. the master file will contain all the relevant data about each and every merchandise in the supermarket. At least two transaction files will be needed to take care of purchase and sales transaction. The sales transaction file may however be more than one depending on the number of cash points present in the supermarket. If more than one file is used for transaction, a merge file is used to combine all the data prior to updating the master file.

A report file is used every day. that means six in a week. At the end of the wek however, all six files are merged to produce the week's report. In turn all the week's report files will generate the month's report. This in turn produce the quarterly and then the yearly report.

All the files to be used will have a backup file each to take

care of unexpected situation such as loss of files due to
carelessness or hardware fault.

Another important aspect of file design is the organisation
of the file. Different methods of file organisation exist. These
are:

1.   Serial File Organisation: Which stores record in physical
adjacent locations without reference to any particular sequence.
To access a record within this file require that all records
preceeding the one of interest be accessed first.

2.   Sequential File Organisation

On the other hand stores record in a certain order depending
on the sort key. A serial file is sorted on a certain key to
produce the records of the file in a desired sequence. Access to
a record is however same as in serial file organisation.

3.   Random File Organisation

This file organisation stores record randomly. No sequencing
is observed for storage of the records. Each record is stored on
a key and the same key is used to access it.

As with type of file, the organisation of the files to be
used in a busines firm depend on the kind of processing as well as
the volume of data to be processed. The new system under
development for use in supermarket will include design to use a
random file organisation for all transaction files as well as the
master file. The other files can however contain records that are
stored sequentially. The system is developed to be useful in both
small and large supermarkets alike. Hence the design is such that
large volume of data can be stored. The use of database is

therefore considered necessary so as to be able to accummodate and effectively manage the large volume of data envisaged.

SOFTWARE DEVELOPMENT

The next stage in system development after the design of the system is the development of software. Software development entails writing of programs based on the design already formulated. Hoever, before a program can be written, it is necessary to identify every step and path making the solution to the problem at hand. An algorithm which is a decription of the step by step method of solving problems can then be drawn. A graphical representation of this algorithm, called flowchart is most appropriate to use.

The following are the different programs that make up the software development for use in supermarkets. the programs are written in modules and linked together by a menu program. Each program is preceeded by the flowchart on which it was developed.

DATA CAPTURE ROUTINE

For a computerised system, the data on items for which transaction will be done should be stored in a file. At any transaction, these data will be retrieved from the file. The data capture routine allows user to enter data concerning the merchandise in a supermarket, through the keyboard. The data is automatically saved. The program used in this routine is based on the following flow-chart:

```
                        ┌──────────────┐
                        │    START     │
                        └──────┬───────┘
                               │
        ┌──────────────────────┼──────────────────────────┐
        │                      ▼                           │
        │         ╱─────────────────────────╲              │
        │        ╱     READ CODE NUMBER       ╲             │
        │        ╲─────────────────────────────╱           │
        │                      │                           │
        │                      ▼                           │
        │        ┌───────────────────────────────┐         │
        │        │         OPEN FILE;            │          │
        │        │   VALIDATE CODE NUMBER        │          │
        │        └───────────────┬───────────────┘         │
        │                        │                          │
        │                     ╱─────╲                       │
        │                    ╱  IS   ╲        NO            │
        │                   ╱  CODE    ╲───────────────────►┘
        │                    ╲ VALID? ╱
        │                     ╲─────╱
        │                        │ YES
        │        ┌───────────────▼───────────────╲
        │       ╱      READ DETAILS FOR           ╲
        │      ╱            ITEM                    ╲
        │      ╲───────────────┬────────────────────╱
        │                      │
        │                   ╱─────╲
        │        NO        ╱  ARE  ╲
        └◄────────────────╱ ENTRIES ╲
                          ╲ CORRECT? ╱
                           ╲───────╱
                              │ YES
                   ┌──────────▼──────────╲
                  ╱   MOVE DATA TO        ╲
                 ╱      STORAGE            ╲
                 ╲──────────┬───────────────╱
                            │
                         ╱─────╲
              YES       ╱  ANY  ╲
       ┌◄──────────────╱  MORE   ╲
       │               ╲ ENTRIES? ╱
       │                ╲───────╱
       │                   │ NO
       │        ┌──────────▼──────────┐
       │        │     CLOSE FILES     │
       │        └──────────┬──────────┘
       │                   │
       │            ┌──────▼───────┐
       │            │   S T O P    │
       │            └──────────────┘
```

60
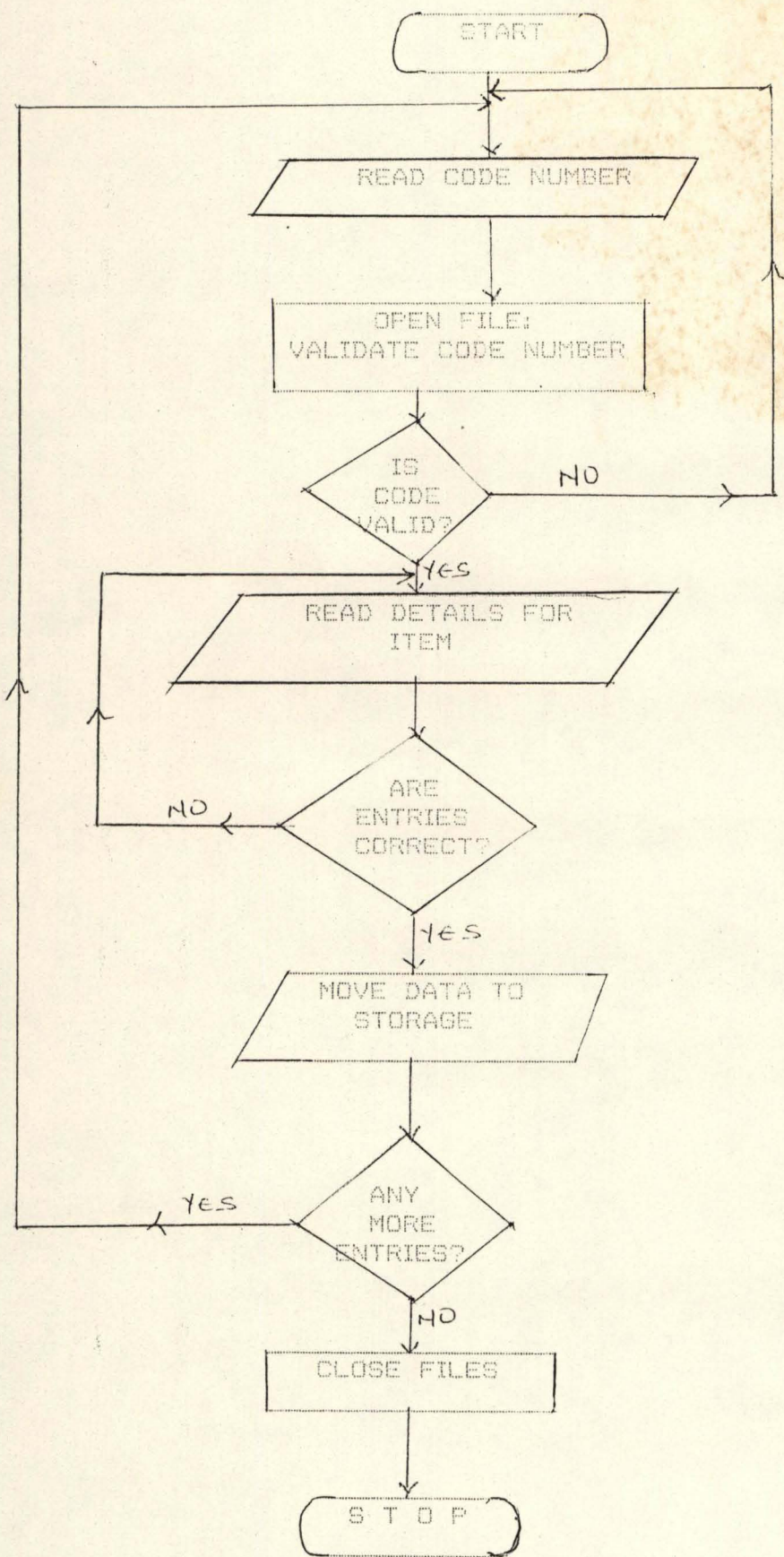
DATA CAPTURE PROGRAM   (CAPTURE.PRG)

```
*    This program capture data into a file
Set color to w/b, n/g, r,/n
clear
use market
do while .t.
      mcode_no = space(3)
      @12,30 to 18,55 double
      @15,31 say "ENTER CODE NUMBER" get mcode_no pict "@!"
      read
      locate for code_no = mcode_no
      if found()
      @18,33 say "Record already exist"
      wait""
      clear
      loop
      else
      endif
      clear
*DECLARE ALL VARIABLES
      mgname = space(15)
      msname = space(15)
      mcprice = space(15)
      msprice = 0.00
      mqty = 0
      mreorder = 0
      msupplier =
      msize = space(6)
      meoq = 0
      mdemand = 0
      mdesc = space (60)
*FORMAT SCREEN TO ENTER DETAIL OF ITEMS
do while .t.
@2,30 say "ITEM DETAILS"
@3,2 TO 23,78 DOUBLE
@4,28 Say "Code number:" get mcode_no
@6,5 say "General name:" get mgname pict "@!"
@9,5 say "Specific name:" get msname pict "@!"
@12,5 say "Size          :" get msize pict "@!"
@15,5 say "Supplier     :" get msupolier pict "@!"
@18,5 say "Description  :" get mdesc pict "@S20"
@21,5 say "Qty in stock:" get mqty
@9,44 say "Cost     price:" get mcprice
@12,44 say "Selling price:" get msprice
@15,44 say "Reorder point:" get mreorder pict "9999"
@18,44 say "Econ. order.Qg:" get mqty pict "99999999"
@21,44 say "Demand last period:" get mdemand pict "9999999"
read
*CONFIRM ENTRIES
@23,20 say "all entries confirmed? (Y/N)"
k = 0
do while k = 0
      k = inkey()
```

```
        if upper(chr(k)) $ "YN"
        exit
        endif
        k = 0
enddo
if upper(chr(k)) = "N"
clear
loop
else
append blank
replace  code_no  with mcode_no,  gname with mgname,  s_name  with
msname,  size with msize,  desc with mdesc,  c_price with mcprice,
s_price  with  msprice,  qty with  mqty,  reorder  with  mreorder,
supplir with msupplier, eoq with meoq, demand with mdemand
exit
endif
enddo
@23,20 say "any more entries? (Y/N)"
f = 0
do while f = 0
        f = inkey()
        if upper (chr(f)) $ "YN"
        exit
        endif
        f = 0
if upper(chr(f)) = "Y"
clear
loop
else
close databases
exit
endif
enddo
clear all
clear
set color to
return
```

EDIT/UPDATE ROUTINE

Data used in business organisation are seldom static.
Changes occur very often. Example of such changes in supermarket
business is price changes. This change has to be reflected
immediately in the file so as to maintain an up to date data. The
edit routine is designed to enable users to effect changes on any
of the data when necessary.
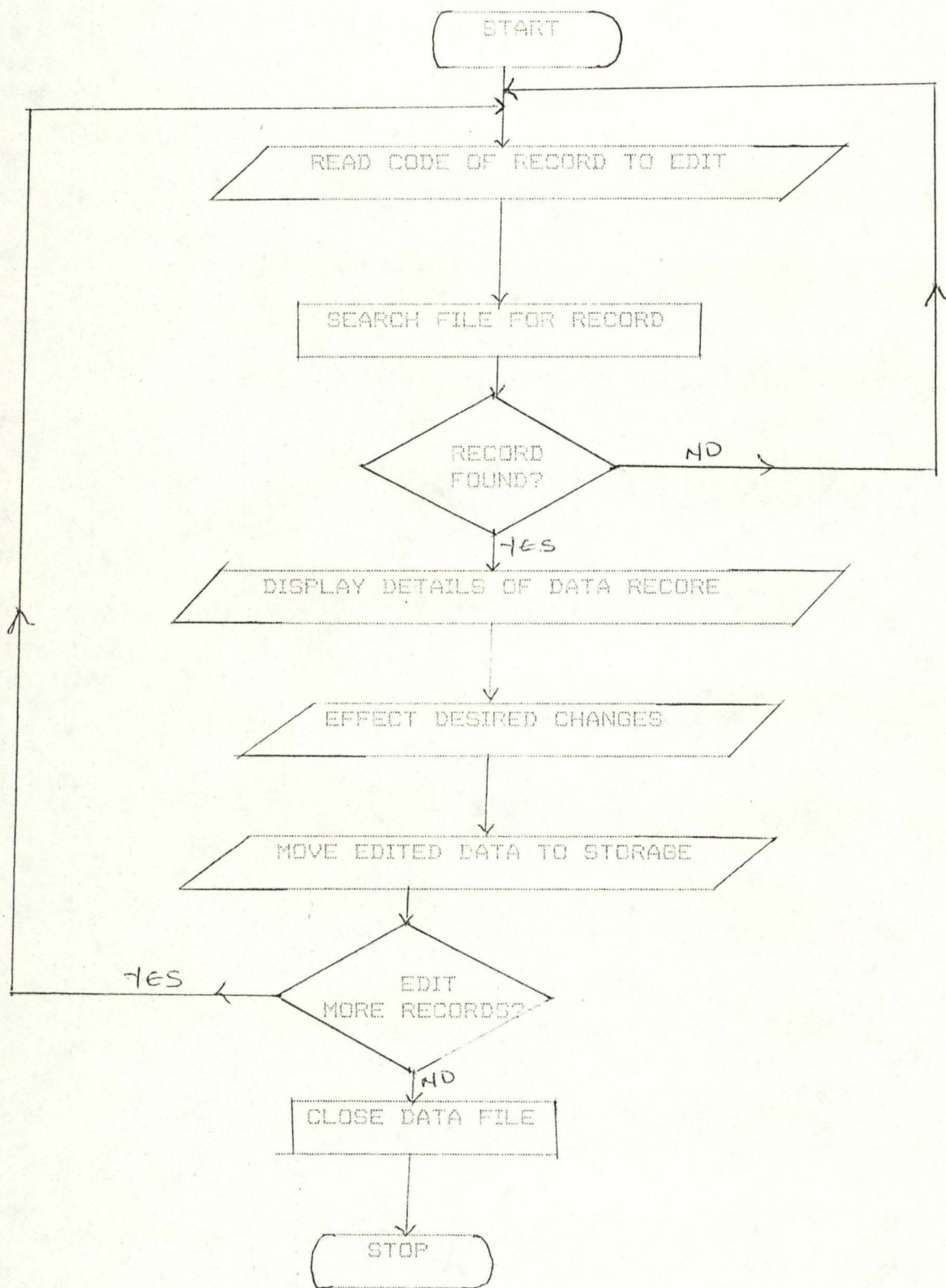
EDIT ROUTINE FLOWCHART
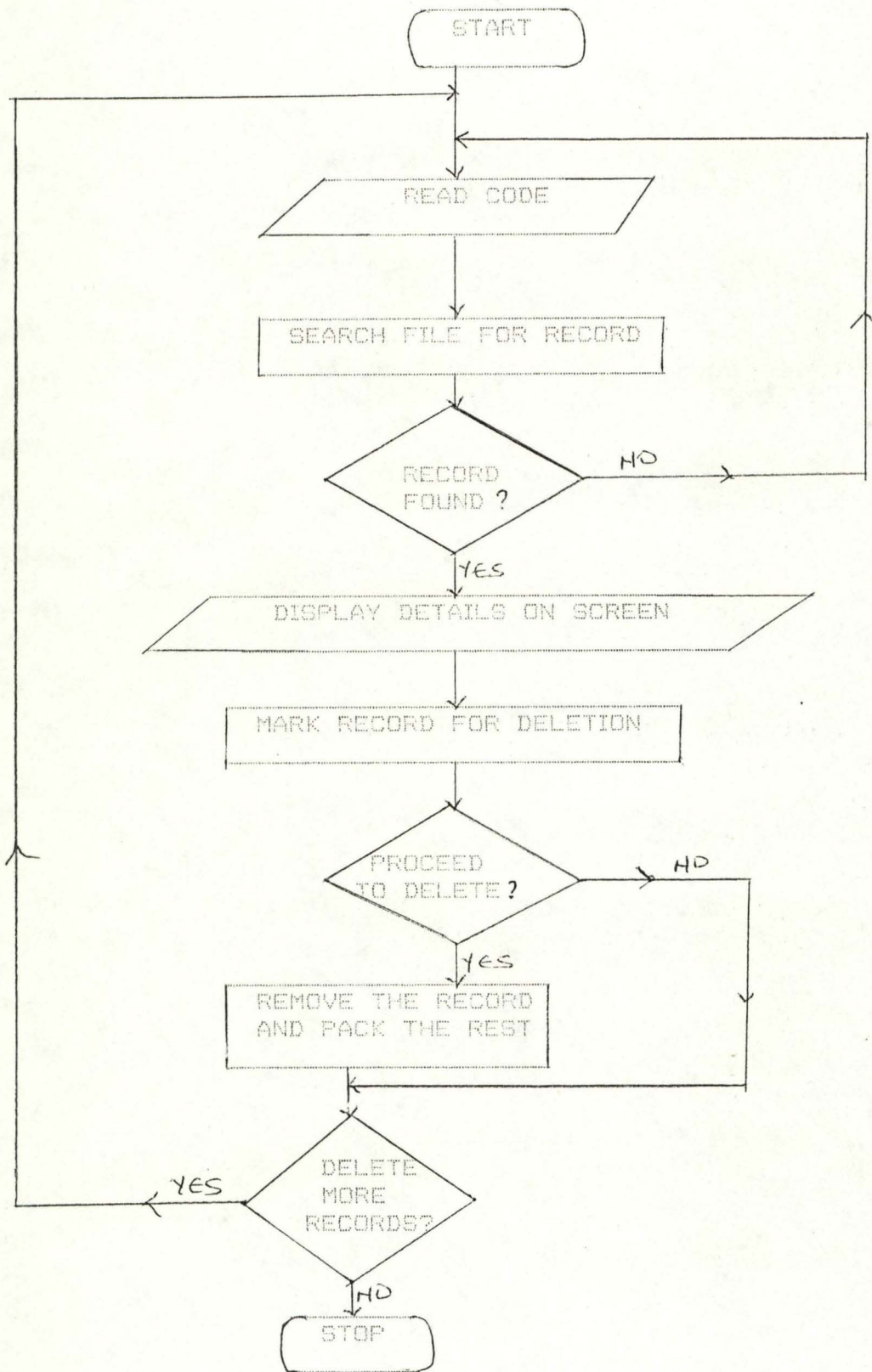
PROGRAM TO EDIT DATA FILE   (FILE EDIT.PRG)

```
   clear
   set color to w/b, n/g, r,/n
   use market
   do while .t.
       mcode_no = space(3)
       @12,30 to 18,55 double
       @15,33 say :Enter code number" get mcode_no pict "@!"
       read
       locate for code_no = mcode_no
       if .not. found()
       @18.32   say  "Record  does  not  exist:   Retrieve  another
                 record? (Y/N)"
       j = 0
       do while j = 0
            j = inkey()
            if upper (char(j)) $ "YN"
            exit
            endif
            j = 0
       enddo
       if upper(chr(j)) = "Y"
            clear
            loop
            else
            exit
       endif
*FORMAT SCREEN TO DISPLAY DETAILS
@2,30 say "ITEM DETAILS"
@3,2 to 23,78 double
@4,28 say "Code number:" get code_no
@6,5 say "General name:" get g_name
@9,5 say "Specific name:" get s_name
@12,5 say "Size         :" get size
@15,5 say "Supplier     :" get supplier
@18,5 say "Description :" get disc pict "@s20"
@21,5 say "Qty in stock:" get qty
@9,44 say "Cost price  :" get c_price
@12,44 say "Selling price :"get s_price
@15,44 say "Reorder point:" get reorder
@18,44 say "Econ. orde qty:"
@21,44 say "Demand last period:" get demand
read
@23,30 say "Any more record to edit? (Y/N)"
f = 0
do while f = 0
     f = inkey()
     if upper (chr(f)) $ "YN"
          exit
     endif
  f = 0
 enddo
```

```
if upper(chr(f)) = "Y"
        clear
        loop
        else
        exit
endif
enddo
close databases
clear all
clear
return
```

ROUTINE TO DELECT DATA RECORD

It is not uncommon for supermarkets to phase out the sale of certain item(s). Once the item is exhausted from the stock, new purhases are not made. The record on such item may then be removed from the file at least to create more space. The facility for removing unwanted records is provided for in the software package. The following design and its program gives the delete routine.

START

READ CODE

SEARCH FILE FOR RECORD

RECORD FOUND ? — NO

YES

DISPLAY DETAILS ON SCREEN

MARK RECORD FOR DELETION

PROCEED TO DELETE ? — NO

YES

REMOVE THE RECORD AND PACK THE REST

DELETE MORE RECORDS? — YES

NO

STOP

FLOWCHART FOR DELETE ROUTINE

66

PROGRAM TO DELETE DATA RECORD   (DELETE. PRG)

```
clear
use market
do while .t.
mcode_no = space(3)
set color to n/gr, w/b
@9,10 clear to 13,70
@11,14 say "ENTER CODE NUMBER" get mcode_no
read
locate for code_no = mcode_no
if .not. found()
@11,15 say "Record does not exist: Get another? (Y/N)"
a = 0
do while a = 0
        a = inkey()
        if upper(char(a)) $ "YN"
              exit
           endif
           a = 0
        enddo
        if upper (chr(a)) = "Y"
              clear
              loop
              else
              exit
        endif
*DISPLAY RECORD TO DELETE
@2,2 say recno()
@2,30 say "ITEM DETAILS"
@3,2 to 23,78 double
@4,28 say "Code number:" get code_no
@6,5 say "General name:" get g_name
@9,5 say "Specific name:" get s_name
@12,5 say "Size          :" get size
@15,5 say "Supplier    :" get supplier
@18,5 say "Description :" get disc pict "@s20"
@21,5 say "Qty in stock:" get qty
@9,44 say "Cost price  :" get c_price
@12,44 say "Selling price :"get s_price
@15,44 say "Reorder point:" get reorder
@18,44 say "Econ. orde qty:"
@21,44 say "Demand last period:" get demand
Delete
@22,26 say "Record is marked for deletion"
@23,22 say "Press D to complete, R to unmark the record"
set color to g*
@23,28 say "D"
@23,42 say "R"
set color to n/gr
b = 0
do while b = 0
```
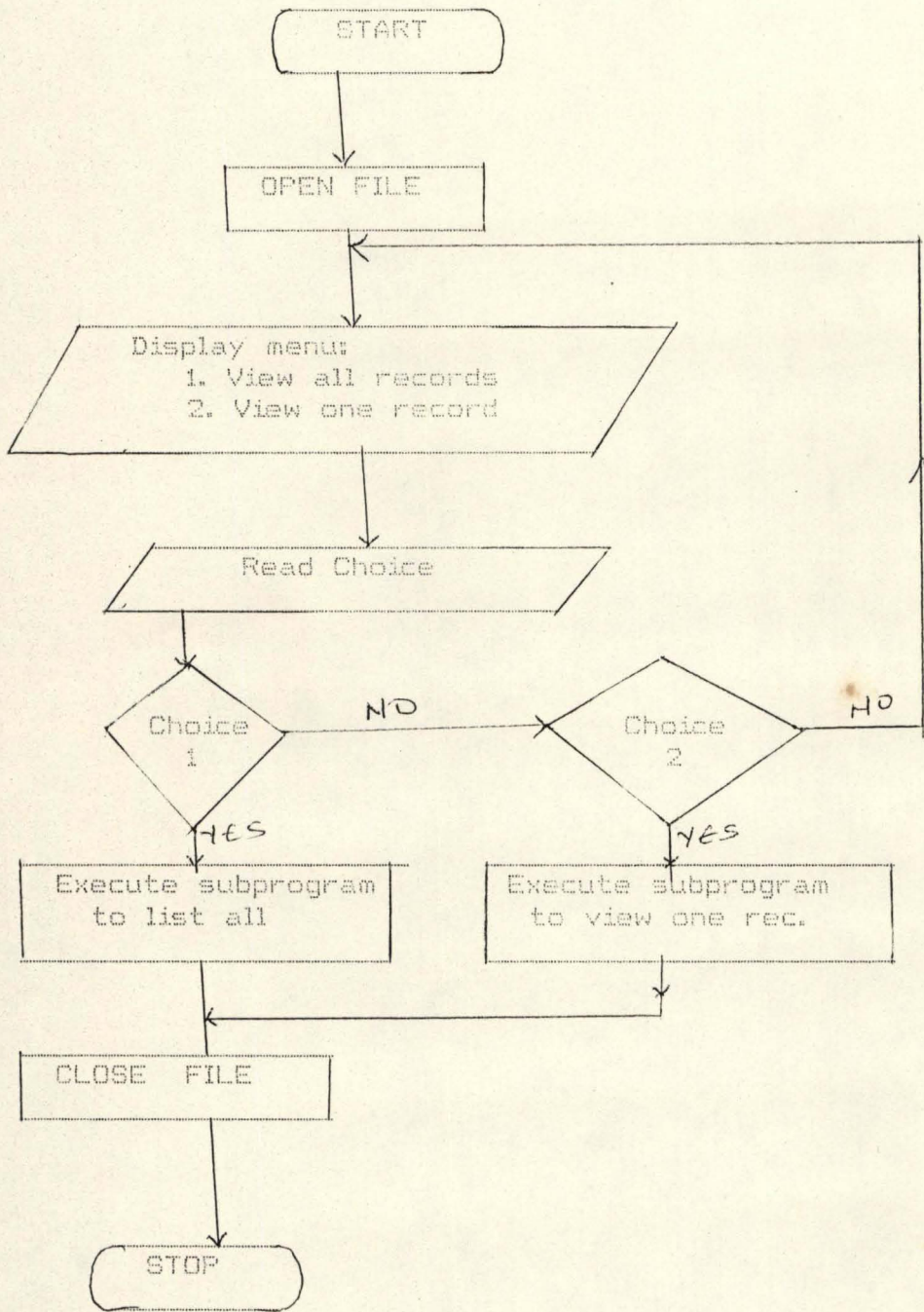
```
        b = inkey()
        if upper (chr(b)) $ ."DR"
             exit
        endif
        b = 0
  enddo
if upper(chr(b)) $ "R"
        recall
        else
        pack
   endif
  set color to r*
@23,22 say "Delete more records? (Y/N)"
c = 0
do while c = 0
        c = inkey(c)
        if upper (chr(c)) $ "YN"
  exit
endif
c=0
enddo
set color to
if upper(chr(c)) = "Y"
        clear
        loop
        else
        exit
endif
enddo
close databases
clear all
clear
return
```

VIEWING RECORD(S) IN A FILE

This routine allow user to view details of record one after
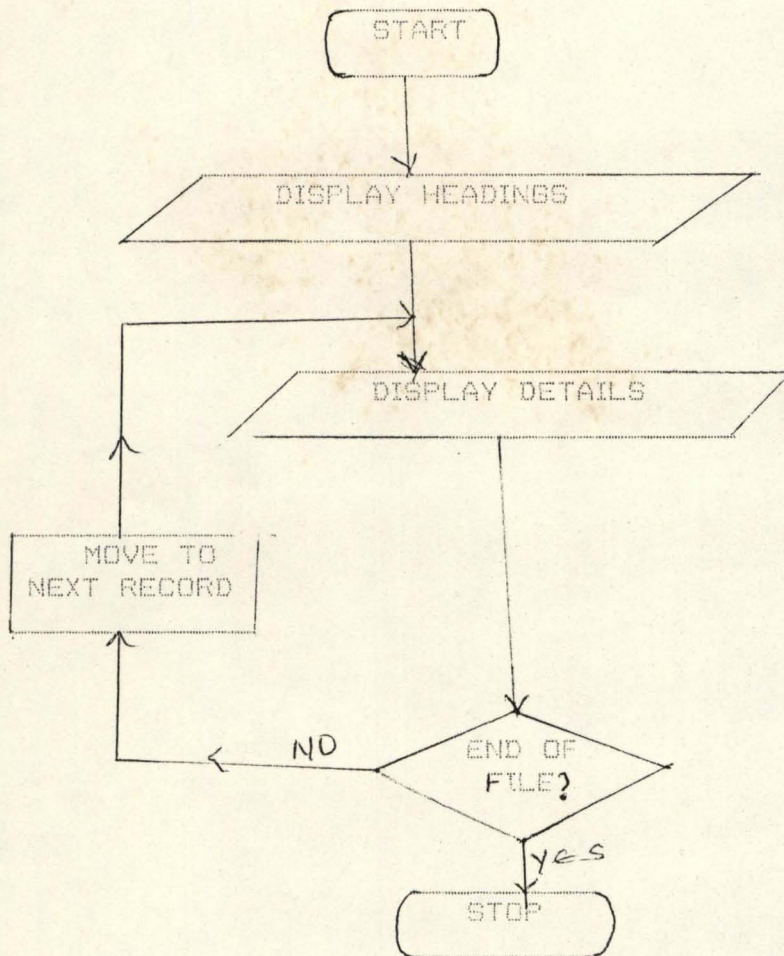he other, or to see a full list of all records in a file

```
                    ┌─────────────┐
                    (    START     )
                    └──────┬──────┘
                           │
                    ┌──────▼──────┐
                    │  OPEN FILE  │
                    └──────┬──────┘
                           │◄──────────────────────────────┐
                    ┌──────▼──────────────┐                │
                   /  Display menu:       /                │
                  /   1. View all records/                 │
                 /    2. View one record/                  │
                /──────────────────────/                   │
                          │                                │
                 /────────▼──────────/                     │
                /    Read Choice     /                      │
               /───────────────────/                       │
                    │                                       │
          ┌─────────┴─────┐            NO      ┌───────────┴──┐   NO
          <   Choice 1    >──────────────────< Choice 2 >──────────┘
          └───────┬───────┘                  └────────┬──────┘
               YES│                                YES │
        ┌─────────▼────────┐            ┌─────────────▼──────┐
        │ Execute subprogram│          │ Execute subprogram  │
        │   to list all     │          │  to view one rec.   │
        └─────────┬────────┘           └─────────────┬──────┘
                  │◄───────────────────────────────────┘
        ┌─────────▼────────┐
        │   CLOSE  FILE    │
        └─────────┬────────┘
                  │
          ┌───────▼──────┐
          (    STOP       )
          └──────────────┘
```

FLOWCHART FOR VIEW ROUTINE

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PROGRAM TO VIEW RECORDS   (LIST MENU.PRG)

```
clear
choice = 0
do while .t.
        @8,20 to 16,50 double
        @9.21 say "Viewing record in a file"
        @11,26 say "1! List all records"
        @13,26 say "2! view one record"
        @16,21 say "Enter 1 or 2 as applicable" get choice pict "9"
        read
        do case
            case choice = 1
            do list all
            case choice = 2
            do viewrec
            otherwise
            clear
            loop
    endcase
enddo
clear all
close databases
clear
return
```

LIST ALL SUBPROGRAM

START

DISPLAY HEADINGS

DISPLAY DETAILS

MOVE TO
NEXT RECORD

NO

END OF
FILE?

yes

STOP

FLOW CHART FOR LIST ALL SUBPROGRAM

(LISTALL.FRG)   PROGRAM TO LIST ALL RECORDS IN A FILE

```
clear
rol = 6
use market
@2,25 say "ITEM AVAILABLE IN STOCK"
@3,25 say repl("-",25)
@4,0 say "CODE:"
```

```
@4,10 say "NAME:"
@4,23 say "Q/STOCK:"
@4,35 say "C/PRICE:"
@4,49 say "S/PRICE:"
@4,64 say "R/P:"
@4,71 say "EOQ:"
@5,0 TO 5,79 DOUBLE
do while .not. eof()
@row, 0 say ":"
@row, 2 say code_no
@row, 7 say ":"
@row 8 say S_name
@row, 22 say ":"
@row, 23 say qty
@row, 33 say ":"
@row,35 say C-price
@row, 47 say ":"
@row ,49 say S_Price
@row, 61 say ":"
@row,62 say reorder
@row, 68 say ":"
@row, 71 say eoq
@row, 79 say ":"
  row = row + 1
 if row + 22
wait
@6,0 clear to 23,79
row = 6
   endif
   skip
   enddo
   return
```
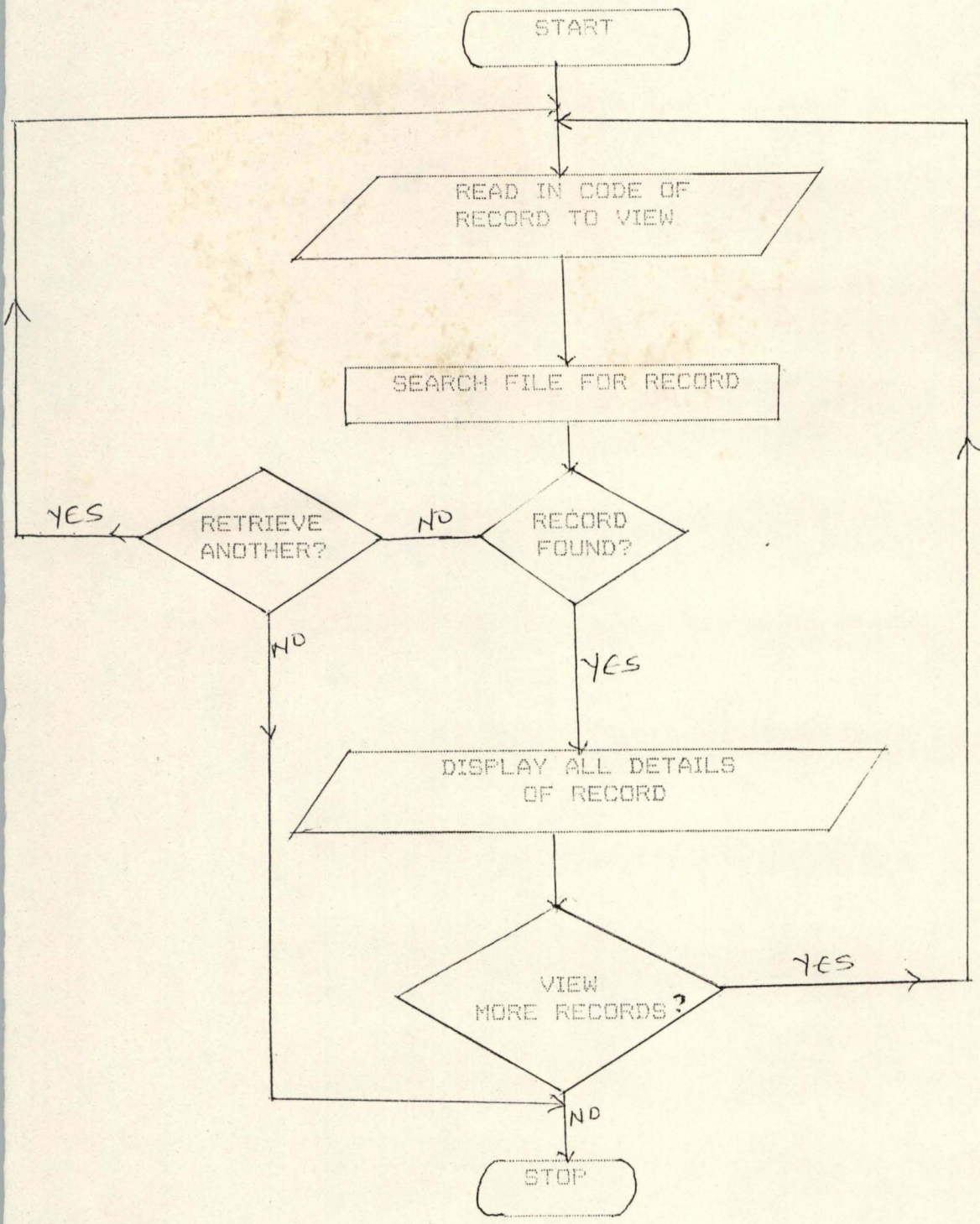
FLOW CHART FOR VIEWREC SUBPROGRAM

```
clear
set color to w/b, n/g, r,/n
Do while .not. eof()
        mcode_no = space(3)
        @10,32 say "Enter code number"
        @12,22 to 16,64 double
        @15,31 say "Code number" get mcode_no pict "@!"
        read
        locate for code_no = mcode_no
        if  not found()
        @18,24 say "Record does not exist: Get another? "(Y/N)"
        a = 0
        do while a = 0
        a = inkey()
        if upper(chr(a)) $ "YN"
             exit
        endif
        a = 0
        enddo
        if upper(chr(a)) = "Y"
        clear
        Go top
        loop
        else
        exit
        endif
*DISPLAY DETAILS OF RECORD
@2,2 say recno()
@2,30 say "ITEM DETAILS"
@3,2 to 23,78 double
@4,28 say "Code number:" get code_no
@6,5 say "General name:" get g_name
@9,5 say "Specific name:" get s_name
@12,5 say "Size          :" get size
@15,5 say "Supplier    :" get supplier
@18,5 say "Description :" get disc pict "@s20"
@21,5 say "Qty in stock:" get qty
@9,44 say "Cost price  :" get c_price
@12,44 say "Selling price :"get s_price
@15,44 say "Reorder point:" get reorder
@18,44 say "Econ. orde qty:"
@21,44 say "Demand last period:" get demand
@23,26 say "View More records? (Y/N)"
 f = 0
 do while f = 0
      f = inkey()
      if upper (chr(f)) $ "YN"
      exit
endif
 f = 0
```

```
enddo
if upper(chr(f)) = "N"
exit
else
go top
clear
loop
endif
enddo
clear all
clear
return
```

SALES TRANSACTION ROUTINE

This routine consist of the program that process sales transaction and automatically update the record of the items in the file. the program calculates the amount of money a customer will pay for the items purchased and also issue out the pay slip. Each transaction is recorded in the transaction file from where the total sales per day as well as the total amount of money can be retrieved. The transaction file is also used to update the master file at the end of the day's business.
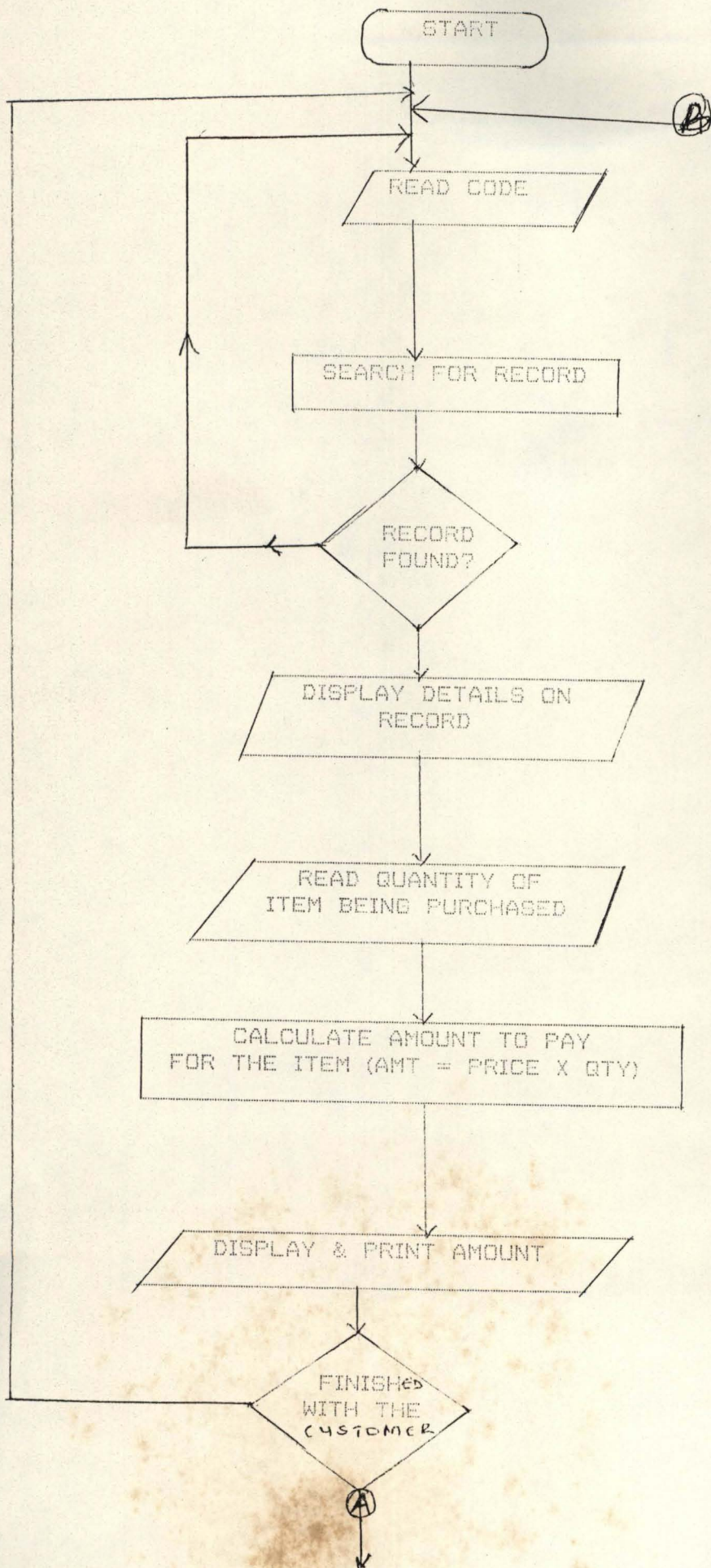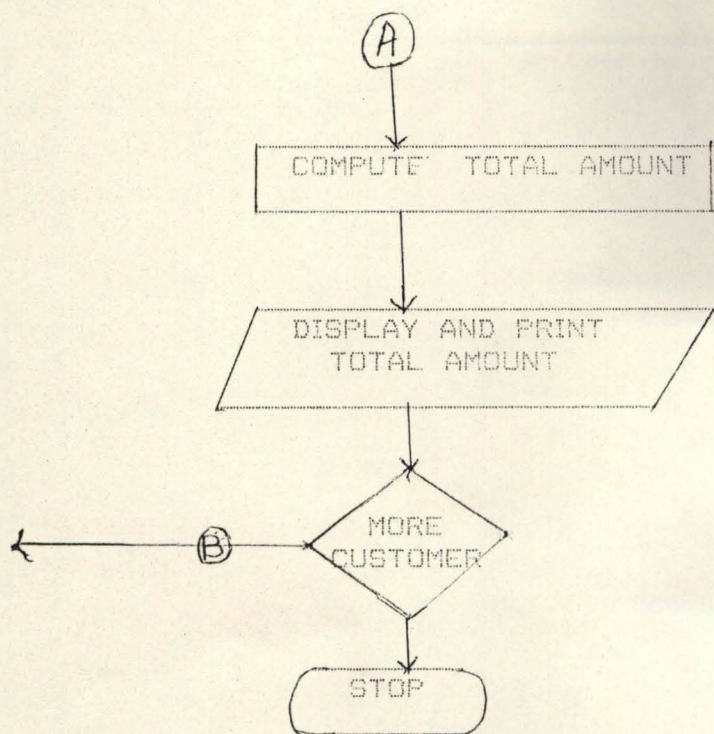
FLOW CHART FOR SALES TRANSACTION ROUTINE

SALES TRANSACTION PROGRAM   (SALES.PRO)

```
clear .
set color to w/b, n/g, r,/n
select A
use market
select B
use super
mcode_no = space(3)
row = 6
msum = 0
choice + space(1)
select b
repl all q-sold with 0
Do while .T.
        @10,30 to 14,52 double
        @11,33 say "Enter code number"
        @13,40 get mcode_no pict "@"
        read
        select A
        locate for code_no = mcode_no
        if .not. found()
```

```
        @14,32 say "Code does not exist"
        wait
        clear
        loop
        else
        @3,2 clear to 22,65
  *Declare variables
        mnumber = 0
        mtotal = 0
  endif
@2,1 to 23,79 double
  set color to n/r
@4,31 to 6,49
@5,32 say "CODE NUMBER:" + mcode_no
set color to w/b, n/g, r,/n
@9,4 say "GENERAL NAME:" + G_NAME
@11,4 say "SPECIFIC NAME:" + s_name
@13,4 say "SIZE            :" + size
@15,4 say "PRICE           :" + Str(S-price)
@18,4 say "NUMBER OF COMMODITY PURCHASED:"
@18,44 get mnumber pict "99"
read
  mtotal = mnumber * s-price
select B
  locate for code_no = mcode_no
repl q_sold with Q-sold + mnumber
@20,14 say Total Price =" + Str(mtotal)
set printer on
  set color to n/g
@3,67 to 22,78
@4,68 say "**AMOUNT**"
5,68 to 5,77 double
@row,68 say mtotal pict "9999999.99"
msum = msum + mtotal
  set printer off
row = row + 1
if row + 18
@6,68 clear to 18,77
row = 6
endif
set color to w/b, n/g, r,/n
@23,21 say "Done with the customer? (Y/N)"
k = 0
Do while k = 0
        k = inkey()
        if upper(chr(k)) $ "YN"
             exit
        endif
        k = 0
enddo
if upper(chr(k)) = "N"
@3,2 clear to 22,65
loop
else
set printer on
```

```
set color to n/r*
@19,68 say "***sum***"
@20,68 to 20,77 double
@21,68 say msum pict "9999999.99"
set printer off
msum = 0
wait
endif
set color to w/b, n/g, r,/n
clear
@17,0 say ""
wait "Press R to continue with the next customer,;
      Q to quit at close of business" to choice
do while choice = space(1)
choice = inkey()
if upper(chr(choice)) $ "RQ"
exit
endif
choice = space(1)
enddo
row = 6
do case
case upper(choice) = "R"
clear
loop
case upper(choice) = "Q"
exit
end case
enddo
close databases
clear all
clear
return
```

ROUTINE TO PRODUCE DAILY SALES SUMMARY

At the end of each day's business, a report is produced to
summarise the total sales.   If there are more than one cash point
in the supermarket, a report is produced first for each and later
combined into one.   This routine takes care of this such that the
accounting system is improved.
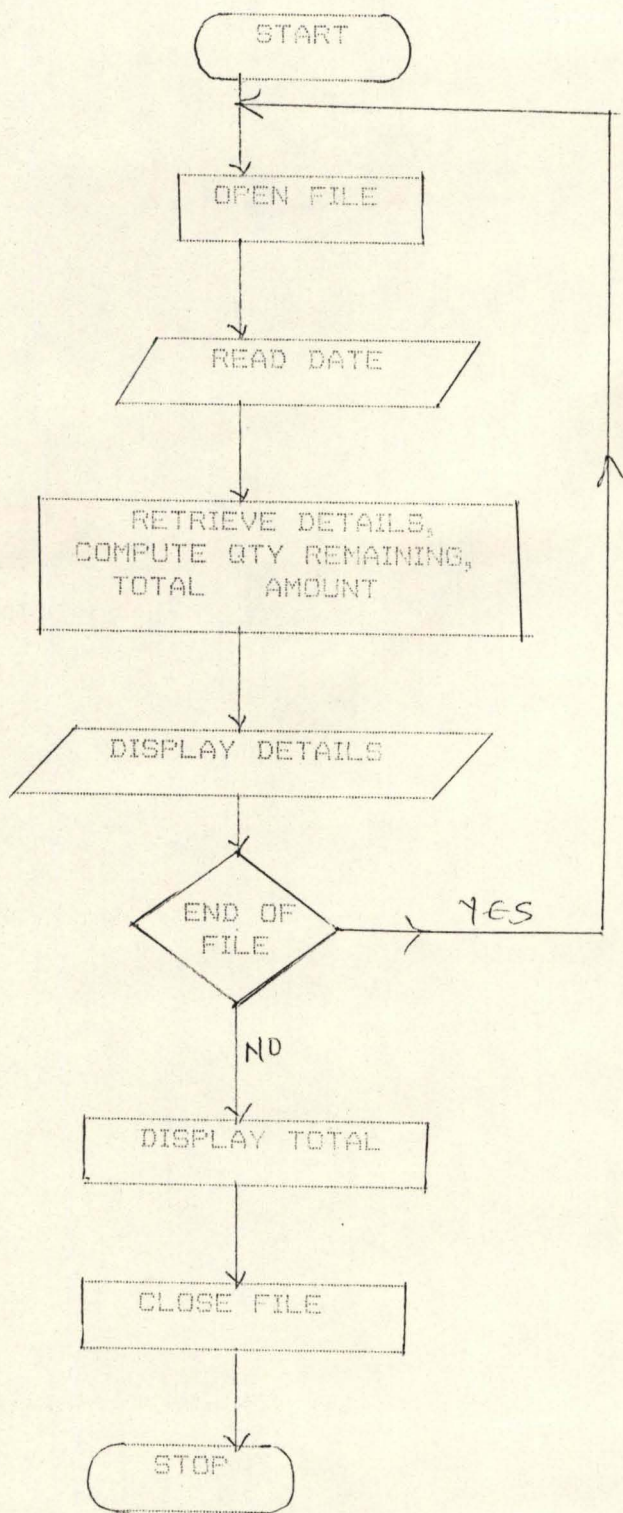
FLOWCHART FOR DAILY SALES SUMMARY

PROGRAM TO GIVE REPORT OF DAILY SALES   (REPORT.PRG)

```
clear
use super
t'date = ctod ("   /    /   ")
@10,28 to 15,50
@11,30 say "Enter today's date"
@13,34 get tdate pict "@E"
read
wait
clear
row = 5
qrem = 0
mamount = q
@1,1 say tdate
@3,2 say "CODE:"
@3,19 say "Q/STOCK:"
@3,34 say "Q/SOLD:"
@3,49 say "Q/REM:"
@3,64 say "AMOUNT:"
@4,2 to 4,76
Do while .not. eof()
@row,2 say ":"
@row,6 say code_no
@row,14 say ":"
@row,17 say qty
@row,32 say ":"
@row 36 say q-sold
@row,47 say ":"
qrem = qty - q_sold
@row,51 say qrem
@row,62 say ":"
@row,66 say amount
@ row,77 say ":"
row = row + 1
if row = 22
wait
clear
row = 5
endif
mamount = amount + amount
skip
enddo
wait
? TOTAL amount = " ;mamount
close databases
clear all
clear
return
```
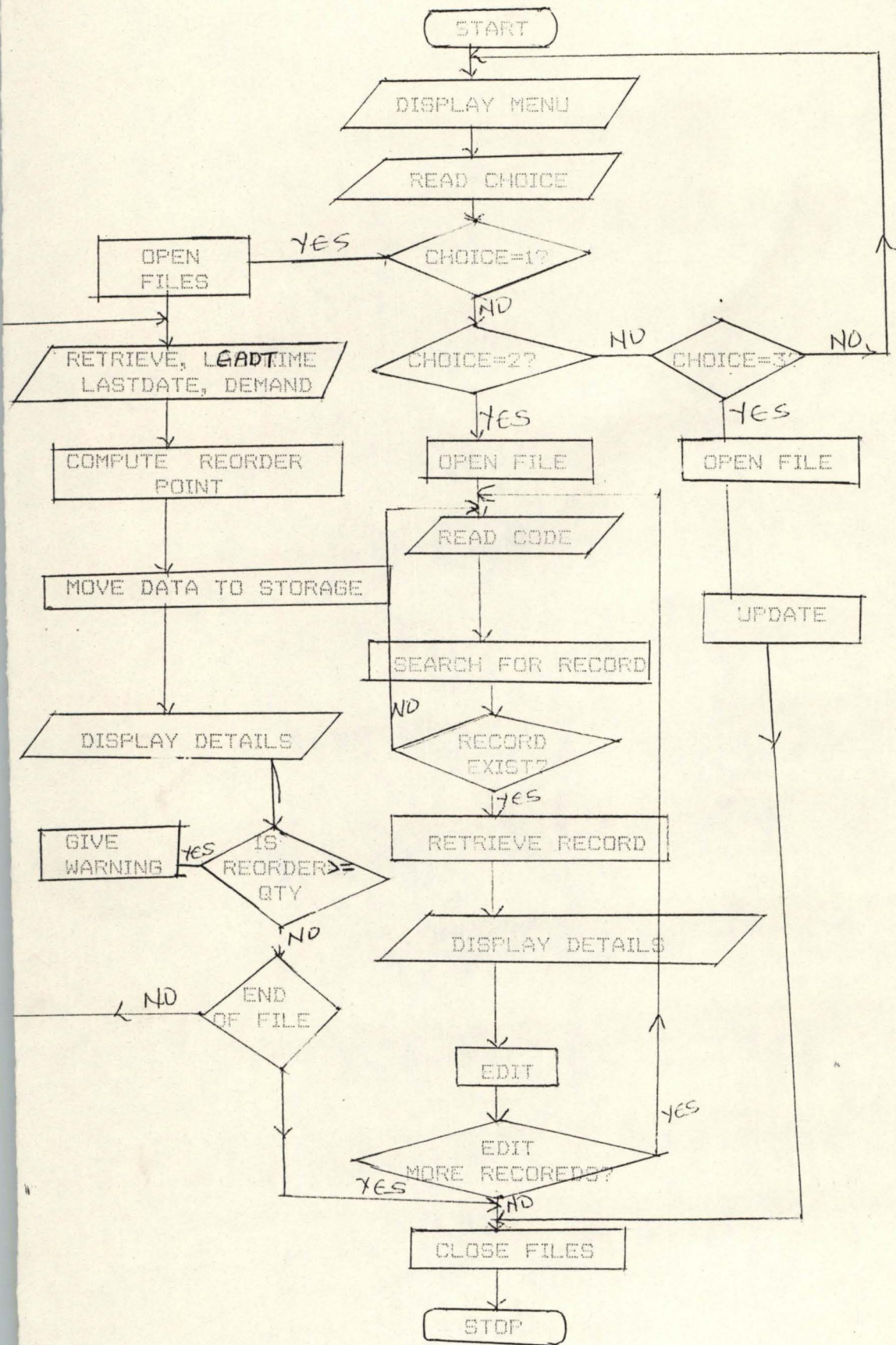
FLOWCHART FOR INVENTORY MANAGEMENT ROUTINE

PROGRAM TO AID MANAGEMENT OF INVENTORY   (PURCHASE.PRG)

```
clear
tdate = ctod ("  /  /  ")
@10,28 to 15,50 double
@11,30 say "Enter today's date"
@13,35 get tdate pict "@E"
read
wait
do while .t.
     choice = 0
       r = 6
       set color to w/b
       @6,18 clear to 20,62
       @7,20 to 20,60 double
       @9,25 say "MENU FOR PURCHASE ACTIVITIES"
       @10,25 to 10,52
       @12,28 say "1: PURCHASE INFORMATION"
       @14,28 say "2: EDIT PURCHASE FILE"
       @16,28 say "3: UPDATE MASTER FILE"
       @18,28 say "4: EXIT PURCHASE ROUTINE"
       @20,25 say "Select 1,2,3 or 4 as applicable "get choice pict
                    "9"
read
do case
 case choice = 1
 select A
 use Market
 select B
 use purchase
 do while .not. eof()
 select A
 mdemand = demand
 select B
day = 1-date - tdate
mreorder = demand/day * leadtime
select A
repl reorder with mreorder
enddo
clear
@2,25 say "PURCHASE INFORMATION
@3,25 say repl("-",20)
@4,0 say ":CODE:"
@4,10 say "NAME:"
@4,23 say "Q/STOCK:"
@4,35 say "C/PRICE:"
@4,49 say "S/PRICE:'
@4,64 say "R/P:"
@4,71 say "EOQ:"
@5,0 to 5,79 double
      select A
```

```
         Do while .not. eof()
@r,0 say ":"
@r,2 say code_no
@r,7 say ":"
@r,8 say S_name
@r,22 say ":"
@r,23 say qty
@r,33 say ":"
@r,35 say C-price
@r,47 say ":"
@r,49 say S_Price
@r,61 say ":"
@r,62 say reorder
@,68 say ":"
@r,71 say eoq
@r,79 say ":"
if reorder +> qty
set color to b*
@r,8 say S-name
@22,20 say "Your stock is too low : ORDER NOW"
waitT
set color to
endif
r=r+1
if r = 20
wait "Press any key to continue listing"
@6,0 clear to 23,79
endif
skip
enddo
*Editing Purchase File
Case choice = 2
mcodeno = space(3)
use purchase
 do while .not. eof()
        @10,28 to 15,60
        @12,30 say "Enter code number"
        @13,45 get mcode_no pict "@:"
        locate for code_no = mcode_no
        if not found()
        @15,30 say "record does not exist"
        @22,20 say "Press any key to enter another code"
        wait
        clear
        loop
        else
        @4,10 to 20,70 double
        @6,30 say "PURCHASE DATA"
        @7,30 to 7,55
        @9,12 say "CODE NUMBER :" get code_no
        @11,12 say "NAME OF ITEM :" get s_name
        @13,12 say "DESCRIPTION :" get disc pict "@S20"
        @15,12 say "DATE OF LAST PURCHASE:"  get l-date
        @17,12 say "QUANTITY PURCHASED :" get p-qty
        @19,12 say b"LEADTIME            :" get leadtime
```

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```
        read
@20,35 say "Any more record to edit? (Y/N)"
 a = O
 do while a = O
 a = inkey()
 if upper(chr(a)) $ "YN"
exit
endif
a=O
enddo
if upper(chr(a)) = "Y"
clear
loop
else
exit
endif
endif
enddo
*Updating Master File
case choice = 3
select A
 use market
 select B
 use purchase
 update on code_no from purchase repl qty
 with qty + B-> p-qty
case choice = 4
      exit
otherwise
@20,25 say "Wrong choice: Select 1,2,3 or 4 only"
endcase
enddo
close databases
clear all
clear
return
```

THE MENU PROGRAM

All the programs above together make up the software developed for the supermarket operation. As mentioned earlier, the programs are written in modules. the menu program is written to link all the programs together such that a common entry is used to execute the programs.
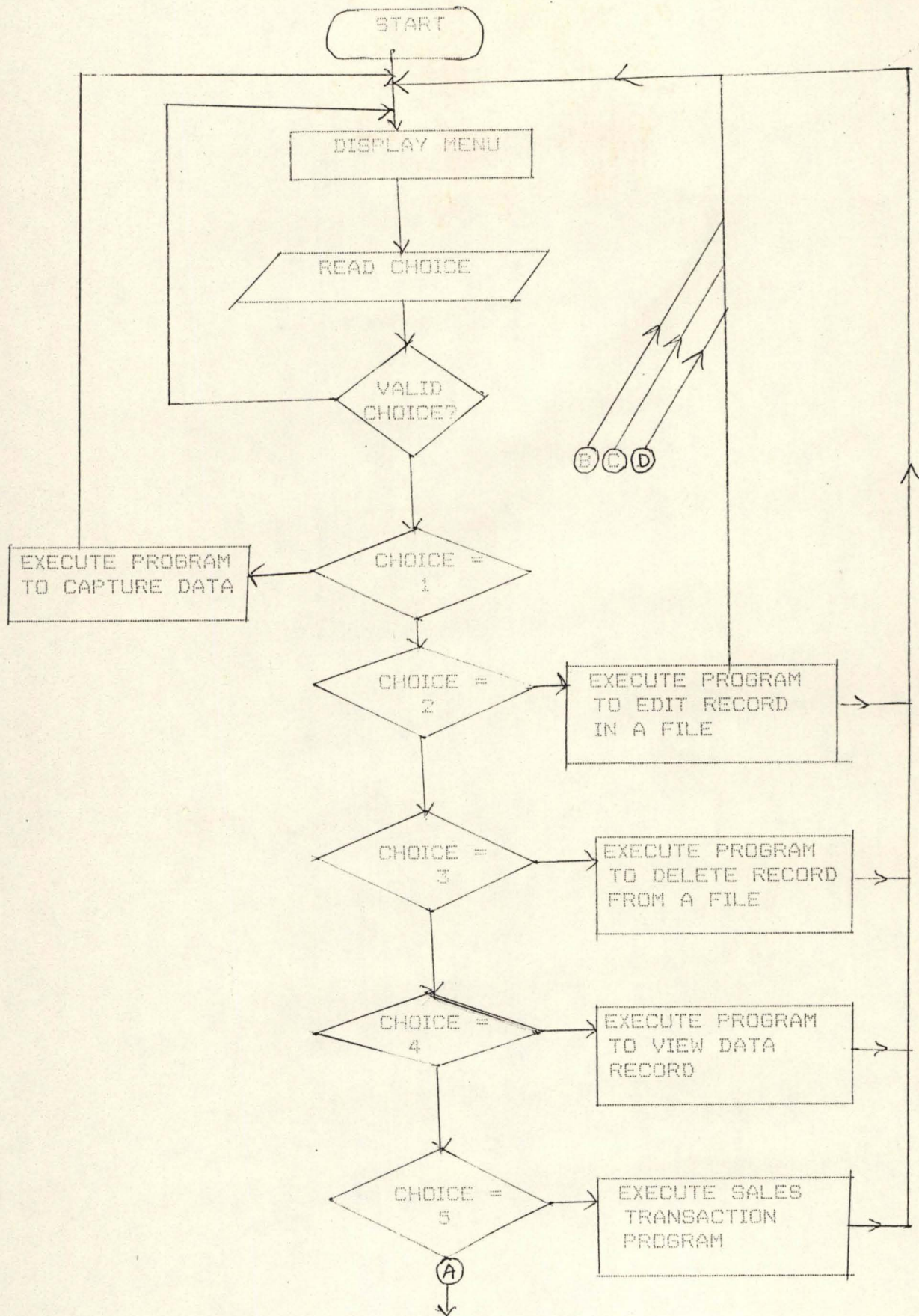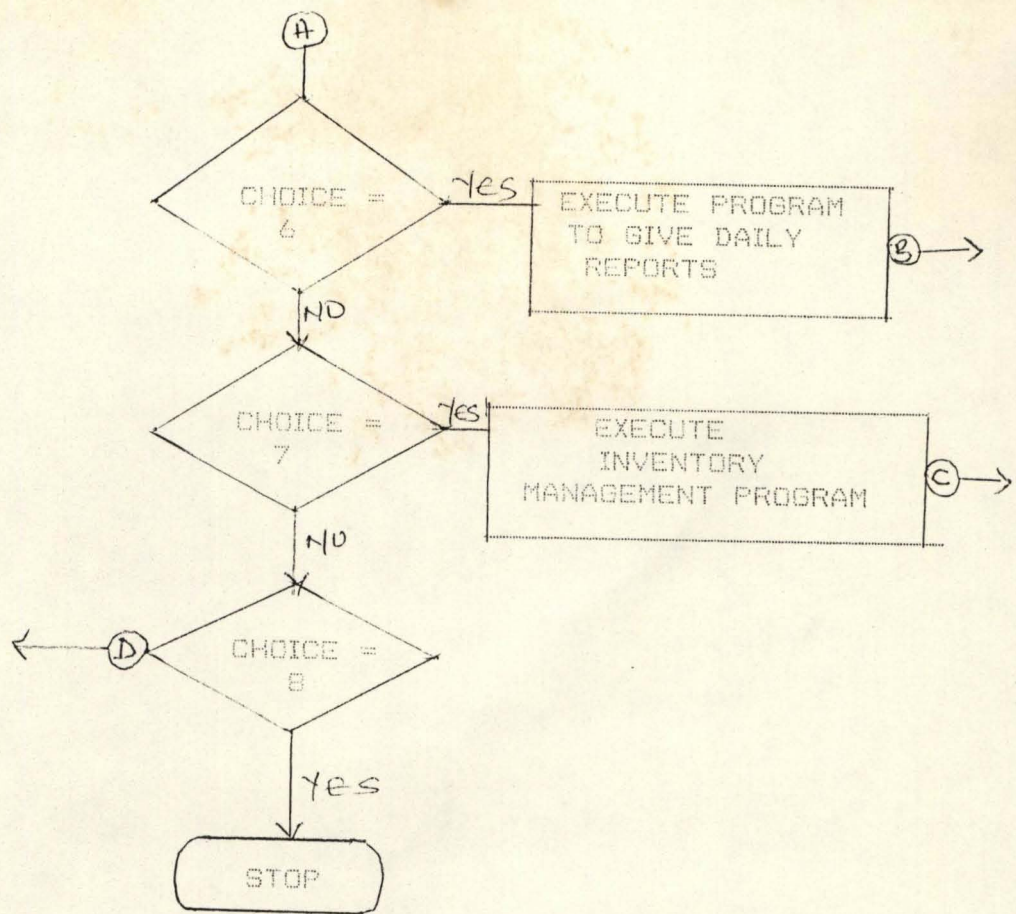
FLOWCHART FOR THE MENU PROGRAM

THE MENU PROGAM

```
set talk off
set status off
set echo off
set bell off
clear
do while .t.
*DISPLAY THE MENU
CHOICE = 0
@2,10 TO 22,70 DOUBLE
@3,30 SAY "SUPERMARKET OPERATION"
@4,30 SAY REPL("=",21)
@6,20 SAY "1: DATA CAPTURE ROUTINE"
@8,20 SAY "2: EDIT ROUTINE"
@10,20 SAY "3: RECORD DELETION"
@12,20 SAY "4: VIEWING RECORD IN A FILE"
@14,20 SAY "5: SALES TRANSACTION"
@16,20 SAY "6: DAILY SALES SUMMARY"
@18,20 SAY "7: INVENTORY MANAGEMENT"
@20,20 SAY "8: EXIT"
```

```
SET COLOUR TO R*
@22,12 SAY "select achoice by typing number preceding it";
 get choice pict "9"
do while choice = 0
if choice = "1,2,3,4,5,6,7,8"
exit
endif
choice = 0
enddo
do case
case choice = 1
set color to n/gr
@6,20 clear to 18,70
@9,35 say "D A T A"
@13,30 say "C A P T U R E "
@16,30 say "R O U T I N E "
wait "press any key to capture data into a file "
do capture
case choice = 2
do editfile
case choice = 3
do delete
case choice = 4
do listmenu
case choice = 5
clear
@8,25 to 16,55
@9,30 say "GOOD MORNING AND"
@11,30 say "WELCOME TO "
@13,30 say "BUSINESS TODAY"
@15,30 say "WISHING YOU THE BEST"
wait "press any key to start business transaction..."
do sales
case choice = 6
do report
case choice = 7
do purchase
case choice = 8
exit
otherwise
@22,12 say "wrong choice: choose a number between 1 and 8 only"
loop
endcase
enddo
clear all
set status on
set talk on
set echo on
set bell on
return
```

DESIGN VALIDATION

This is a very important aspect in the development of a system. Errors and ommisions, if undetected and corrected before the implementation stage, becomes very expensive to handle. A complete redesign and reimplementation may be required. The validation of a design is aimed at ensuring that:

(i) the software design is correct,

(ii) all requirements are met.

The verification of a software design to establish its correctness is handled by the designer. A design which correctly implement the intention of the designer is deemed correct.

A design review is used to check if all requirements are met by a software design. This entails checking the correspondence between the requirement and the design.

The design for a system in supermarket operation has been validated. It's correctness is established and all requirements are met.

CHAPTER SIX

IMPLEMENTATION AND EVALUATION

Now that a new system has been designed and software developed for use in supermarkets based on the requirement specified after thorough analysis of facts obtained from system study, the next thing to consider is the implementation of the system. The implementation of a new system involve all the activities that must be done to correct from the old system. Such activities are as highlighted below:

1. Program testing and debugging

2. File creation with real data

3. Documentation and maintainance

4. Personnel training

5. Conversion

6. Installation.

Testing and debugging of Programs

It is a common knowledge that the validation of a software system is a continuing process through each stage of the software life cycle. Program testing is a part of the validation process which is carried out during implementation and also, in a different form when implementation is complete. It involves exercising the program using data which is similar to the real data on which the program is designed to execute, observing the program outputs and inferring the existence of errors from anomalies in the output. Program testing, like the writing of the

programs is in stages. It is unrealistic to test a software system as a single entity. the system consists of sub-systems which are in turn made up of modules, and within each module are the functions and procedures. The testing of the system therefore, involve the following steps:

(i) Function Testing

At this stage, the functions making up a module are tested to ensure that they operate correctly. Each function should have a single, clearly defined and straight forward purpose. A function should alos be independent of other functions at the same level.

(ii) Module Testing

After individual functions have been tested, the cooperation of these function when they are put together in a module is then tested. Each module is also tested as a single entity.

(iii) Subsystem Testing

The interfaces between modules in each subsystem are also tested to ensure cooperation and communication among the modules.

(iv) System Testing

A system arise when subsystems are integrated under some controller. The testing here is used to validate the overall system functions in line with requirement specified in addition to finding errors in design and coding.

(v) Acceptance Testing

This is the process of testing the system with real

data. Errors in requirements specification are detected at this stage. The requirements may not reflect the actual facilities and performance required of the system. And thus this testing may demonstrate that the system does not perform as envisaged.

Two broad philosophers exist in program testing. These are the top down and bottom up testing. The bottom up technique consist of the stages described above and in the same order. The top down technique on the other hand is in a reverse order starting from the subsystem testing, and once the module and function testings are completed, the system testing is also done. The technique employed in testing the programs in this project is the bottom up technique.

Program Debugging

Once the program has been tested and errors detected, the next thing is to correct the errors. Program debugging is a process which identifies the areas of the program where errors occur and modify them to correct the errors. The process involve locating the parts of the programm code which are incorrect or which cause some requirements not to be met and then correcting such errors or modifying the program to meet the specified requirements. All these were carefully handled in the system developed for use in supermarket activities.

FILE CREATION

Creation of files containing real data cannot be separated entirely from the testing and debugging stage. Apart from the fact that the files used in testing contain similar structures and

data with the real files intended to use the system, the acceptance testing which is the last stage in testing uses the real data and hence the real files. With the dbase III plus package used in developing this system, the first stage in file creation is to create the file with a file name using the CREATE command. A menu driven screen is provided for user to design the structure of the file. Once this is done and saved in storage medium, data can be entered into the file as desired.

The file structure and the types of files to be used in the system have been discussed earlier in Chapter 3. However, the detail structure containing the different types of data in each file, is given below:

(1)   Structure of Master file

This file is given the name MARKET.DBF

FIELD NAME	FIELD TYPE	WIDTH	DECIMAL
CODE_NO	Character	3	
G_NAME	Character	15	
S_NAME	Character	15	
DESC	Character	60	
SIZE	Character	6	
SUPPLIER	Character	10	
QTY	Numeric	8	0
C_PRICE	Numeric	10	2
S_PRICE	Numeric	10	2
REORDER	Numeric	4	0
EOQ	Numeric	8	0

| DEMAND | Numeric | 8 | 0 |

(2)   Sales Transaction file called   SUPER.DBF

FIELD NAME	FIELD TYPE	WIDTH	DECIMAL
CODE_NO	Character	3	
S-NAME	Character	15	
SIZE	Character	6	
QTY	Numeric	8	0
Q-SOLD	Numeric	8	0
AMOUNT	Numeric	10	2

(3)   Daily Report file called   REPORT.DBF

FIELD NAME	FIELD TYPE	WIDTH	DECIMAL
CODE_NO	Character	3	
S-NAME	Character	15	
SIZE	Character	6	
QTY	Numeric	8	0
Q-SOLD	Numeric	8	0
AMOUNT	Numeric	10	2

(4)   Purchase Transaction File Called   PURCHASE.DBF

FIELD NAME	FIELD TYPE	WIDTH	DECIMAL
CODE_NO	Character	3	
DATE_L_PUR	Date	9	
QTY_PURCH	Numeric	8	0

After creating the structure this way, data is captured into the Master file using the data capture module of the software system. The other files obtain data from the master file and from results of processing.

DOCUMENTATION AND MAINTAINANCE

The new system developed for use in supermarkets is self documenting.

Not withstanding it is necessry to provide a manual of instructions which will aid in training and can also be used for reference purpose. At least five different documents should be provided with the system for user's understanding and to ease operation. These documents are:

(1) A functional description which should outline the system requirements, and aims of the user. It should also describe what the system can and cannot do. All the requirements specified earlier in chapter 2 will form a part of this document. In addition the strategies for meeting the requirements also highlighted in chapter 3 will also be included. It will also be stated that the speed of processing cannot be compared to the other system such as the bar coding and kimball tags reading system where the capture of data is the sole responsibility of the computer.

(2) An installation document which explains how to install the system and tailor it for particular hardware configuration. In

this document, the type and number of storage media used to carry the system is described. The files making up the system, which of them are permanent files and what minimum hardware configuration is required to run the system are also described.

(3)   The introductory manual explains in simple terms how to get started with the system. This manual also include instruction on how to get our of trouble when things go wrong. How the system is loaded and how to gain access to using the different modiles of the system are specified. similar instruction as contained in the menu driven program are explained here.

(4)   A reference manual which describes the facilities available to the user and how to use these facilities. All the facilities available in the system are described in detail and a formal descriptive techniques of usage is also included.

(5)   An operators guide explaining how the operator should react to situations that may arise when the system is in use. Messages generated at the operator's console and how to react to the messages are described. What happens when wrong steps are taken and how the situation should be handled are also included. For instance, if the system occupies more than one diskette. Instruction on which diskette to load first, and which next is included. A system may also require the use of password to licence its usage or gain access to the files. The document should also describe the procedure required.

<u>Maintainance</u>

All systems, large or small need to be maintained. Modification of requirements may become necessary to reflect changing needs. The environment of the system may also change and obscure errors undetected during system validation will emerge. However, since cost of maintainance is always greater than the cost of developing a system, it is important that systems be designed and implemented to minimise maintainance problems.

Systems documentation aids maintainance and that is why the documentation of all the steps in the development of the system, from analysis to implementation is very important. Most of the time, the maintainance of a system is handled by the system developer. For large systems a maintainance team may be required. The system developed for use in supermarket will be maintained by the developer. Any change in user requirements or the environment will require a modification of design and consequently, the programs.

<u>PERSONNEL TRAINING</u>

The training of the personnel that will use the system is very necessary. The personnel of the supermarket that will be trained to use the system are the cashiers, data entry personnel and the account and purchase managers. Training could be vendor, in-services or in house.

The vendor training involves inviting the professionals that developed, supplied or install the system to train the personnel.

In-service is sending the personnel on course usually to a

training centre.

In-house training involves organising the training services within the organisation. Personnel within the organisation handles the training.

For the computerised system developed for use in supermarkets, the vendor training is more applicable. All the personnel expected to handle the system will be trained by the developer or any other professional that can handel the training services.

CONVERSION

Conversion is the process of changing from an old system to a new one. Four methods of conversion exist. These are:

(i)   Parallel operation method: the new system is used along with the old one which is gradually phased out.

(ii)   Direct cut over: this is total replacement of an old system by the new one at once.

(iii) Pilot approach: a working version of the system is implemented in one part of the organisation. Changes are made based on feedback and the system is them installed in the rest part of the organisation.

(iv)   Phase-in method: this is a gradual process of changing from old to new. The new system is used in a section of the organisation in parallel with the old, until it becomes effective on its own. then the same thing is done in another section. This is repeated in all sections until the entire organisation is covered.

The conversion method that is appropriate for the system

developped for supermarket operation is direct cur-over. Though this method is seldom recommended because of the adverse effect it could produce on the organisation performance, it is chosen for the following reasons:

(a)   The new system is incompatible with the old and hence cannot be run in parallel.

(b)   All the sections of the organisation are connected together in the new system. Therefore neither the pilot approach nor the phase in method can be used.

This of course leaves only the direct cut-over. In order to use this conversion method however, the training has to be extensive. All the data should be ready and accurate and personnel should organise mock operations using the new system, as part of the training.

INSTALLATION

The computerised system is just being introduced into supermarket operation. Therefore, the installation of the system encompasses both hardware and software installation. The requirements for hardware installation have been specified in chapter 2. Before the hardward is installed, the invironmental requirements should be met. The computer room should be dust-free, fully airconditioned and of low humidity.

Regular cleaning of the supermarket floor will help to reduce dust in the room. the machines are to be covered during the cleaning exercises. Any steam producing device should be avoided in the supermarket and other rooms where the computers are

installed.

Another important factor considered in the installation of computers is the power supply. The flow of current should be constant. The wiring system of the supermarket should avoid interference between the computer and other electric gadget. Because of the sensitivity of computers to fluctuations in power supply, stabilizers should be made available for each of the computer device. All the necessary insulations to protect the computers should be provided in the room. In Nigeria, the municipal power supply is unreliable. Therefore each supermarket that will use the system is expected to provide a backup in case of power failure. The computer hardware devices that will use the system is also expected to have an automatic in-built power reserviour.

The software installation is simple. The system will be provided in storage media usually the floppy disks. the entire system can be compied into the hard disk of the computer. The files that contain information to be processed by the system are also copied along to the same hard disk. Any part of the system can be used as required through the menu.

POST IMPLEMENTATION REVIEW

After the whole process of implemeting the system and when it becomes operational, the system is reviewed to ensure that all the requirements for which it was designed are met. The post implementation review is done using the following methods:

(i) Event logging: the users record any unusual or unexpected events that affect the system. This is communicated to

the developer who investigates the problem and make necessary modifications.

(ii) Impact evaluation: this is done to determine how the system affect the area of operation of the oganisation in which they are installed. The cost of using the system as well as benefit derived from it is assessed.

(iii) Attitude survey: this is collection of data on ideas and opinions of users about the system. This helps to assess the workability as well as acceptance of the system.

SUMMARY, CONCLUSION AND RECOMMENDATION

SUMMARY

In this project, the current system of operation in some selected supermarkets was carefully studied and the requirements for improvements were compiled. A new system was designed based on these requirements and a software is subsequently developed. After the software has been validated, the required activities for the implementation of the new system was then considered. A detailed discussion of all the steps taken towards the development and implementation of the new system is discussed earlier in the text. This contain in the four chapters is highlighted below:

(a)   Chapter 1: Feasibility study

(b)   Chapter 2: System Analysis

(c)   Chapter 3: The design and Development of a new system

(d)   Chapter 4: Implementation and evaluation.

In the feasibility study, the current system of operation was examined to determine whether a change is desired or not. The areas where problems occur were noted and the alternative solutions to the problems were looked into. Problems are identified in four major areas. These are:

i.   Fixing of pricetags on items for display

ii.   Payment at cash points

iii. Information on inventory

iv.   Preparation of daily account summaries.

Four alternative solutions were suggested. Ther are:

i.   Use of ledger to record every transaction such that information can be obtained as required.

ii.   Use of computer with items marked with kimball tags

iii.   Use of computer with the bar code reading system

iv.   Use of computer with the keyboard coding system.

The alternatives are assessed operationally, financially and technically. the overall assessment lead to the recommendation of the keyboard coding system for the Nigeria supermarkets for now.

In system Analysis, a detailed investigation of the current system of operation was embarked on. the techniques used for this study are:

i.   Observation

ii.   Interview.

Facts obtained are documented using the structured English technique. Analysis of this facts led to the compilation of the following requirements for improvement:

(a)   Increasing speed of processing sales transaction.

(b)   Error Minimisation

(c)   Availability and accessibility of information on sales and inventory.

(d)   Removal of tedious tasks in stock taking and labelling item with price tags

(e)   Improved Accounting system.

Other requirements has to do with the computer on which the system will run and the environment in which it is installed.

In the design of the new system, the first step taken was to

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compile the strategies for meeting the requirements specified. Then the specific areas of the system that need be designed were examined. These inclued:

    i.   the input activities

    ii.   file management

    iii.   output activities

    iv.   Design and organisation of files.

Once the design is completed, the software was developed. This is done by writing programs based on design formulated. the programs were written in modules, all of which wer later linked together with a menu program. The program modules in the system are:

1.   Data capture routine

2.   Edit routine

3.   Data deletion routine

4.   Routine to view records in a file

5.   Sales transaction routine

6.   Daily sales summary routine

7.   Inventory management routine.

In the implementation stage, the programs were tested and the errors detected were adequately corrected. File are created to meet the design. Four types of files were included in the system. These are:

1.   The master file containing all the data for the overall running of the system.

2.   The sales transaction file contains data relevant for transaction at the cash point.

3.   The report file for storing information generated after each day's business.

4.   The purchase transaction file for storing information after each purchase transaction.

Other implementation procedures are:

a.   System documentation and maintainance.

b.   Personnel training

c.   Conversion to the new system and

d.   Installation of the new system.

All past implementation review was also done to ensure that the system meets all the requirements for which it was designed.

CONCLUSION

The preliminary study of the current system of operation in supermarkets has revealed that a change is inevitable. A lot of problems are encountered with the manual system of processing transaction. The use of computer is considered, to simplify the processing and solve the problems.

Three different methods that uses computers were examined. These are:

i.   The bar code reading system

ii.   The kimball tags reading system

iii.   The keyboard coding system

Among the three systems, the keyboard coding is found to be most feasible both operationally, technically and financially for the Nigerian supermarkets.

A detailed study of the problems brought out the

requirements for improvement. These requirements are:

i. Inproving the speed of processing sales transactions

ii. Obtaining accurate and up to date information on quality
of items in stock.

iii. Obtaining daily sales summary for proper acountability.

iv. Improving the accuracy of results obtained from transaction
processing

v. Removal of tedious task of counting item physically and
affixing labels on individual item.

A new system is designed based on this requirements. The
software is then developed from this design and implemented to
ascertain its workability and whether all the requirements are
met.

RECOMMENDATION

Based on findings from investigation of the current system
of operation in some selected supermarkets, which highlighted the
various problems encountered, it is obvious that a change to a new
system is desirable. A lot of benefits awaits supermarkets that
convert to using computers for transaction processing. The
keyboard coding system is recommended for use in Nigerian
supermarkets for now. It is found to be most feasible
operationally, technically and financially, when compared to the
more sophisticated systems of using bar codes or kimball tags.

However, the bar code or kimball tags systems are more
efficient. The processing is faster and much more accurate. With
advancement in technology in Nigeria, supermarkets may soon have
the opportunity of using such systems which have been in operation
for long in advanced countries,

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