

**TITLE PAGE**

**DATA SECURITY AND PRIVACY IN  
A STATISTICAL DATABANK**

**A COMPUTER APPROACH  
(A Case Study of National Planning Commission)**

**By**

**JIMOH MUFUTAU IYANDA  
PGD MCS/356/97**

**PROJECT SUBMITTED TO THE DEPARTMENT OF MATHEMATICS AND  
COMPUTER**

**SCHOOL OF SCIENCE AND SCIENCE EDUCATION  
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA  
IN PARTIAL FULFILLMENT OF AWARD OF POST GRADUATE IN  
COMPUTER SCIENCE**

**DECEMBER 1999**

## CERTIFICATION

I certify that this work was done by JIMOH MUFUTAU IYANDA under my supervision in the department of Mathematics and Computer. Faculty of Science and Science Education Federal University of Technology, Minna, Niger.

.....  
Mr EZEAKO  
(SUPERVISOR)

.....  
DATE

.....  
DR REJU  
(HEAD OF DEPARTMENT)

.....  
DATE

.....  
EXTERNAL EXAMINER

.....  
DATE

## CERTIFICATION

I certify that this work was done by JIMOH MUFUTAU IYANDA under my supervision in the department of Mathematics and Computer. Faculty of Science and Science Education Federal University of Technology, Minna, Niger.

.....  
Mr EZEAKO  
(SUPERBVISOR)

.....  
DATE

.....  
DR REJU  
(HEAD OF DEPARTMENT)

.....  
DATE

.....  
EXTERNAL EXAMINER

.....  
DATE

## ACKNOWLEDGEMENT

I am very grateful to almighty Allah for giving me the opportunity to complete this laudable project. I am greatly indebted to my supervisor Mr Ezeako for his invaluable, meticulous and sincere supervision of this work.

My appreciation also goes to the other lecturers in University for their invaluable contribution to my knowledge during the course of my programme. My special thanks goes to the other lecturers for their invaluable contribution to my knowledge during the course of the programme. My special thanks goes to Prince Badmus, Mr Raimi Kola, Dr Reju, Prof. Adeboye, others are Mr Adewale, Dr Yomi who have in one the other contributed to knowledge, I say thank you all.

My deepest appreciation goes to Alhaji Munir Ibrahim Lawal, Arc. Shakiru Suara, Rasheed Salman, Barrister Lawrence Adeosun, Raymond Osiberne, Bayo Mutiu, Charles Akonnor, Chuks Okoh for their love, moral and financial support through the course.

My special appreciation goes to friends on campus, friends like Abdultalib, Olanikanmi, Olajide Samaila Sodangi, Mrs Adem Ikwubiala, Hutman Toyin, and other who I can not mention and others who I can not mention but have weathered the storm with me., I say thank you for all your support.

## TABLE OF CONTENTS

TITLE PAGE .....	i
CERTIFICATION .....	ii
DEDICATION.....	iii
ACKNOWLEDGEMENT.....	iv
TABLE OF CONTENTS.....	v-vii
ABSTRACT.....	viii
1.0 INTRODUCTION	1
1.1 OBJECTIVE OF THE STUDY	2
1.2 SCOPE OF RESEARCH	3
1.3 DEFINITION OF BASIC TERMS	3
1.3.1 Data	3
1.3.2 Databank	3
1.3.3 Data Security	3
1.3.4 Code	3
1.3.5 Privacy	4
1.3.6 Confidentiality	4
1.3.7 Algorithm	4
1.4 SECURITY DESIGN PRINCIPLE	4
1.4.1 Access	4
1.4.2 User Acceptability	5
1.4.3 Open Design System	5
1.4.4 Separation of Duties	5
1.4.5 Least Privilege	5
1.4.6 Least Common Principle	6
1.5 GENERAL PROTECTION MEASURES	6
1.5.1 Access Control	6
1.5.2 Log In Security	7
1.5.3 Data Encryption	7

1.6	REASONS FOR DATA SECURITY IN A STATISTICAL DATABANK	8
1.7	VULNERABILITY OF A SECURITY SYSTEM	8
1.7.1	Temporary Assignment and In-house transfer	8
1.7.2	Termination	9
1.7.3	Contractor Access Consideration	9
1.7.4	Public Access Considerations	9

## **CHAPTER TWO**

2.0	SECURITY MEASURES	11
2.1	SECURITY PERSONNEL	11
2.2	USER ADMINISTRATION	12
2.3	USER ACCOUNT MANAGEMENT	12
2.4	AUDIT AND MANAGEMENT REVIEW	13
2.5	CATEGORY OF PERSONNEL THAT HAVE ACCESSED INTO THE COMPUTER ROOM	13
2.6	SECURITY ON THE COMPUTER AGAINST ILLEGAL ACCESS	15

## **CHAPTER THREE**

3.0	SYSTEM DESIGN AND MODELLING	17
3.1	DESIGN OF A CRYPTOGRAPHY ON FILE SYSTEM	18
3.2	MODE OF IMPLEMENTATION	19
3.3	OPTIONS OF ENCIPHERING/DECIPHERING TECHNIQUE	20
3.3.1	The Vigenere Routine	20
3.3.2	The Transpose Routine	20
3.3.3	The Ceasar Routine	21
3.3.4	The Running Key Routine	21
3.3.5	The Columnar Routine	21

## CHAPTER FOUR

4.1	CHOICE OF THE PROGRAMMING LANGAUAGE	22
4.2	HARDWARE REQUIREMENT	22
4.3	COST BENEFIT ANALYSIS	22
4.4	PROGRAM	23

## CHAPTER FIVE

5.1	SUMMARY AND CONCLUSIONS	31
5.2	BIBLIOGRAPHY	33

## ABSTRACT

The study focussed on Data Security and Privacy in a Statistical Databank, a computer approach in National Planning Commission. The objective of the study was to examine the data security and privacy in the commission, and to examine the various lapses common to data security and privacy in the commission and to examine the various lapses common to data protection in a statistical data bank. In order to achieve this objective, various security measures were discussed to protect the vulnerability of data from illegal access by individuals who have no association with the organisation and if perpetrated, how the tractor could be traced.

Meanwhile, emphasis were laid in Encryption as a form of security to protect the data, five major types of encryption were discussed.

It is however recommended that security measures should be taken seriously. This warning has become necessary because no matter how effective a security is, it becomes ineffective when the treat comes from within, that is why Artemiderous said to the Great Julius Ceasar in one of the Shakespeare plays that "Security gives Way to Conspiracy.



## 1.0 INTRODUCTION

Reliable data are responsible for policy formulation and development planning in every sector of any nation's economy. Clearly thought out and well formulated policies are necessary for setting development priorities and initiating new programs.

The issue of having a databank has gained prominence. Accurate data reflect true relationship with good planning. It must be noted that the national databank in general is weak, the paucity of reliable data has been responsible for the apparent lack of meaningful and sustainable planning in the country. The situation is compounded by the fact that most ministry do not keep appropriate records. Previous effort to address the situation has yielded limited result, as attempt by different ministry yielded different statistics. This has prompted the Federal Government of Nigeria to set-up NATIONAL PLANNING COMMISSION (MINISTRY) to co-ordinate and harmonize the various sector of the economy.

The National Planning Commission has put in place a workable arrangement for uniform data gathering and analysis which has enable the commission to properly monitor all sectors of the economy like industrial and business output, cost of production, employment ratio, external trade, internal debt, inventory balance of payment and its component, gross domestic product etc.

The commission has introduced a lot of security measure in order to maintain the security and privacy of the data stored. The National Planning Commission by taking this bold step would be following the steps taken by United States of America Government in

1977 when the government issued a report on violation of privacy relating to the computerized maintenance records. The two year focused on the enormous flow of personal medical purposes and the resulting invasion of privacy.

The reports concluded that safeguards must be applied to control both the access to any personal data and the type or data collected and stored.

The necessity for protecting data cannot be over emphasized. Data are exposed to many dangers in computing, such dangers includes: Un-authorized access, Virus attack, Manipulation of data for mischievous purposes etc. In this era, when the world has become a global village through international and internal networking computers now communicate with computers hundreds of kilometers apart, tactical information and even funds are transferred through advanced computer telecommunication networking. All these made computers highly vulnerable to mischievous attack through data manipulation which has made the issues of data security a great concern.

### **1.1 OBJECTIVES OF THE STUDY**

The objectives of this research work includes:

- (a) Definition of basic terms
- (b) Detects the risks the computers are exposed in computing.
- (c) Analyze existing measures against such risks
- (d) Propose more effective measures where existing ones are found to be lacking.

## **1.2 SCOPE OF RESEARCH WORK**

Data security is a wide area in computer science - However the research work is limited to the following :

- Encryption as a means of protecting data and information transferred in an Internet system from unauthorized access and eaves dropping.
- Problems and solution to computer virus
- How best to prevent and protect data in databank from un-authorized access.

## **1.3 DEFINITION OF BASIC TERMS**

### **1.3.1 DATA:**

This are fact that are certainly known from which valid conclusions can be drawn or made and it can also be information collected, prepared and operated or processed on a computer.

### **1.3.2 DATABANK**

This can be regarded as a center whereby comprehensive information are stored and can be retrieved when required. It can also be defined as a center with a comprehensive file of computer.

### **1.3.3 DATA SECURITY**

It involves the need to protect the corporate information database, its integrity and accessibility from unauthorized personnel.

### **1.3.4 CODE**

Code can be regarded as a special mode of communication or encrypted which prevent eaves dropping or wire-tapping from an unauthorized individuals or organization.

### 1.3.5 PRIVACY

Privacy involves prohibiting an infringement of individual personal files, so that what is kept secret would be secret. Privacy also involves a situation whereby an individual or corporate organization is guaranteed non-interference in their activities.

### 1.3.6 CONFIDENTIALITY

This is a situation in which the organization has developed confidence in their system and that the sensitivity of the information is assured. The sensitivity is such that information is sensitive if its unauthorized disclosure, modification (i.e. loss of integrity) or unavailability would harm the agency. In general, the more important a system is to the mission of the agency, the more sensitive it is.

### 1.3.7 ALGORITHM

An algorithm is a step-by-step of instruction for solving a specific problem. It can also be defined as a set of unambiguous rules that defines how a particular problem or class of problems can be solved in a finite sequence of steps.

Another way of defining algorithm is, as a list (i.e. a finite sequence) of instruction (each of which has a clear meaning) which can be carried out in a fixed order (with a finite amount of effort and time) to find the answer to a problem.

## 1.4 SECURITY DESIGN PRINCIPLE

### 1.4.1 ACCESS

This is a process whereby the user has a way to operate the system. That is the user gained access into the system by following all the required procedures on the system before any operation can be done.

#### 1.4.2 USER ACCEPTABILITY

The security system must be acceptable to the user in order to put the system into maximum use. The human interface must be simple and easy to use and whereby it is not user friendly then the system would be rendered ineffective.

#### 1.4.3 OPEN DESIGN SYSTEM

This is the process of exposing the design facilities to a number of people during planning stages which will facilitate correction before the system are implemented and also before the system can be rely on.

It is important to have open design in order to detects bugs earlier than in the long run when the designers of the security will not be available.

#### 1.4.4 SEPARATION OF DUTIES

It refers to dividing roles and responsibilities so that a single individual can not subvert a critical process e.g. in financial systems, no single individual should normally be given authority to issue check. Rather, one person initiates a request for a payment and another authorized that same payment. In effect, checks and balances need to be designed into the process as well as the specific individual position of personnel who will implement the process ensuring that such duties are well defined is the responsibility of management.

#### 1.4.5 LEAST PRIVILEGE

This refers to the security objective of granting users of only those accesses they need to perform their official duties. Data entry clerks, for example, may not have any need to run analysis reports of their data base. However, least privilege does mean that all will have

extremely little functional access; some employees will have significant access if it is required for their position. However, applying this principle may limit the damage resulting from accidents, errors or unauthorized use of system resources. It is important to make certain that the implementation of least privilege does not interfere with the ability to have personnel substitute for each other without undue delay.

#### 1.4.6 LEASE COMMON MECHANISM

Every shared mechanism represents a potential information path between the user. Therefore, this should be minimized, adhering to this principle would minimize the flows through operation on computer.

### 1.5 GENERAL PROTECTION MEASURE FOR STATISTICAL DATABANK

There are several protection measures existing which are used to protect data from unlawful accessibility from various individuals or organizations.

The statistical databank can make use of all the measures or use any one of them.

#### 1.5.1 ACCESS CONTROL

This is done by assigning user access levels that determine the user's file access and field access privileges. The file access privileges and field access privileges for a file are called its privilege scheme.

The user access levels are numbered 1 through 8. Assigning a low number gives the user greater access privileges. Assigning a higher number limits the user's access. However, only access level determines what the user can do with the file once it is accessed.

The access level securely can be worked at three levels

- (I) User Access Level: This is the process whereby the user is those file and field access the user can access. The file and field given to a user is known as its Privilege Scheme.

(II) File Access Level: This is a privilege assigning to a user to determine the operations a user can do on the file. The access can be either to read, update, extend and delete. These privileges grant users the ability to

- (i) View records in a file
- (ii) Change records in a file
- (iii) Append new records
- (iv) Delete records from a file.

**Field Access:** At the field level, its possible to control what operations each user is allowed.

You can grant full(FULL), read only (R/O) or no access (NONE) privilege to each field in a database.

### 1.5.2 LOG IN SECURITY

This may be used on a single micro-computer or in a local area network. The log in security allows to create a password protect system. If password protection is in force (1) No user can gain access to the system unless the user enters a valid log in. The log consist of three items: a group name, a log in name and a password.

### 1.5.3 DATA ENCRYPTION

Data encryption scrambles data, so that the scramble data can not be read until it is unscrambled. An encrypted file contains data that has been translated from source data to another form that make its contents unreadable. If the statistical databank is protected with encryption, the system automatically encrypt and decrypt files.

inconsistent with the principle of least privilege.

### **1.7.2 TERMINATION**

Termination of a user's system access generally can be characterized as either friendly or unfriendly. Friendly termination may occur when an employee is voluntarily transferred, resign to accept a better position, or retires. Unfriendly termination may include situations when the user is being fired for cause "Rifed" or involuntarily transferred.

Fortunately both instances pose a security threat to the organization. For instance in a friendly termination is how confidentiality of data can be guaranteed? E.g. do employees know what information they are allowed to share with the public and in an unfriendly termination, the greatest threat from unfriendly termination is likely to come from those personnel who are capable of changing code or modifying the system or application. For example, system personnel are ideally positioned to wreak considerable havoc on system operators. This user can place logic bomb ( e.g a hidden program to erase a disk) in code that will not even execute until after the employee's departure. There are even instances where code has been "held hostage" other employees can also cause damage.

### **1.7.3 CONTRACTOR ACCESS CONSIDERATION**

Many Federal Agencies as well as private organization use contractor and consultants to assist with computer processing contractor are often used for shorter period of time than regular employers. This factor may change the cost of effectiveness of conducting screening.

The often higher turnover among contractor personnel generates additional cost for security program in terms of user administration.

### **1.7.4 PUBLIC ACCESS CONSIDERATIONS**



system for electronic dissemination of information to the public. Some systems provide electronic interaction by allowing the public to send information to the government. (e.g. electronic fax filling) as well as to receive it. When system are made available for access by the public, additional security issues arise due to increased threat against public access system and the difficulty administrator.

Public access system are subject to a greater threat from hacker attacks on the confidentiality, availability, and integrity of information processed by a system.

Besides increased risk of hackers, public access system can be subject to insider malice. For example, an unscrupulous user, such as disgruntled employee, may try to introduce errors into data files intended for distribution in order to embarrass or discredit the organization. Attacks on public access system could have substantial impact on the organization's reputation and the level of public confidence due to the high visibility of public access systems.

Other security problems may arise from unintentional actions by untrained users. In public access system, users are often anonymous, this can complicate security administration.

## CHAPTER 2

### 2.0 SECURITY MEASURES

Many important issues in computer security involve human users designers, implementors and manager. A broad range of security issues relate to how these individuals interact with computer and the access and authorities they need to do their jobs. No computer system can be secured without properly addressing these security issues.

Knowledge of the duties and access levels that a particular position will require is necessary for determining the sensitivity of the position. Determining the appropriate levels is based upon such factors as the type and degree of harm (e.g. disclosure of private information, interruption of critical processing, computer fraud) individual can cause through misuse of the computer system as well. More traditional factors such as access to classified information and fiduciary responsibilities.

### **SECURITY ON PERSONNEL**

The first step in staffing the computer center of the National Planning Commission is the process of screening and selecting. The process of screening and selecting helps determine whether a particular individual is suitable for a given position for example, the screening process help to ascertain the person's trust worthiness and appropriateness for a particular position. The screening process is formalized through a series background conducted through the personnel department.

After a candidate has been employed, the employees undergone training which includes which computer security responsibilities and duties.

Every member of staff of the computer center has a special identity card apart from the general identity card given to other member of staff. Also each member of staff has a special password allocated to them which are strictly confidential but only known to the

recorded finger of any individual that has any contacts with the system. There is also digital optical camera at the center which captures any image that entered the center.

### USER ADMINISTRATION

Effective administration of users computer access is essential to maintain system security. User account management focuses on identification, authentication and access authorization. This is augmented by the process of auditing and otherwise periodically verifying the legitimacy of current accounts and access authorizations.

There is timely modifications or removal of access and associated issues for employees who are reassigned, promoted, or terminated or who retire.

### USER ACCOUNT MANAGEMENT.

User account management involves

- (1) The process of requesting, establishing, issuing, and closing user accounts.
- (2) Tracking users and their respective access authorization and
- (3) Managing these functions

User account management typically begins with a request from the user's supervisor to the system manager for a system account. If a user is to have access to a particular application, this request may be sent through the application manager to the system manager. This will ensure that the system office receives formal approval from the "Application Manger" for the employee to be given access. The request will normally state the level of access to be granted, perhaps by function or by specifying a particular user profile.

System operators staff will normally then use the account request to create an account for the new user. The access level of the account will be consistent with those requested by the supervisor. This account will normally be assigned selected access authorization.

process. New user account are added and other are deleted. Permission change, sometimes permanently, sometimes temporarily. New applications are added, up graded and removed. Tracking this information to keep it up to date is not easy, but it is necessary to allow users access to only those functions necessary to accomplish their assigned responsibilities thereby helping to maintain the principle of Least privileges.

In managing these accounts, there is a need to balance timeliness of service and record keeping.

The managing of the user account is centralized in such a way that regional offices (states level) make a request in order to make necessary changes. The approval of these change is important, it may require the approval of the system or supervisor of the employee whose access is being changed.

### AUDIT AND MANAGEMENT REVIEWS

From time to time, it is necessary to review user account management on a system. Within the area of user access itself, such reviews would examine the levels of access each individual has conformity with the concept of least privilege, whether all accounts are still active, whether management authorizations are up-to-date, whether required training has been completed, and so forth.

Those reviews can be conducted on at least two levels

(1) On application -by- application basis or (2) On a system wide basis.

Both kinds of reviews can be conducted by, among other, in-house system personnel (a self-audit), the organization internal audit staff, or external auditors. For example, a good practice is for Application Manager to review all access levels of all application users every month and sign a formal access approval list which will provide a written record of approval. While it may initially appears that such reviews should be conducted by systems personnel, they usually are not fully effective. However because access requirement may change over time, it is important to involve application manager,

**CATEGORY OF PERSONNEL THAT HAVE ACCESSED INTO THE  
COMPUTER SYSTEM**

The various categories of personnel that have accessed into the computer system are discussed below

(i.) Head of Department:

The head of department acts as the administrative head of the center and is responsible for the co-ordinating and supervising the various activities in order to have a smooth running of the department.

(ii.) The Senior Officers

The Senior Officer from level 10 and above are allowed access into the computer system with the conditions that they are computer literate and they are subjected to proper monitoring in order not to cause damage to the system.(iii

The Analyst

This are responsible for modifying and refined the system to ensure that the system works efficiently, so that the objectives and goals of the commission are achieved.

(iii.) The Programmer

This is another set of people who are allowed access into the computer system, they are the blood stream of the system. They write the program used in the commission and also perform program documentation and rectify any problem which may arise from program documentation through programming.

(iv.) Data Entry Operator

This set of personnel are granted access into the system. The data entry operator enter data and programs into the computer but perform no verification. In fact, data entry operator has no right to change or correct any job submitted.

**ACCESS TO HARDWARE AND SOFTWARE.**

when proper complaints have been made about the malfunction of either the hardware or software.

The head of department would give approval for the correction or repairs to be made and any attempt made to repairs or correct any problem on the system is a criminal act and can lead to the terminating of the appointment of any staff involved.

### **SECURITY ON THE COMPUTER AGAINST ILLEGAL ACCESS**

Security monitoring is an ongoing activity that works for vulnerabilities and security problems, and especially against illegal access.

Several security system are provided to monitor this problems, some of the measures are discussed below.

#### **Check Summing Program.**

This program presumes that files should not change between updates. They work by generating a mathematical value base on the contents of a particular file. When the integrity of the file is to be verified, the check sum is generated on the current file and compared with the previously generated value. If the two values are equal, the integrity of the file is verified.

Program check summing can detect viruses, trojan horses, accidental changes to files caused by hardware failures and other changes to files.

#### **PASSWORD CRACKERS.**

Check passwords against a dictionary (either a "regular" dictionary or a specialized one with easy-to-give passwords) and also checks if passwords are common permutations of the user.

#### **INTEGRITY VERIFICATION PROGRAM**

This can be used to look for evidence of data tampering, errors, and omissions.

and processing. These techniques can check data element, as input or as processed against expected values or ranges of values, analyze transactions for proper flow, sequencing, and authorization or examine data elements for expected relationships

These programs comprise a very important set of process because they can be used to convince people that, if they do what they should not do, accidentally or intentionally, they will be caught. Many of these program rely upon logging of individual user activities.

### VIRUS SCANNER

This are popular means of checking for virus infections. These programs test for the presence of viruses in executable program file.

### INTRUSION DETECTORS

This analyze the system audit trail especially log-in, connectors, operating system calls and virus command parameters, for activity that could represent unauthorized activity.

System performance monitoring analyses system performance logs in real time to look for availability problems including active attacks (such as the 1988 Internet worm) and system and network slow down and crashes.

## **1.6 REASONS FOR DATA SECURITY IN A STATISTICAL DATABANK**

Computers system security encompasses the security of all the information asset that constitutes the system be it manual or automatic. Security measures should not be taken just as the physical access and password. It should be noted that if hardware fails then the information system has failed. Therefore adequate measures should be taken regarding data stored in data bank.

It is pertinent to note that security in a statistical data bank prevent invasion of the corporate database, its integrity and accessibility by unlawful individuals or organization.

Also the security of statistical data bank gives assurance to the user that the information been used has not be tampered with, high level of confidence are then developed in the usage of the data.

## **1.7 VULNERABILITY OF A SECURITY SYSTEM**

The vulnerability of any protected system be it data storage system or communication are numerous and most of them are discussed below.

### **1.7.1 TEMPORARY ASSIGNMENT AND IN-HOUSE TRANSFER**

One significant aspect of managing a system involves keeping user access authorization up to date. Access authorization are typically changed under two types of circumstances

change in job role, either temporary e.g. (while covering for an employer on sick leave) or after in-house transfer and

Termination

User often are required to perform duties outside their normal scope during the absence of others. This require access authorization. However, additional authorization creates "Authorization creep" which have occurred with employees continuing to maintain



## CHAPTER 3

### 3.0 SYSTEM DESIGN AND MODELING

This system was designed so as to give maximum protection for the data in a statistical data bank. There were lot of laxity found in the security measure of the organization studied. The inadequacies in the physical data security measures could be view as matters involving internal arrangement of the organization..

The organization could perform better if the following suggested solution are implemented. A software that automatically and permanently record the following is developed

- (a) The identity of the operator that work in the organization's system.
- (b) The nature of operation and the time, the operation was performed
- (c) The file worked operated upon.

Such software could be developed and attached to all EXEC files so that it automatically spun to action each time such files are run.

The advantages of such " user monitoring device" include the culprit involved in data fraud to bed nabbed even long after such crime has been committed.

Employing log-in and simple enciphering techniques as presently done are not enough to guaranteed for security of data transferred through public lines. The major weakness includes: Not providing for log out mechanism after a number of unsuccessful attempt to log-in. It is mathematically provable that the probability of successful log-in will be directly related to number of trials i.e. let X denotes success in log-in to a system, and N to denote number of trial. We can say, an individual does not know the correct log-in number,

$$P(X) = F(N)$$

What the above simple equation implies is that the number of successfully log-in to a system increases with number of attempts. The Security implication is that a system become exposed to authorities access as the person trying to illegal log-in to the system line try different log-in numbers.

To guard against such risk, a provision is provided to log-out after a number of unsuccessful attempt for example, when any intruder, tried three different unsuccessful access codes, such intruder or non-intruder would be automatically log-out of the system network.

### 3.1 DESIGN OF A CRYPTOGRAPHY ON FILE SYSTEM

The nowadays use of computer controlled communication system, ask for special protection of data by crypto system, and cryptography provides efficient 'techniques of achieving this goal.' These cryptographical techniques are methodologies for transforming the representation or appearance of message through communication representation or appearance of message through communication channel ensuring, its privacy and authenticity, without changing its information content between the sender and the receiver.

The message to be transmitted or stored is called the plaintext. The process of transforming it and thereby locking the contents of the plaintext from being known to others (privacy) is called encryption or enciphering. The transformed plaintext is called ciphered text or encrypted text or a cryptogram. The process of unlocking the ciphered text, to get back the original plaintext (message) is called decryption or deciphering.

Historically, the use of cryptography, which is the focus of this project, was exclusively confined to military and diplomatic communities, to guarantee the security of data being communicated. But in recent days, cryptography has gone public. Both private companies and corporate sectors alike have started using cryptography to protect the secrecy of

The importance of cryptography in teleprocessing cannot be over emphasized in time sharing environment, data can be physically protected since the most important data paths are centralized. In a geographical distributed network, like Natural Planning Commission, data vital to organization functioning are transmitted over communication links which physical protection are sometimes impossible and where possible uneconomical.

### 3.2 MODE OF IMPLEMENTATION

The program is implemented in pascal programming language. For this program, an interactive system is required, so there is a reliable and accessible system is advantageous. The program involves simulation of some enciphering and deciphering techniques.

The program starts off with an introduction of the author and then goes on to display the options available to the user. The options available are enciphering coded text, deciphering coded text and stopping option.

If the enciphering option is selected a list of the available enciphering technique are displayed in a menu like form. The message to be encipher must be resident on a diskette file. After selecting an enciphering technique, the user would be asked to indicate the location or name of the file. If an option that requires the use of a keyword (i.e. Vigenere or 4 Runningkey) is selected, the keyword has to be supplied by the user.

Only an authorized user will be able to supply the correct keyword and hence decipher the code text.

After enciphering procedure has transformed text, the cipher text is stored in a file with the post fix "code". This coded forms is what can be transformed to the printer or transmitted in a network system. If the deciphering option is selected, the list of deciphering techniques is displayed which is the same as the list of enciphering techniques (but the procedure are in reverse order)

The cipher text to be deciphered must be resident **ON A DISKETTE FILE**. After

cipher text file. The appropriate keyword must be supplied on decoding the cipher text before it can be transformed or stored.

### 3.3 OPTIONS OF ENCIPHERING/DECIPHERING TECHNIQUE AVAILABLE

#### 3.3.1 THE VIGENERE ROUTINE

For enciphering, the vigenere routine make use of a procedure which first convert each letter of the plaintext and the keyword to a numerical value and then this value is transformed using the formula

$$(I + J) \text{ Mod } 27$$

The value obtained is then converted back to a character. For deciphering, the same character conversion is carried out but it is transformed using the formula

$$(I - J) \text{ mod } 27$$

Where I is a character in the plaintext and J is a character in the keyword.

#### 3.3.2 THE TRANSPOSE ROUTINE

For enciphering using the transpose routine, it breaks words of plaintext into blocks of five letters (including spaces) and then rearranges the letter according to the permutation

$$(1\ 2\ 3\ 4\ 5)$$

$$(2\ 5\ 1\ 4\ 3)$$

Meaning the first letter is substituted with the second, the second with the fifth, the third, fourth and third, fifth respectively. For deciphering, it is rearranged accordingly.

#### 3.3.3 THE CAESAR ROUTINE

For enciphering, the Caesar routine uses the character conversion procedure and then transforms the value the formula is  $(J + 3) \text{ Mod } 27$

The value obtained is converted back to character deciphering, character conversion is carried out using the formula.

$$(J - 3) \text{ mod } 27$$

### 3.3.4 THE RUNNING KEY ROUTINE

For enciphering and deciphering the transformation is similar to that of the vigenere method. The difference however is that whereas the alphabet can be shifted in the vigenere routine, it cannot be shifted in the running key routine. The formula for transformation (enciphering and deciphering) are basically the same.

3.3.5 THE COLUMN ROUTINE, the Transformation is carried out by writing characters alternately on each two rows and then read row by row.

I AM A SURE WINNER

I M S R W N E

A A U E I N R

and is written as

IMSRWNE AAUENR

for deciphering, the ciphertext is reassembled accordingly.

## CHAPTER 4

### 4.1 CHOICE OF THE PROGRAMMING LANGUAGE

Pascal is used as the programming language. It has a wide range of roles in areas of engineering, scientific, statistical and mathematical application. It is generally a scientific language and is adaptable to suit many purposes of many people who may be interested in using the package.

### 4.2 HARDWARE REQUIREMENT

The program required the following hardware which would enhance its performance and this includes

- |                              |                       |
|------------------------------|-----------------------|
| a. Pentium                   | g. Enhanced Keyboard  |
| b. 16MB RAM                  | h. YGA Adaptor        |
| c. 2.1 GB Hard Disk          | i. Laser Jet Printer  |
| d. 1.44MB (3.5') Floppy Disk | j. U.P.S (500 Volts ) |
| e. CD ROM ( x 23)            | k. Serial Mouse       |
| f. 14" SVGA Monitor          |                       |

### 4.3 COST AND BENEFIT ANALYSIS

Initially, the cost of designing a new system especially when it comes to the security look very high in a short run but when compared with the long run effect the benefit outweigh the cost.

Procurement of the system hardware system and the software development was 1.5m which was believed to be very high initially but compared to the security benefits in the long run, it is realised to be cost effective

For example with this system, it is difficult for an intruder to log in and access any information in the system. And again there is a high level of employee satisfaction because of confidence they have in the system.

4.4

PROGRAMUSING PASCAL HIGH LEVEL LANGUAGE.

```

WriteIn      ("  1.  Vigenere  ")
WriteIn      ("  2.  Transpose ")
WriteIn      ("                ")
WriteIn      ("  3.  Caesar   ")
WriteIn      ("  4.  Running Key ")
WriteIn      ("                ")
WriteIn      ("  5.  Columnar ")
WriteIn      ("                ")
WriteIn      ("  6.  Exit     ")
WriteIn      ("  ???      ")
WriteIn      ("  Select from options using number on the left of option
              desired")

```

End:

```

Procedure Chr (var Letter: xter: Number: Integer);

```

Begin

```

Letter:= Copy ("ABCDEFGHIJKLMNOPQRSTUVWXYZ"); Number;

```

```

If Number := 0 then letter: = " ";

```

End.

```

Procedure ord (Var Number: integer; Letter; xter);

```

Begin:

```

Number; pos (letter , "ABCDEFGHIJKLMNOPQRSTUVWXYZ);

```

End

```

Procedure Encipher; (* The Enciphering Procedure *)

```

Procedure vigenere; (\* To encipher using the vigenere's algorithm \*)

Begin

For K: = 1 to length (sentence) Do

Begin

ord (I, character {K J});

ord (J, key { K J});

J:= (I + J) mod 27

chr (K I, J);

Newsence: = concat (Newsence, C(KJ));

End;

End;

Procedure Transpose: (\* To encipher using the transposition method\*)

Begin

I: - 1;

While I <=length (sentence) Do

Begin

L: = (length (sentence) - I) mod 5 );

If  $\diamond 0$  then for J:= 1 to L Do

Word: = Concat (word, " ");

Word:= copy (sentence , I, 5);

Transpose: = Concat (copy (word, 2, I), copy (word, 5,I) copy word 1, I) copy (word 4, I)

Transpose:= Concat (Transp., copy (word, 3, 1));

Newsence:= Concat (Newsence, transp.);

I;: = 1 + 5;

End;

End;

Begin;



```

Begin
ord. (J, character {I});
J:= (J + 3) mod 27;
Chr (c {I}, J);
Newsence:= Concat {Newsence, C (I) };
Number := Pos (letter, "ABCDEFGHIJKLMNOPQRSTUVWXYZ);
END

```

Procedure: Caesar (\* To Encipher using the Caesar's algorithm)

```

Begin
For I:= 1 to length (sentence) Do
Begin
ord (J, character (I);
      J:= ( J + 3) mod 27
chr © (I), J);
Newsence:= concat (Newsence, c (I);]

```

```

Begin

```

```

End;

```

```

End;

```

Procedure Runkey: (\* To Encipher using the Running key cipher\*)

```

Begin
For K:= 1 to length (sentence) Do
ord. (J, character {K J});
ord. (I, key (KJ);
J: = ( I + J) mod 27

chr (c ( k), J);

```

End;

End;

Procedure Columnar ( \* To encipher using the columnar transposition \*)

(\* Using the backwards method of encipherment and the Raul)

Begin

For I:= Length (sentence\_) down to 1 Do

J:= length (sentence) -I + 1;

c (J) := character (I)

End ;

K:= I

L:= Round (Length (sentence )/2 ):

for l:= J to L Do

Begin

J:= 2 \* I -1);

c(K):= character (J);

K:= K + I;

End;

Begin (main menu)

Repeat

Menu;

Read (option);

If (option = 1) or (option = "4") then

Begin

WriteIn ('Input cipher key');

ReadIn (key stream);

```

key (I_):= copy (keystream, I, 1);
End;
WriteIn      (Device "input text");
While not E Of (f) Do
Begin
ReadIn(f. sentence): Newsence:= ' '
character {I}:= copy (sentence, I, 1);
WriteIn      (Device, sentence);
If option:=  '1' then vigenere else
              :=  '2' then transpose else
              :=  '3' then Caesar else
              :=  '4' then Runkey else
              :=  '5' then columnar:

WriteIn      (Device);
WriteIn      ("Since this is supposed to be a secrecy");
WriteIn      (System not all the codes generated on the screen");
WriteIn      (Device);
WriteIn      ("Press space bar to continue);
ReadIn
WriteIn      ("Due to the nature in the system stores")
Write in     ("Files by storing anything that is entered to");
Write in     ("The system as, text, to Decipher");

WriteIn     ("you first key in the text to be deciphered");
WriteIn     ("Then save it, after which you go to the filler");
WriteIn     (" Mode and use the change option, to change the text to code");

```

WriteIn (Device);

Procedure Menu

Begin

Page (input);

WriteIn

WriteIn (" Do you wish to encipher encoded text")

WriteIn (:"Decipher coded text");

WriteIn (" Transfer text");

WriteIn

WriteIn (" stop program");

WriteIn

WriteIn ???

WriteIn (" select from option using character or left of bracket of option desired");

End;

Procedure prefer;

Begin

End;

Begin (\* main program\*)]

Welcome

WriteIn (" Input preferred output device in full);

ReadIn

Rewrite (Device, P: rename);

Read

Repeat

Begin

Readied (Decision);

page (Out put)

```

Begin
WriteIn      (“ Encipher...”);
WriteIn      (“ indicate name or location of file to be enciphered”)
ReadIn(filename);
If (filename = “console”) or (filename = ‘I’ ) then
Begin
Reset (f, filename);
Rewrite (G, ‘ Bad I: Pow, code”);
End          (* if console option is wanted *)
Else
Begin
Reset (f, concat, (filename, ‘text’);
Encipher
close (G, lock);
Rewrite end, concat (filename “code”);
Else
Begin, if decision = D’ then
Begin
WriteIn      (“decipher...”);
WriteIn      (“ indicate name or location of file to be deciphered’)
ReadIn(Filename_);
Reset        (F, concat (filename ‘code’);
Rewrite      (G, concat “text”);
Decipher
Close        (S * Lock);
Reset        (S * concat (filename, ‘text’);
End

```

```

Begin
WriteIn      ("Transfer...");
WriteIn      (Transfer which file (Please indicate where text or code )?);
ReadIn      (Filename)
Rewrite      (G, filename);
Transfer;
End;
WriteIn      ("output...");
WriteIn
Screen:=      0
While not E of (G) Do
Begin
Screen:=      Screen + 1;
ReadIn(G, Newsence);
WriteIn      (Device, Newsence);
If screen = S then
Begin
WriteIn      (" type < space > to continue') Read (space);
end;
End;
Close (f); close (G, lock);
End;
Write (Type <space> to continue") read (space);
End
Until (decision = 'E' ) and decision = 'D' ) and Decision <> T );
Close = Device, lock;
End.

```

## CHAPTER 5

### 5.1 SUMMARY AND CONCLUSIONS

The application package which does not need special user training has been developed. The package which was developed could serve different specialist and serves as practical and theoretical tools for security planning in computing activities. Since the aim of the project is to maintain privacy and security of data. The package is able to fully secure the data in the system.

Meanwhile it is better to note that no system is fool proof because the issue of security in computing is highly dynamic. With this reason, some area of suggestion for further research would be suggested.

One area which has not been explore but which is a thorough research is done will go a long way in alleviating data security problem is **SYSTEM SURVEILLANCE**. The technique involves the building of surveillance or detective reporting into the system in order to identify attempted violates.

Another important aspects of security which has been handling with nonchalant attitude is the contingency and incident handling in most organization. It is discovered that most of the organization lacks contingency planning that is if there is an accident or virus invasion into the system, this is an area for further research for any interested researcher.

It is better to consider the warning of Artemiderous to the Great Julius Caesar in one of the Shakespear plays that "Security gives way to conspiracy". This warning becomes necessary because no matter how effective a security is, it becomes ineffective when the threat come from within. Therefore a high degree of motivation in form of monetary and other incentives which promote job contentment in staff is suggested computer experts in an organization should be highly remunerated to dissuade them from participating in fraudulent practices.

look simple but will be very effective if more research is done. The mainstream of the technique is that organization should have different rather than one enciphering technique. Each technique employed should have a code. This will make enciphering technique more complex thereby reducing the chance of breaking the code.

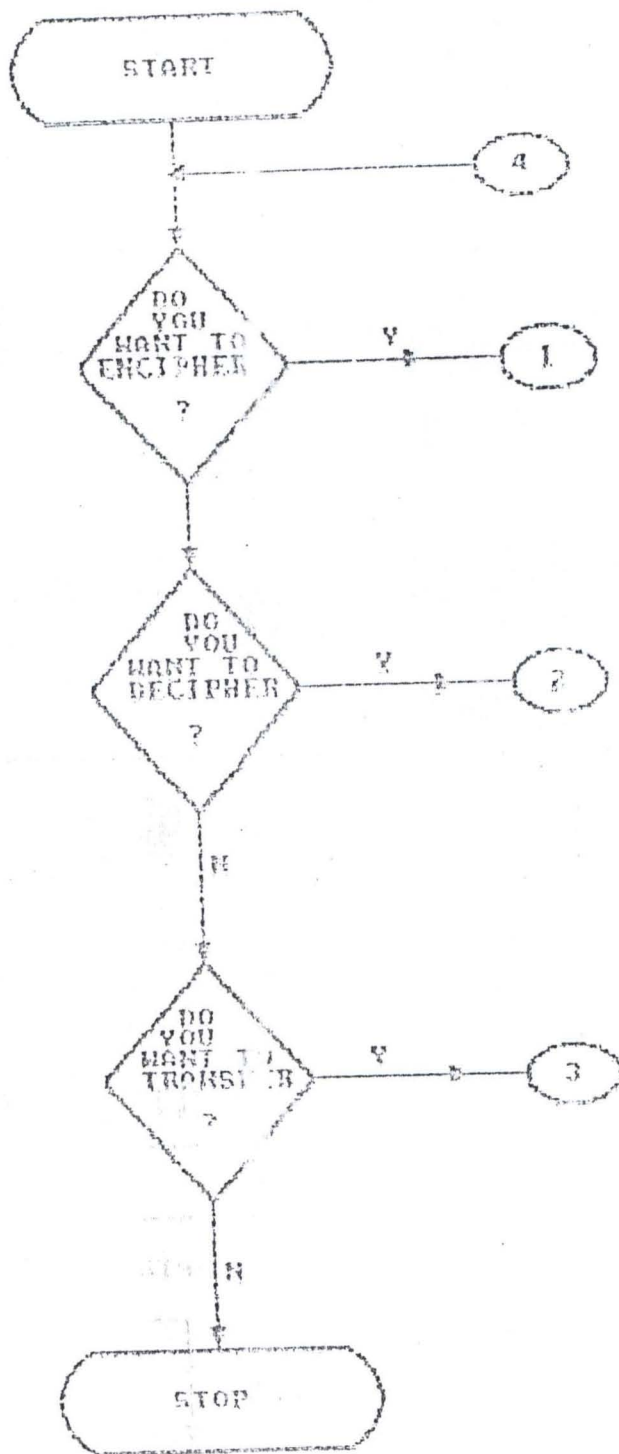
The final achievement of effective security measure requires all personnel to be aware and committed to constant improvement and central surveillance on day to day basis.

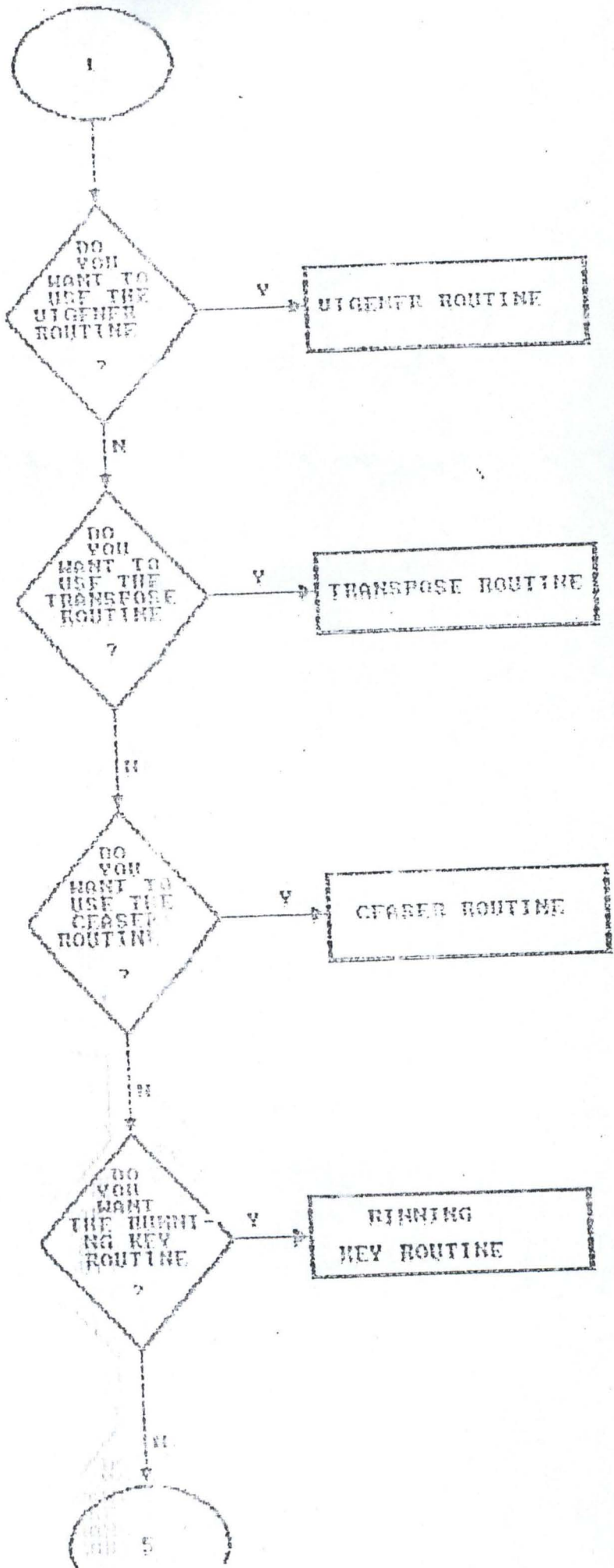


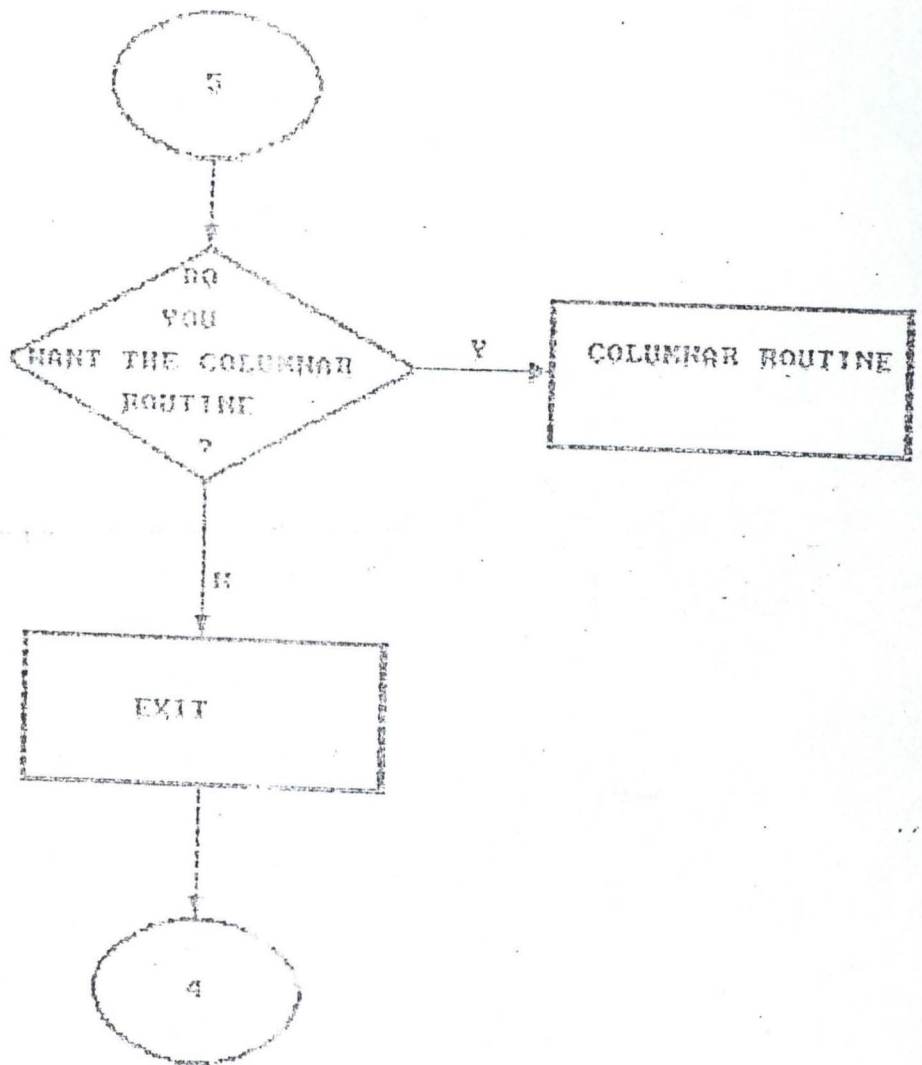
### BIBLIOGRAPHY

- (1) ALEXANDER, M. ed. "Multimedia Means Greater Awareness"  
In fosecurity News 4(6), 1993 pp 90-94
- (2) BURNS, G. M "A Recipe for a Decentralized Security Awareness program" ISSA  
Access Vol 3, Issue 2, 2<sup>nd</sup> Quarter 1990 pp 12-54
- (3) FITES, P. AND M. KRATZ Information Systems Security: A Practioner's Reference.  
New York, NY: Van Nostrand Reinhold, 1993.
- (4) NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY.  
"Security issues in Public Access Systems". Computer  
System Laboratory Bulletin. May 1993.
- (5) NORTH S. "To Catch a 'Crimoid,' Beyond Computing (1), 1992. pp  
55-56.
- (6) PANKAU, E. "The Consumate Investigator" Security Management.  
37(2), 1993. pp. 37-47.
- (7) SINKOV ABRAHAM Elementary Cryptoanalysis. Mathematical Association of  
America 1996.
- (8) MARTIN JAMES Security Accuracy and Privacy in Computer System.  
Prentice-Hall Inc. New Jersey 1973.
- (9) DAVID LIGHTFOOT Computer Programming in Pascal Richard Clay Ltd Bristol  
- 1983.
- (10) BROWNE PETERS 'Computer Security - a survey " New York 1972.
- (11) DON B. PARKER Threats to Computer System. The Risos Project March  
1973.
- (12) ALLEN B. R. " Danger Ahead! Safeguard your Computer Vol 12,  
Academic Press Inc. New York 1972.

# FLOWCHARTS









MODIFYING CANDIDATE'S RECORD

ENTER REGISTRATION NUMBER or (XXX TO QUIT): 972345JF

ENTER FIRST NAME: ZAKARI

ENTER INITIALS N.

ENTER LAST NAME OF CANDIDATE: MAHMUD

ENTER CANDIDATE'S SEX M

ENTER CANDIDATE'S STATE OF ORIGIN NIGER

ENTER FIRST SUBJECT: ENGLISH

ENTER SCORES: 51

ENTER SECOND SUBJECT: CHEMISTRY

ENTER SCORES: 50

ENTER THIRD SUBJECT: PHYSICS

ENTER SCORES: 52

ENTER FOURTH SUBJECT: GEOGRAPHY

ENTER SCORES: 50

ENTER INSTITUTIONS OF CHOICE: FUT,MINNA,UNI.OF ABJ

ENTER DURATION FOR THE COURSE: 5YRS

ENTER CUT OFF REQUIREMENT: 201

VIEWING CANDIDATE'S RECORD

ENTER REGISTRATION NUMBER or (XXX TO QUIT): 972345JF

ENTER FIRST NAME: ZAKARI

ENTER INITIALS N.

ENTER LAST NAME OF CANDIDATE: MAHMUD

ENTER CANDIDATE'S SEX M

ENTER CANDIDATE'S STATE OF ORIGIN NIGER

ENTER FIRST SUBJECT: ENGLISH

ENTER SCORES: 51

ENTER SECOND SUBJECT: CHEMISTRY

ENTER SCORES: 50

ENTER THIRD SUBJECT: PHYSICS

ENTER SCORES: 52

ENTER FOURTH SUBJECT: GEOGRAPHY

ENTER SCORES: 50

ENTER INSTITUTIONS OF CHOICE: FUT,MINNA,UNI.OF ABJ

ENTER DURATION FOR THE COURSE: 5YRS

ENTER CUT OFF REQUIREMENT: 201

any key to continue...

DELETING CANDIDATE'S RECORD

ENTER REGISTRATION NUMBER or (XXX TO QUIT): 972345JF

ENTER FIRST NAME: ZAKARI

ENTER INITIALS N.

ENTER LAST NAME OF CANDIDATE: MAHMUD

ENTER CANDIDATE'S SEX M

ENTER CANDIDATE'S STATE OF ORIGIN NIGER

ENTER FIRST SUBJECT: ENGLISH

ENTER SCORES: 51

ENTER SECOND SUBJECT: CHEMISTRY

ENTER SCORES: 50

ENTER THIRD SUBJECT: PHYSICS

ENTER SCORES: 52

ENTER FOURTH SUBJECT: GEOGRAPHY

ENTER SCORES: 50

ENTER INSTITUTIONS OF CHOICE: FUT, MINNA, UNI. OF ABJ

ENTER DURATION FOR THE COURSE: 5YRS

ENTER CUT OFF REQUIREMENT: 201

TO DELETE THIS RECORD (Y/N) ?

# CHAPTER FIVE

## 5.1

### SUMMARY & CONCLUSION

From the foregone discussions, it can be noted that a tremendous success has been achieved in carrying out this project work towards attaining its aims and objectives.

One could easily see with clarity and ease of understanding, that the project divided into different chapters. Where the first part gives a highlight of the establishment of the Joint Admissions and Matriculation Board (JAMB). Also evident is its structured organisation, the type of Admission system adopted, with specific reference to the U.M.E. (University Matriculation Examination) Admission process.

And at the end, the type of program designed and adopted to meet with this type of admission system. It could be noted here that, a considerable success has been attained in test and run of program adopted for this purpose. In this, its clearly seen how a candidate's Registration number would be supplied to the computer to obtain other details of the candidate such as, His institutions of choice, the faculty, the course the candidate applies for, his sex, his aggregate score which determines his chances of being admitted or not, based on the computed cut-off mark of the school or institution of choice. etc

Another important aspect in using DBase(iv) program in writing this project is in its capability to

- (i) Create and maintain (add, delete and revise records)
- (ii) Extract and list all records or only those records that meet certain conditions.



- (iii) Make an inquiry.
- (iv) Sort records in ascending or descending order by primary, secondary and tertiary fields, and
- (v) Generate formatted reports with sub-totals and totals.

## 5.2

# RECOMMENDATIONS

A considerable success has been achieved in this project, in terms of the program design and execution.

It's worth giving some kind of recommendation in terms of:-

- (i) adopting new method of programming language usage (dbase) to replace the old existing and the currently used method of programming language, which in this case is COBOL most especially in the organisation. This owes to the fact that its use is gradually giving way to the newly developed fourth generation languages. Also is, its wordy nature which consumes a lot of programmers time and effort.
- (ii) the acquisition of new software packages that would relate to the organisational application and use.
- (iii) training of more staff to be able handle and maintain such packages efficiently.
- (iv) Continuous search for more newer methods developed that are more efficient and easier while put into use than the currently used method since we are already in an Era of continuous improvement in Technology Day-in and Day-out. As such

there is the need for the update of our currently existing systems, to meet the specification.

- (V) Usually, individual database files are designed to meet the specific requirements of particular functional unit in organization, such as admissions, personnel, accounting, sales, or production. Consequently different but similar files are created to support these functions. Many of the data elements on each of these files are common. For example, each functional area needs to maintain such data as candidates name, candidates address and other related particulars concerning the individual. Here for instance, when the name of the contact person changes in a traditional file environment, each file must be updated separately. The associated data redundancy is therefore costly. But this can be minimized by adopting and designing an integrated database to serve the organization as a whole, not just one specific department. And the kind of integrated database that would make this possible is the Data Base Management System (DBMS) software.

The DBMS in effect, minimizes data, redundancy, through advanced data structures, or the manner in which the data elements and records are related to one another. The programming task is simplified because data are more readily available. In a database system, data are independent of the applications programs, that is data elements can be added, changed, and deleted from the database, and this does not affect existing programs. In addition, the processing constraints of traditional files are also overcome by DBMS.

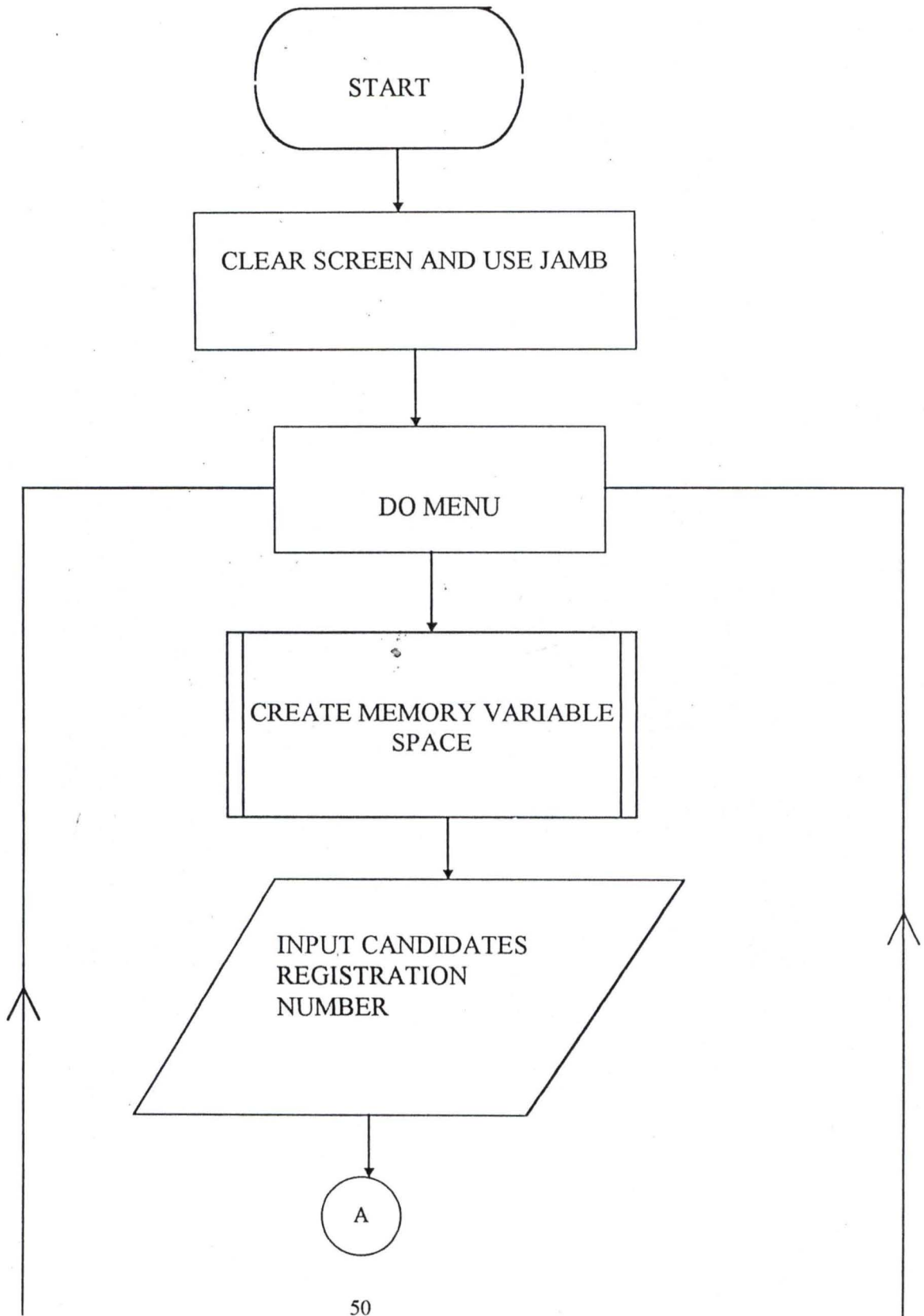
(VI) Another major benefit of the database environment is greater access to information. Most organizations would be seen to have accumulated a wealth of data, but translating these data into meaningful information has, at times, proved difficult. Therefore the structure of an integrated database can provide enormous flexibility in the types of reports that can be generated and the types of on-line inquiries that can be made.

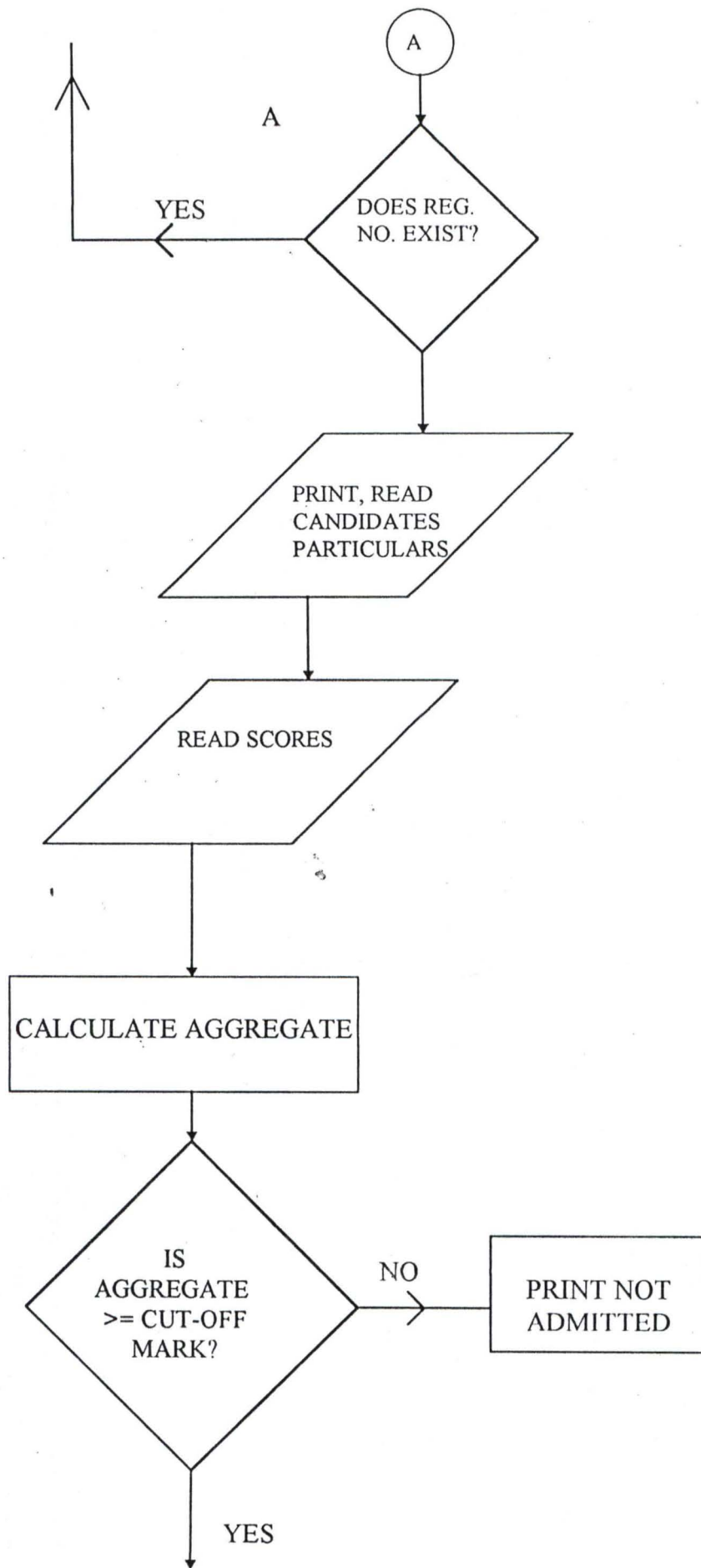
## REFERENCES

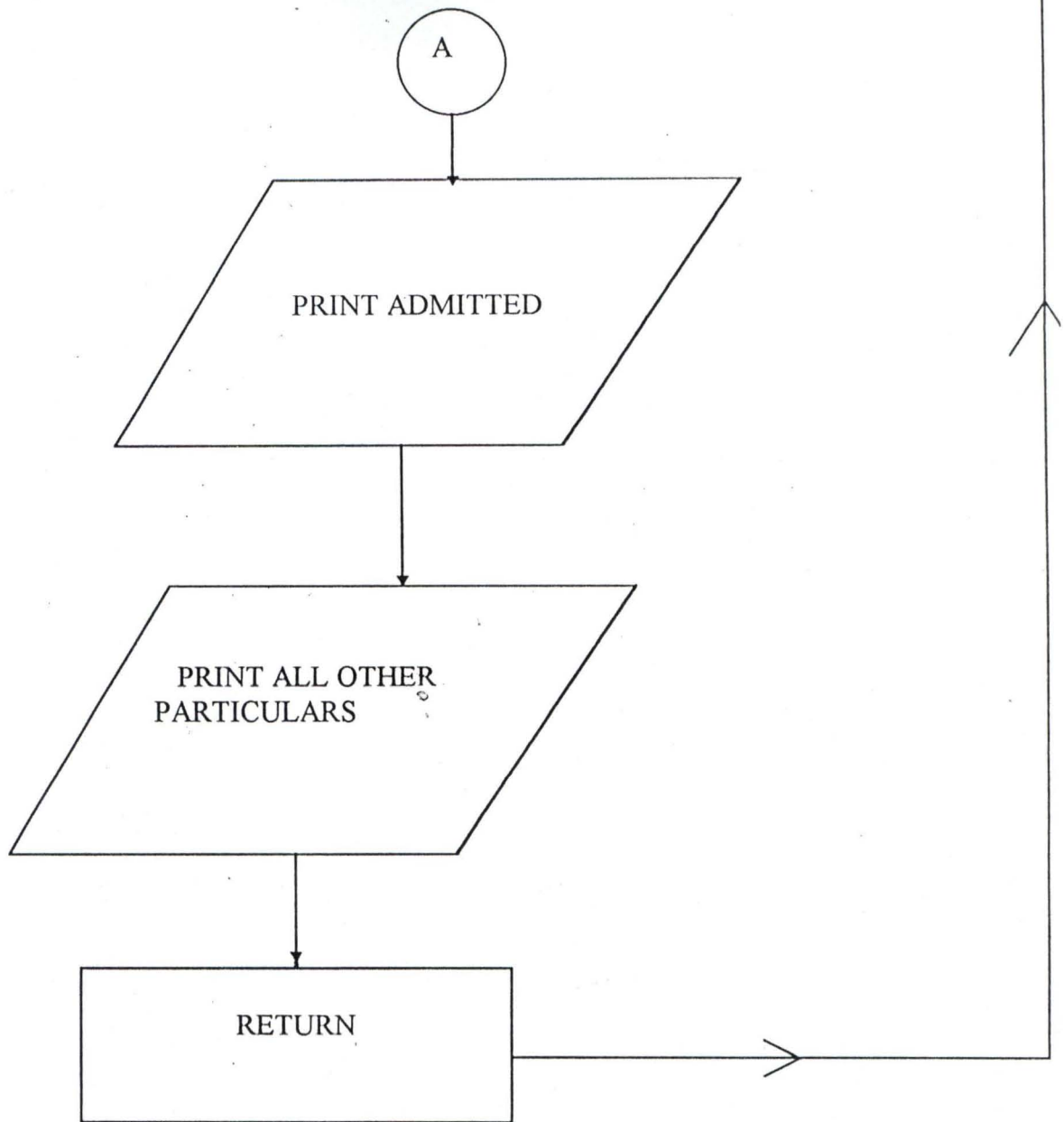
1. Akin F. Understanding and using micro-computers. Published by AFLON Publishing Services Limited Nigeria. (1995)
2. Alan S. Understanding DBASE IV, Published by Berkley:Sybex, (1984).
3. Angulu M. S. Comparability of the W.A.E.C.S Examination And the JAMBS Examination result as Admission criteria into Nigerian University - Seminar presentation, (1986).
4. French C. S. Computer Science Fourth Edition, published by DP Publication, Aldine place London W128AW, (1992).
5. Kola, R. Data Base Management SDystem Hand out, (1996).
6. Oladeji K. O. Test Administration: A critical Appraisal of the problems involved in conducting the U.M.E by JAMB, (1995).
7. JAMB Annual report And Accounts JAMB information Department, (1986).
8. JAMB Brochure JAMB information Department,(1997).
9. JAMB Information Booklet JAMB information Department, Published by Merit communications Ltd. Ikoyi Lagoos, (1985).

# APPENDIX A

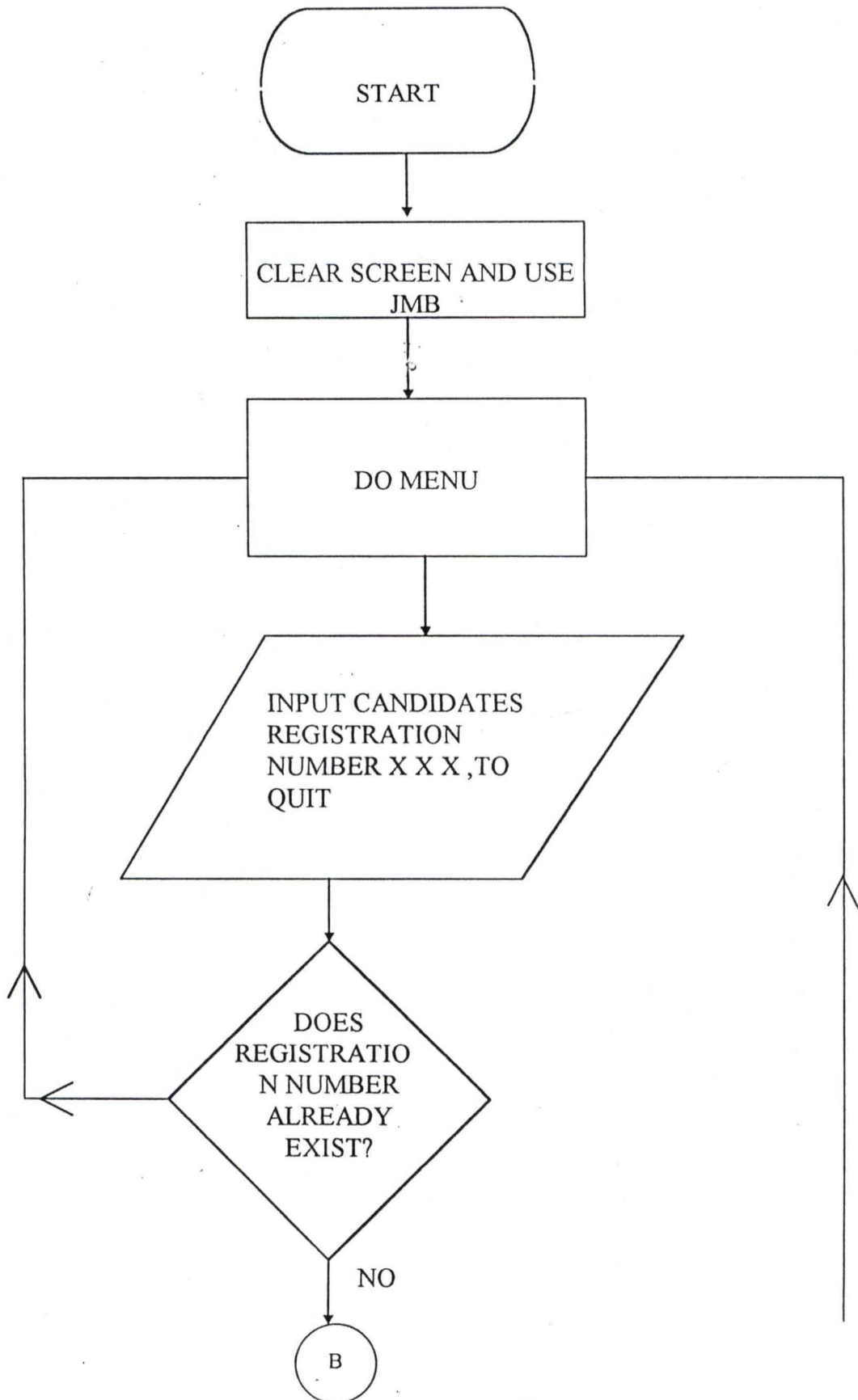
## FLOW-CHART FOR THE ADD-PROGRAM



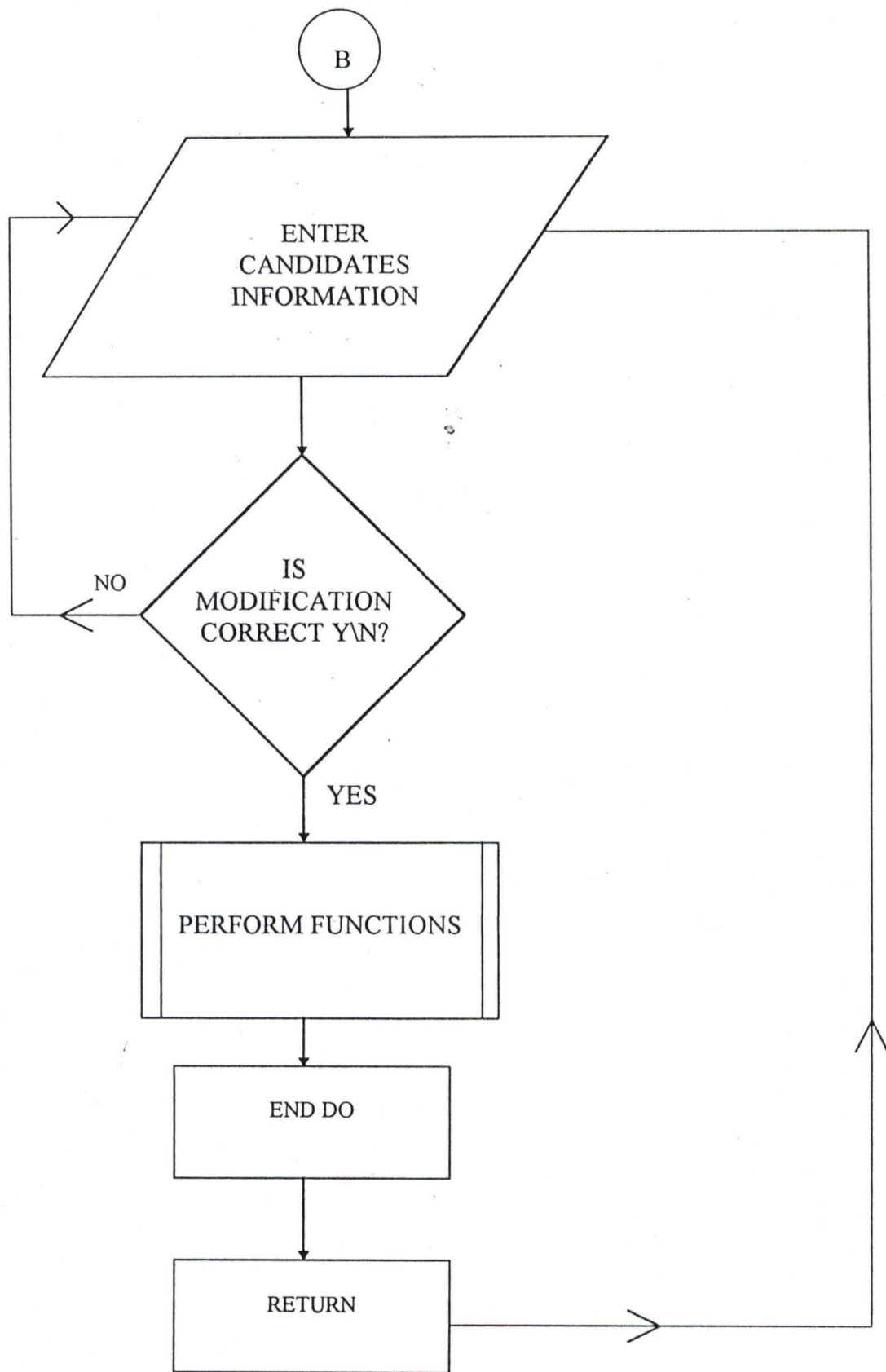




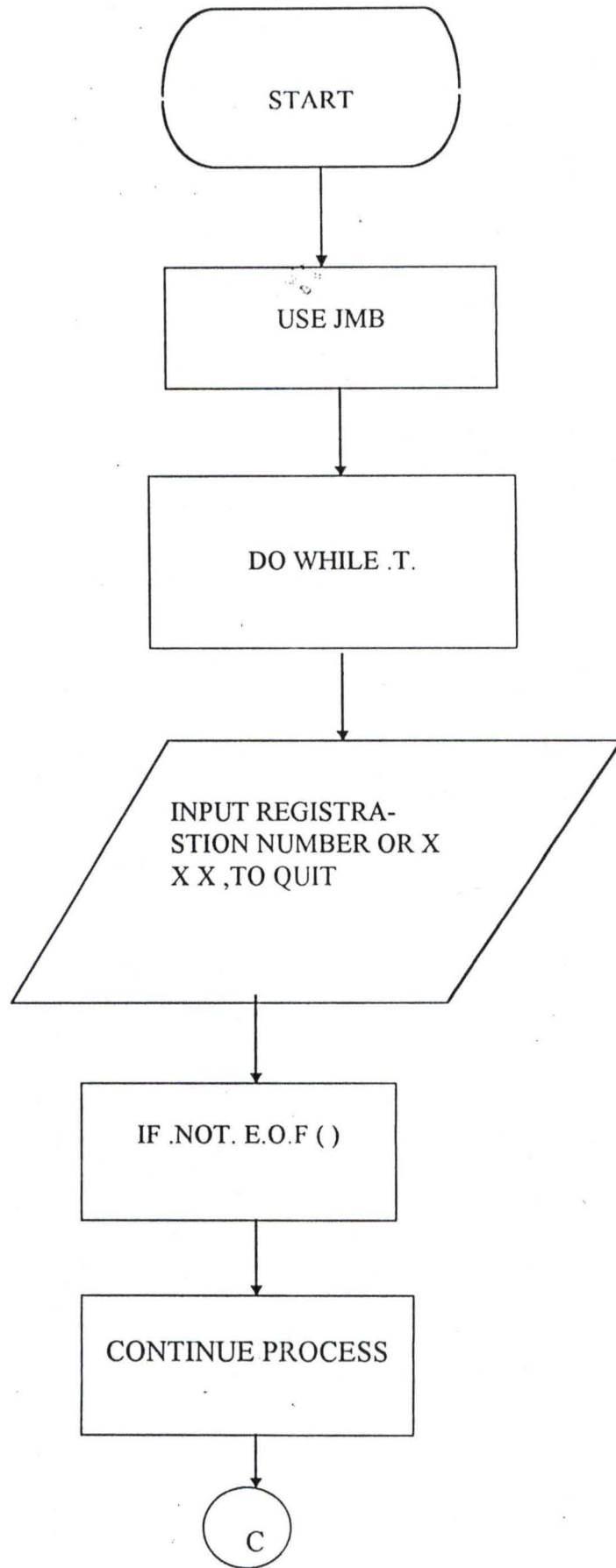
# FLOW-CHART FOR ALL THE MODIFY PROGRAM

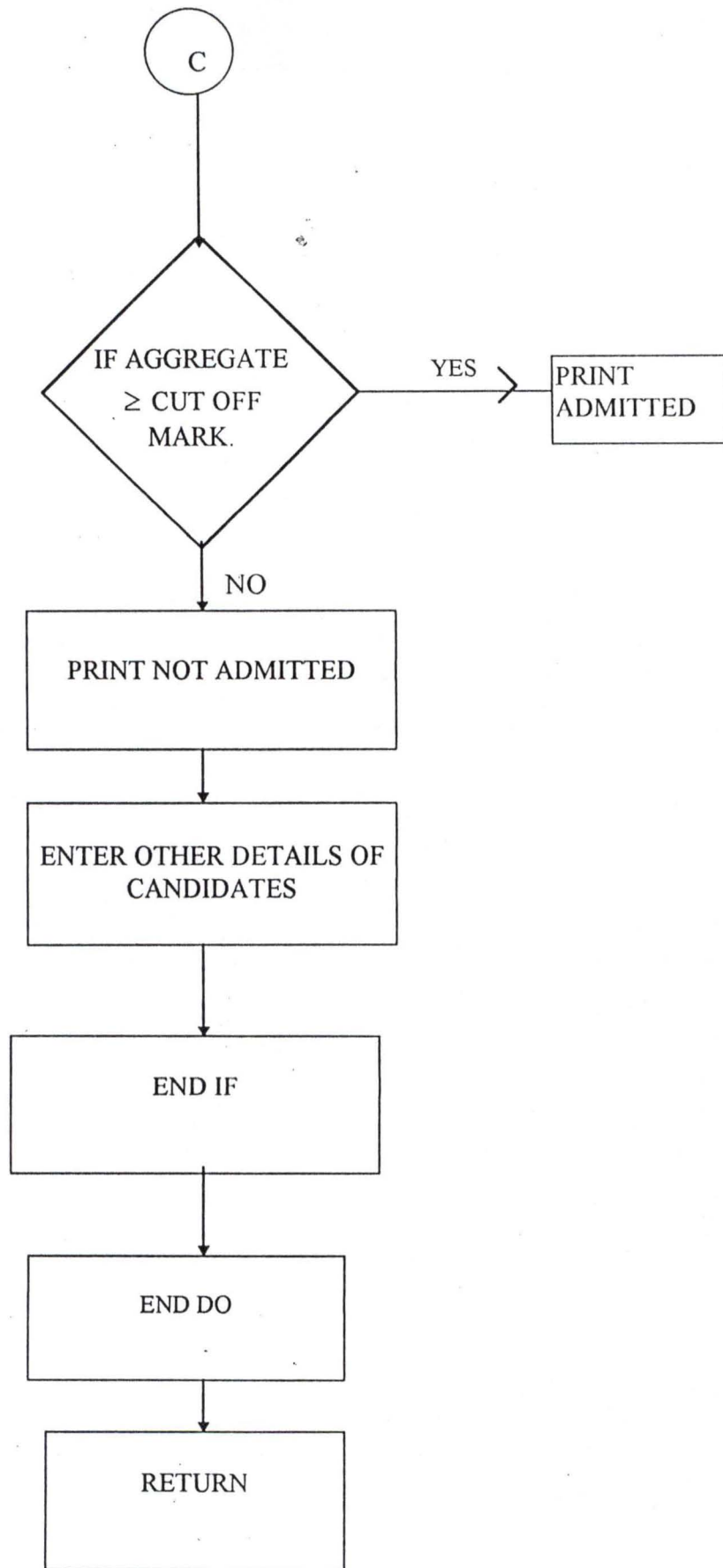




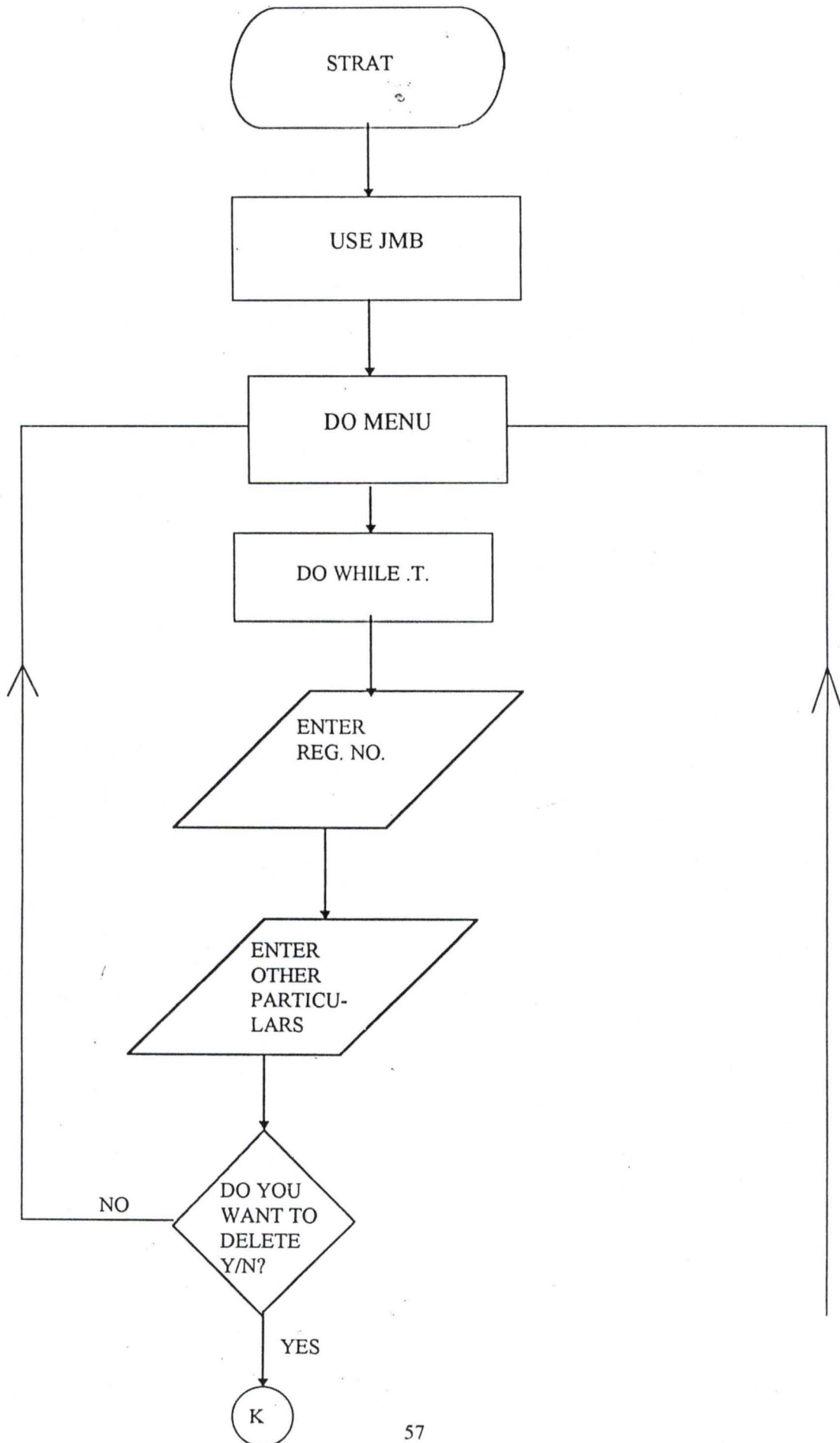


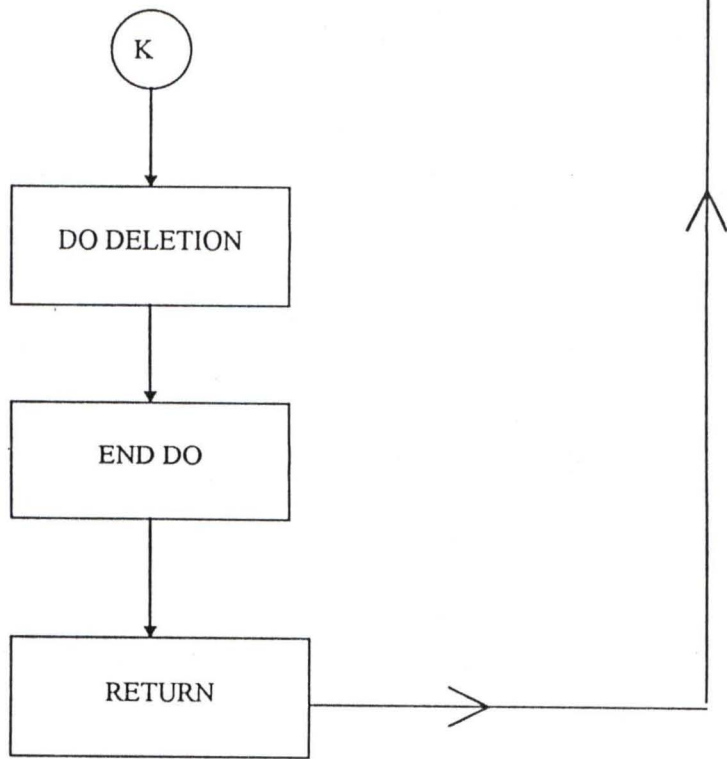
FLOW-CHART FOR THE VIEW PROGRAM,





# FLOW-CHART FOR THE DELETE PROGRAM





## APPENDIX B

ABUMENU.PRG

```
SET TALK OFF
SET STATUS OFF
SET SCOREBOARD OFF
SET SAFETY OFF
SET DATE BRITISH
DO WHILE .T.
  CLEAR
  @ 1,15 TO 23,64 DOUBLE
  @ 0,26 TO 2,54 DOUBLE
  @ 1,27 SAY "JAMB (UME) ADMISSION SYSTEM"
  @ 3,35 SAY 'MAIN MENU'
  @ 4,35 TO 4,43 DOUBLE
  @ 5,21 SAY '1 ..... ADD RECORDS OF CANDIDATES'
  @ 7,21 SAY '2 ..... MODIFY RECORDS OF CANDIDATES'
  @ 9,21 SAY '3 ..... VIEW RECORDS OF CANDIDATES'
  @ 11,21 SAY '4 ..... DELETE RECORDS OF CANDIDATES'
  @ 13,21 SAY '5 ..... LIST RECORDS OF CANDIDATES'
  @ 15,21 SAY '6 ..... SORT RECORDS OF CANDIDATES'
  @ 17,21 SAY '7 ..... EXITTING ADMISSION SYSTEM'
  ANS = SPACE(1)
  @ 19,16 TO 19,63 DOUBLE
  @ 21,30 SAY "ENTER YOUR CHOICE:" GET ANS
  READ
DO CASE
CASE ANS = "7"
  CLEAR
  CLEAR ALL
  EXIT
CASE ANS = "1"
  DO ADD
CASE ANS = "2"
  DO MOD
CASE ANS = "3"
  DO VIEW
CASE ANS = "4"
  DO EDELE
```

```
CASE ANS = "5"  
DO ABULIS  
CASE ANS = "6"  
DO SORT  
ENDCASE  
ENDDO  
RETURN
```

ADD.PRG

```
CLEAR  
USE JMB  
*@1,18 TO 3,60
```

DO WHILE .T.

```
MREGNO = SPACE(8)  
MFNAME = SPACE(15)  
MLNAME = SPACE(15)  
MINITIALS = SPACE(5)  
MSEX = SPACE(1)  
MSTATE = SPACE(13)  
MSUBJECT1 = SPACE(15)  
MSUBJECT2 = SPACE(15)  
MSUBJECT3 = SPACE(15)  
MSUBJECT4 = SPACE(15)  
MINSTITUT = SPACE(20)  
MDURATION = SPACE(7)  
MCUTOFFR = SPACE(5)  
MCOURSECO = SPACE(3)  
MFACULTYCO = SPACE(2)  
MAGGREGS = SPACE(3)  
MSORTOP = SPACE(6)  
MSC1 = 0  
MSC2 = 0  
MSC3 = 0  
MSC4 = 0  
@ 1,1 TO 24,75 DOUBLE  
@ 1,27 SAY "ADDING CANDIDATE'S RECORD"  
@ 0,26 TO 2,52 DOUBLE
```

```

@3,3 SAY "ENTER REGISTRATION NUMBER or (XXX TO QUIT):" GET
MREGNO
READ
IF MREGNO = "XXX"
EXIT
ENDIF
LOCATE FOR REGNO = MREGNO
IF .NOT. EOF()
@22,10 SAY "REGISTRATION NUMBER ALREADY EXIST, ENTER ANOTHER
REG. NUMBER"
WAIT
CLEAR
LOOP
ENDIF
@5,3 SAY "ENTER FIRST-NAME:" GET MFNAME PICTURE '@!'
@7,3 SAY "ENTER LAST NAME OF CANDIDATE:" GET MLNAME PICTURE
'@!'
@5,50 SAY "ENTER INITIALS" GET MINITIALS PICTURE '@!'
@7,50 SAY "ENTER CANDIDATE'S SEX" GET MSEX PICTURE '!'
@9,3 SAY "ENTER CANDIDATE'S STATE OF ORIGIN" GET MSTATE
PICTURE '@!'
@11,3 SAY "ENTER FIRST SUBJECT:" GET MSUBJECT1 PICTURE '@!'
@11,50 SAY "ENTER SCORES:" GET MSC1 PICTURE '999'
@13,3 SAY "ENTER SECOND SUBJECT:" GET MSUBJECT2 PICTURE '@!'
@13,50 SAY "ENTER SCORES:" GET MSC2 PICTURE '999'
@15,3 SAY "ENTER THIRD SUBJECT:" GET MSUBJECT3 PICTURE '@!'
@15,50 SAY "ENTER SCORES:" GET MSC3 PICTURE '999'
@17,3 SAY "ENTER FOURTH SUBJECT:" GET MSUBJECT4 PICTURE '@!'
@17,50 SAY "ENTER SCORES:" GET MSC4 PICTURE '999'
@19,3 SAY "ENTER INSTTUTIONS OF CHOICE:" GET MINSTITUT PICTURE
'@!'
@21,3 SAY "ENTER DURATION FOR THE COURSE:" GET MDURATION
@23,3 SAY "ENTER CUT-OFF REQUIREMENT:" GET MCUTOFFR
READ
MAGGREGS = SC1+SC2+SC3+SC4
IF MAGGREGS > 205
@2,65 GET MAGGREGS
@3,10 SAY "ADMITTED"
ELSE
@3,10 SAY "NOT ADMITTED"
ENDIF

```



```
CLEAR
APPEND BLANK
REPLACE REGNO WITH MREGNO
REPLACE FNAME WITH MFNAME
REPLACE LNAME WITH MLNAME
REPLACE INITIALS WITH MINITIALS
REPLACE SEX WITH MSEX
REPLACE STATE WITH MSTATE
REPLACE SUBJECT1 WITH MSUBJECT1
REPLACE SUBJECT2 WITH MSUBJECT2
REPLACE SUBJECT3 WITH MSUBJECT3
REPLACE SUBJECT4 WITH MSUBJECT4
REPLACE INSTITUT WITH MINSTITUT
REPLACE DURATION WITH MDURATION
REPLACE CUTOFFR WITH MCUTOFFR
REPLACE SC1 WITH MSC1
REPLACE SC2 WITH MSC2
REPLACE SC3 WITH MSC3
REPLACE SC4 WITH MSC4
*REPLACE SORTOP WITH SORTOP
CLEAR
LOOP
ENDDO
USE
CLEAR
RETURN
```

MOD.PRG

```
CLEAR
USE JMB
*@1,18 TO 3,60
```

```
DO WHILE .T.
MREGNO = SPACE(8)
@ 1,1 TO 24,75 DOUBLE
@ 1,26 SAY "MODIFYING CANDIDATE'S RECORD"
@ 0,25 TO 2,54 DOUBLE
@3,3 SAY "ENTER REGISTRATION NUMBER or (XXX TO QUIT):" GET
MREGNO
```

```

READ
IF MREGNO = "XXX"
EXIT
ENDIF
LOCATE FOR REGNO = MREGNO
IF EOF()
@22,10 SAY "REGISTRATION NUMBER ALREADY EXIST, ENTER ANOTHER
REG. NUMBER"
WAIT
CLEAR
LOOP
ENDIF
MFNAME = FNAME
MLNAME = LNAME
MINITIALS = INITIALS
MSEX = SEX
MSTATE = STATE
MSUBJECT1 = SUBJECT1
MSUBJECT2 = SUBJECT2
MSUBJECT3 = SUBJECT3
MSUBJECT4 = SUBJECT4
MINSTITUT = INSTITUT
MDURATION = DURATION
MCUTOFFR = CUTOFFR
MCOURSECO = COURSECO
MFACULTYCO = FACULTYCO
MAGGREGS = AGGREGS
MSORTOP = SORTOP
MSC1 = SC1
MSC2 = SC2
MSC3 = SC3
MSC4 = SC4
@5,3 SAY "ENTER FIRST NAME:" GET MFNAME PICTURE '@!'
@7,3 SAY "ENTER LAST NAME OF CANDIDATE:" GET MLNAME PICTURE
 '@!'
@5,50 SAY "ENTER INITIALS" GET MINITIALS PICTURE '@!'
@7,50 SAY "ENTER CANDIDATE'S SEX" GET MSEX PICTURE '!
@9,3 SAY "ENTER CANDIDATE'S STATE OF ORIGIN" GET MSTATE
 PICTURE '@!'
@11,3 SAY "ENTER FIRST SUBJECT:" GET MSUBJECT1 PICTURE '@!'
@11,50 SAY "ENTER SCORES:" GET MSC1 PICTURE '999'

```

```

@13,3 SAY "ENTER SECOND SUBJECT:" GET MSUBJECT2 PICTURE '@!'
@13,50 SAY "ENTER SCORES:" GET MSC2 PICTURE '999'
@15,3 SAY "ENTER THIRD SUBJECT:" GET MSUBJECT3 PICTURE '@!'
@15,50 SAY "ENTER SCORES:" GET MSC3 PICTURE '999'
@17,3 SAY "ENTER FOURTH SUBJECT:" GET MSUBJECT4 PICTURE '@!'
@17,50 SAY "ENTER SCORES:" GET MSC4 PICTURE '999'
@19,3 SAY "ENTER INSTITUTIONS OF CHOICE:" GET MINSTITUT PICTURE
 '@!'
@21,3 SAY "ENTER DURATION FOR THE COURSE:" GET MDURATION
@23,3 SAY "ENTER CUT OFF REQUIREMENT:" GET MCUTOFFR
READ
MAGGREGS = SC1+SC2+SC3+SC4
IF MAGGREGS > 205
@2,65 GET MAGGREGS
@3,10 SAY "ADMITTED"
ELSE
@3,10 SAY "NOT ADMITTED"
ENDIF
CLEAR
REPLACE REGNO WITH MREGNO
REPLACE FNAME WITH MFNAME
REPLACE LNAME WITH MLNAME
REPLACE INITIALS WITH MINITIALS
REPLACE SEX WITH MSEX
REPLACE STATE WITH MSTATE
REPLACE SUBJECT1 WITH MSUBJECT1
REPLACE SUBJECT2 WITH MSUBJECT2
REPLACE SUBJECT3 WITH MSUBJECT3
REPLACE SUBJECT4 WITH MSUBJECT4
REPLACE INSTITUT WITH MINSTITUT
REPLACE DURATION WITH MDURATION
REPLACE CUTOFFR WITH MCUTOFFR
REPLACE SC1 WITH MSC1
REPLACE SC2 WITH MSC2
REPLACE SC3 WITH MSC3
REPLACE SC4 WITH MSC4
*REPLACE SORTOP WITH SORTOP
CLEAR
LOOP
ENDDO
USE

```

CLEAR  
RETURN

VIEW.PRG

CLEAR  
USE JMB  
\*@1,18 TO 3,60

DO WHILE .T.  
MREGNO = SPACE(8)

@ 1,1 TO 24,75 DOUBLE  
@ 1,27 SAY "VIEWING CANDIDATE'S RECORD"  
@ 0,26 TO 2,53 DOUBLE  
@3,3 SAY "ENTER REGISTRATION NUMBER or (XXX TO QUIT):" GET  
MREGNO  
READ  
IF MREGNO = "XXX"  
EXIT  
ENDIF  
LOCATE FOR REGNO = MREGNO  
IF EOF()  
@22,10 SAY "REGISTRATION NUMBER ALREADY EXIST, ENTER ANOTHER  
REG. NUMBER"  
WAIT  
CLEAR  
LOOP  
ENDIF  
MFNAME = FNAME  
MLNAME = LNAME  
MINITIALS = INITIALS  
MSEX = SEX  
MSTATE = STATE  
MSUBJECT1 = SUBJECT1  
MSUBJECT2 = SUBJECT2  
MSUBJECT3 = SUBJECT3  
MSUBJECT4 = SUBJECT4  
MINSTITUT = INSTITUT  
MDURATION = DURATION

```
MCUTOFFR = CUTOFFR
MCOURSECO = COURSECO
MFACTYCO = FACULTYCO
MAGGREGS = AGGREGS
MSORTOP = SORTOP
MSC1 = SC1
MSC2 = SC2
MSC3 = SC3
MSC4 = SC4
@5,3 SAY "ENTER FIRST NAME:" GET MFNAME PICTURE '@!'
@7,3 SAY "ENTER LAST NAME OF CANDIDATE:" GET MLNAME PICTURE
 '@!'
@5,50 SAY "ENTER INITIALS" GET MINITIALS PICTURE '@!'
@7,50 SAY "ENTER CANDIDATE'S SEX" GET MSEX PICTURE '!'
@9,3 SAY "ENTER CANDIDATE'S STATE OF ORIGIN" GET MSTATE
 PICTURE '@!'
@11,3 SAY "ENTER FIRST SUBJECT:" GET MSUBJECT1 PICTURE '@!'
@11,50 SAY "ENTER SCORES:" GET MSC1 PICTURE '999'
@13,3 SAY "ENTER SECOND SUBJECT:" GET MSUBJECT2 PICTURE '@!'
@13,50 SAY "ENTER SCORES:" GET MSC2 PICTURE '999'
@15,3 SAY "ENTER THIRD SUBJECT:" GET MSUBJECT3 PICTURE '@!'
@15,50 SAY "ENTER SCORES:" GET MSC3 PICTURE '999'
@17,3 SAY "ENTER FOURTH SUBJECT:" GET MSUBJECT4 PICTURE '@!'
@17,50 SAY "ENTER SCORES:" GET MSC4 PICTURE '999'
@19,3 SAY "ENTER INSTITUTIONS OF CHOICE:" GET MINSTITUT PICTURE
 '@!'
@21,3 SAY "ENTER DURATION FOR THE COURSE:" GET MDURATION
@23,3 SAY "ENTER CUT OFF REQUIREMENT:" GET MCUTOFFR
CLEAR GETS
WAIT
CLEAR
LOOP
ENDDO
USE
CLEAR
RETURN
```

```
EDELE.PRG
CLEAR
USE JMB
```

\*@1,18 TO 3,60

```
DO WHILE .T.
MREGNO = SPACE(8)
@ 1,1 TO 24,75 DOUBLE
@ 1,26 SAY "DELETING CANDIDATE'S RECORD"
@ 0,25 TO 2,53 DOUBLE
@3,3 SAY "ENTER REGISTRATION NUMBER or (XXX TO QUIT):" GET
MREGNO
READ
IF MREGNO = "XXX"
EXIT
ENDIF
LOCATE FOR REGNO = MREGNO
IF EOF()
@22,10 SAY "REGISTRATION NUMBER ALREADY EXIST, ENTER ANOTHER
REG. NUMBER"
WAIT
CLEAR
LOOP
ENDIF
MFNAME = FNAME
MLNAME = LNAME
MINITIALS = INITIALS
MSEX = SEX
MSTATE = STATE
MSUBJECT1 = SUBJECT1
MSUBJECT2 = SUBJECT2
MSUBJECT3 = SUBJECT3
MSUBJECT4 = SUBJECT4
MINSTITUT = INSTITUT
MDURATION = DURATION
MCUTOFFR = CUTOFFR
MCOURSECO = COURSECO
MFACULTYCO = FACULTYCO
MAGGREGS = AGGREGS
MSORTOP = SORTOP
MSC1 = SC1
MSC2 = SC2
MSC3 = SC3
MSC4 = SC4
```

```

@5,3 SAY "ENTER FIRST NAME:" GET MFNAME PICTURE '@!'
@7,3 SAY "ENTER LAST NAME OF CANDIDATE:" GET MLNAME PICTURE '@!'
@5,50 SAY "ENTER INITIALS" GET MINITIALS PICTURE '@!'
@7,50 SAY "ENTER CANDIDATE'S SEX" GET MSEX PICTURE '!'
@9,3 SAY "ENTER CANDIDATE'S STATE OF ORIGIN" GET MSTATE PICTURE '@!'
@11,3 SAY "ENTER FIRST SUBJECT:" GET MSUBJECT1 PICTURE '@!'
@11,50 SAY "ENTER SCORES:" GET MSC1 PICTURE '999'
@13,3 SAY "ENTER SECOND SUBJECT:" GET MSUBJECT2 PICTURE '@!'
@13,50 SAY "ENTER SCORES:" GET MSC2 PICTURE '999'
@15,3 SAY "ENTER THIRD SUBJECT:" GET MSUBJECT3 PICTURE '@!'
@15,50 SAY "ENTER SCORES:" GET MSC3 PICTURE '999'
@17,3 SAY "ENTER FOURTH SUBJECT:" GET MSUBJECT4 PICTURE '@!'
@17,50 SAY "ENTER SCORES:" GET MSC4 PICTURE '999'
@19,3 SAY "ENTER INSTITUTIONS OF CHOICE:" GET MINSTITUT PICTURE '@!'
@21,3 SAY "ENTER DURATION FOR THE COURSE:" GET MDURATION
@23,3 SAY "ENTER CUT OFF REQUIREMENT:" GET MCUTOFFR
CLEAR GETS
DO WHILE .T.
ANS=SPACE(1)
@ 24,20 SAY 'TO DELETE THIS RECORD (Y/N) ?' GET ANS PICT '!'
READ
IF ANS='Y'
EXIT
ENDIF
IF ANS='N'
EXIT
ENDIF
LOOP
ENDDO
IF ANS='Y'
DELETE
PACK
ENDIF
LOOP
ENDDO
USE
CLEAR
RETURN

```

ABULIS.PRG

```
SET TALK OFF
SET ECHO OFF
USE JMB
DO WHILE .T.
CLEAR
PN = 0
SN = 0
W = RECNO()
LINENO = 0
F = 1
@1,1 SAY "SN"
@1,6 SAY "REGNO"
@1,13 SAY "FNAME"
@1,25 SAY "LNAME"
@1,35 SAY "INITIALS"
@1,57 SAY "AGGREG"
@1,44 SAY "CUTOFF REQ"
@1,65 SAY "REMARK"
AGGREGS = SC1+SC2+SC3+SC4.
IF AGGREGS > 205
@2,65 SAY "ADMITTED"
ELSE
@2,65 SAY "NOT ADMITTED"
ENDIF
LINENO = 1
DO WHILE F < > W+1
LINENO = LINENO+1
SN = SN+1
@LINENO,1 SAY STR(SN,2)
@LINENO,6 SAY (REGNO)
@LINENO,13 SAY TRIM(FNAME)
@LINENO,29 SAY TRIM(LNAME)
@LINENO,35 SAY TRIM(INITIALS)
@LINENO,50 SAY (AGGREGS)
@LINENO,50 SAY CUTOFFR
IF LINENO = 20
WAIT
CLEAR
LINENO = 3
```



```
*GO TOP
SKIP
LINENO = LINENO+1
*@2,10 CLEAR TO 23,70
*ENDIF
IF EOF()
EXIT
ENDIF
ENDIF
SKIP
LINENO = LINENO+1
ENDDO
ENDDO
CLEAR
RETURN
```