

COMPUTERISATION OF MEDICAL LABORATORY TEST RECORD KEEPING SYSTEM

A CASE STUDY OF MEDICAL LABORATORY UNIT GENERAL HOSPITAL, MINNA

BY

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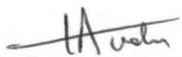
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**A PROJECT SUBMITTED TO THE DEPARTMENT OF MATHEMATICS
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FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF A POST-
GRADUATE DIPLOMA IN COMPUTER SCIENCE.**

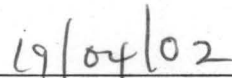
APRIL, 2002.

CERTIFICATION

This is to certify to the best of my knowledge that this work was carried out by me, SIDI AMINA under the supervision of Mallam Isah Audu of the Department of Mathematics/Computer Science, Federal University of Technology, Minna.



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DATE

DEDICATION

This work is dedicated to my beloved Husband, **DADDY**.

ACKNOWLEDGEMENT

I give gratitude to Almighty Allah for giving me the wisdom, sound states of health and mind and above all strength to undertake this study.

I am highly indebted to my supervisor, Mallam Isah Audu whose meticulous supervision had led to the completion of this work. I equally acknowledge the contribution of the Head of Department of Mathematics/Computer Science Department, Mr L. N. Ezeako, Dr Yomi Aiyesimi, Mallam D. Hakimi, Prince R. O. Badmus, Dr N. I. Akinwande and all other staff of Mathematics/Computer Science Department whose names are not mentioned.

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I am most grateful to my husband and children, Binta and Abba [may Almighty Allah bless, guide and protect them (Amen)] for their patience and understanding throughout the period of my study.

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ABSTRACT

Computerisation will go a long way to solve the problems of record keeping in the Laboratory Unit of General Hospital, Minna. This problems ranging from slow response to report requested to loss of data make access to test results difficult.

To develop software suitable for this record keeping purpose, a Database Management System package is required.

CHAPTER ONE

GENERAL INTRODUCTION

1.1 HISTORY OF THE MINNA GENERAL HOSPITAL

General hospital, Minna was established in 1962 to take care of the health needs of the populace of Minna, and its environs the hospital at inception was made up of vital departments and sections such as medical Records, Laboratory, pharmacy, Medical, surgical, obstetrics and gynaecology, paediatrics, out patients and wards the only eye centre (where major operations are performed) is situated within the hospital. The hospital also has its own infusion plant (that produces infusion solutions).

The hospital started with a bed capacity of 100 and was later expended to 150 and again expanded in 1980 to a 200 bed capacity. Those expansion were necessary due to the population growth of the area it is meant to serve which in turn led to an increasing demand on the hospital. Until the upgrading of the Bida, General Hospital to the status of a Federal Medical Centre, a few years ago, almost all referral cases (especially, laboratory investigations) by other hospitals within Niger State were made to the Minna General Hospital Medical laboratory. The hospital is fully operational with all the departments performing their specific functions to promote the health care needs of the populace.

Practical training of house officers, intern pharmacists, student nurses and midwives and other allied health courses is also undertaken by the hospital.

Increase in awareness (as regards the use of orthodox medicine) in the country has increased the patronage of the hospital services. Hence, a proper record keeping system is inevitable.

1.2 ADMINISTRATIVE STRUCTURE OF THE HOSPITAL

The General Hospital, Minna is headed by a medical officer designated "Head of Hospital Services" (HHS). The "Hospital secretary", is in charge of administration. All other departments are headed by the relevant professionals on the ranks of Principal, Assistant Chief, and Chief as the case may be.

The various departments outlined below see to the smooth running of the hospital.

A General Records

1. **New Cards Section:** – Patients coming into the hospital for the first time are issued new cards on payment of a fee.
2. **Old cards Section:** – Patients who have been registered before, present their small cards (or state their registration numbers) which is used to locate the larger card. The larger cards are then taken to the doctor who is supposed to attend to the patient. This section is absent in Minna, General Hospital.

Here, patients, medical records are kept in twenty leaves exercise books, which are taken home by the patients except the paediatric clinic where the exercise books are kept by the clinic.

B. Reception Departments.

1 **Out – Patients:** - This is the first point of call for most patients. After registration at the card section, the patient is directed to the out patients department (OPD). Here, the patients consult a G.P. who diagnosis immediately following the outcome of a (or some) test(s) carried out. When necessary, patients are referred to consultants in the appropriate specialities by the G.P. the consultant afterwards updates the G.P. on his decision(s) and outline of future treatment.

2. **Accident/Emergency Department (causality):** - This department deals with both major and minor episodes. This department may be the referral points for in or out- patient care or home care by a G. P. to protect patients and junior medical staff many hospitals now appoint consultant staff to head teams of doctors and nurses working round the clock in these vital departments.

B. Diagnostic Departments

This department consists of various units where specialists carry out investigations on functions of the body. Most hospitals have the following: -

1. Clinical Laboratory
2. Electrocardiography
3. X-ray
4. Ultra-sound

All these departments are staffed by qualified personnel and trainees and may have a doctor as head of the team.

Patients are taken to these departments on wheel chair or stretchers, if unable to walk, accompanied by voluntary helps or hostesses or go alone if strong enough to do so. Samples could also be collected from in-patients by doctors or nurses for laboratory tests.

C. Treatment (In-patients)

The total care of a patient does not depend entirely on the nursing services. But some or all of the following must be co-ordinated by the ward sisters and medical staff.

- 1 Administrative Services
 - Catering
 - Domestic
 - Laundry
 - Secretarial
 - Maintenance
2. Area Health Authority Services
 - Pharmaceutical

- Community health care
- 3. Local Authority Services
Social Services Department
- 4. Paramedical Services
Occupational therapy
Physiotherapy
Radiotherapy
Speech therapy
- 5. Nursing Services
Operating theatres
Special care units.

All the departments must co-operate with and respect the contribution of each other to see to the smooth, effective, and efficient running of the hospital.

1.3 ADMINISTRATIVE STRUCTURE OF THE MEDICAL LABORATORY UNIT

The medical laboratory, which is the area of concern of this project work, is an organised unit of the diagnostic department. It comprises of subunits, which carry out different functions. The activities of these subunits are co-ordinated centrally.

The administrative structure is illustrated by the organogram shown in Appendix A.

Chief Medical Laboratory Scientist (CMIS): - Controls the over-all activities of the medical laboratory. He sees to the welfare of both patients and staff, and also makes sure that both financial and test records are properly kept. He also signs the test result slips after investigations are carried out. The various sub unit heads report directly to him. The Assistant chief medical laboratory scientist (ACMLS) also report to him. He is answerable to the hospital secretary or the head of hospital services.

Assistant Chief Medical Laboratory Scientist (ACMLS): - Makes sure that reagents and equipment needed for various investigations are available and in good condition. He also sees to it that the staff under his unit work according to their schedule of duty.

Principal Laboratory Scientist (PLS): - Each sub-unit of the laboratory unit is headed by this category of staff. They co- ordinate the activities of the unit and report to the CMLS or ACMLS as the case may require.

Medical Laboratory Scientist I And II (MLS I & II): - Carries out most of the investigation (e.g. full blood count, fasting blood sugar etc). They also ensure that discipline is maintained in the laboratory. They report directly to the ACMLS or the PLS as the case may require.

The Clinical Laboratory Technician (CLT): - Sees to the maintenance of laboratory equipment and preparation of reagents. He may also be assigned the job of sample collection and preparation. He is answerable to the MLS II.

The Attendants: - Ensure that sanitation is maintained in the laboratory. They also assist the technicians in sample collection and preparation.

The laboratory sub-units work together as a team (single unit). They Co-operate with and respect the contributions of each other.

An ideal medical laboratory should have a reception where patients are registered. Costing and payment of bills should also be conducted here. a sample collection centre (where sample are collected and labelled) should also be attached to the reception .

From the sample collection centre, the labelled samples and their corresponding request forms are distributed to the various sub-units concerned.

After the tests are conducted, results should be sent back to the reception where it is record by the computer operator. They could then be retrieved by the doctors, establishments, organisations, institutions, etc making the request.

The medical laboratory could be run as an entity independent of a hospital setting

1.4 FUNCTIONS OF THE MEDICAL LABORATORY UNIT

The medical laboratory unit at Minna, General hospital serves the hospital where it is located and other government owned and private Clinics in Minna and its environ. It also serves institutions and organisations that may require its services.

In this unit, tests are conducted on various samples (blood, tissues etc) taken from human body (either dead or alive) by experts. The out come of these investigations could be used to deduce the health condition or the cause of death of an individual.

Most medical laboratories comprise of various subunits. Below are the subunits and some investigations they perform. The types of investigations carried out by a medical laboratory depend largely on the demands of the host hospital which in turn depends on the level of the doctors running the hospital. While investigations carried out by a private medical laboratory depends on the competence of the laboratory staff, the sophistication of the instrument /equipment available and local demand.

1. BIOCHEMISTRY SUB-UNIT

- i. Kidney function investigations
- ii. Gastrointestinal tract function investigations
- iii. The liver and Biliary function investigation tests.
- iv. Enzyme efficiency investigations.

- v. Toxicology and ultra micro analysis
- vi. Amino acid and other inborn errors of metabolism investigations
- vii. Endocrine investigations

2. MICROBIOLOGY

- i. Immunoglobulins and immunity investigations
- ii. Antibiotic sensitivity investigations
- iii. Mycological investigations
- iv. Parasitological investigations
- v. Basic medical entomological investigations
- vi. Virological investigations.

3. HISTOLOGY

- 1. Tissue fixation
- 2. Embedding (e.g. preservation of dead bodies)
- 3. Preservation of tissues for future use (e.g. kidney)

4. HAEMATOLOGY AND BLOOD BANK

Investigation On: -

- i. Erythrocyte disorders
- ii. Disorders of leukocytes and plasma.
- iii. Disorders of haemostasis
- iv. Immunohaematology

- v. Blood transfusion
- vi. Blood bank organization

5. HUMAN CYTOGENETICS

Investigations involving genetic factors e.g. DNA test and blood group serology

6. CYTOLOGICAL DIAGNOSIS

- i. Malignant (cancerous) condition investigations
- ii. Sex hormonal investigations in females.
- iii. Gastro-intestinal investigations (verification of oesophageal, prostate etc. lesions)
- iv. Identification fixation, and mailing of smears (specimen).

7. HIV/AIDS SCREENING SUB-UNIT

- i. Screening investigations on the Human Immune Deficiency Virus
- ii. Confirmatory investigations on Acquired Immune Deficiency Syndrome

A patient may need to be tested by more than a sub-unit at a time. in such instances, the investigations are grouped and sample(s) are taken accordingly. Separate result(s) are also provided for each group.

1.5 OBJECTIVES OF THE STUDY

The main objectives of this study cover the following: -

- i. To provide a logical and physical design of a computerised medical laboratory test record keeping system.
- ii. To provide a documentation manual which will state the various operations of the proposed system and its mode of operation.
- iii. To provide a basis for the implementation of the computerised system for the sake of efficiency.
- iv. To make appropriate recommendations to those concerned by the study.

The overall objective of this study is to design and implement a computer-based system which will be efficient, fast, and have the capability of managing the records generated from investigations conducted at a medical laboratory.

1.6 HYPOTHESIS

The claim made here is that the old and new systems perform the same task but in different ways of which the new system performs better.

1.7 SIGNIFICANCE OF THE STUDY

Since the early sixties the world has recorded a regular and steady advancement in computer technology. Today, computer is the brain of businesses and all other spheres of human endeavour. A medical laboratory is very important to the lives of

individuals and the world at large hence, the importance of its computerization can not be over emphasised.

The new system (computerisation) will eliminate problems such as lost of records, delay of information and lack of record security among others associated with the old system (manual).

1.8 SCOPE OF THE STUDY

As at the time of this study, Minna, General Hospital Laboratory unit comprises of the following sub-units: -

- a) Biochemistry
- b) Microbiology
- c) Haematology and blood bank
- d) HIV/AIDS screening unit.

Record keeping in the first subunit (Biochemistry) will be considered for the purpose of this study due to time constraint.

1.9 ORGANISATION OF THE STUDY

To analyse the requirements of computerising a medical laboratory test record, the study is divided into five chapters. Each chapter goes a long way to explain the ultimate aim of the computerisation.

Chapter one deals with the basic preambles of studies of this nature, chapter two treats the importance of computer technology and how it could be applied or relates to records keeping generally and medical laboratory records keeping in particular and chapter three analysis the existing system as well as the design of the proposed system. The mode and nature of implementing the proposed system is discussed in chapter four while chapter five contains the concluding part of the study.

1.10 METHODOLOGY

1.10.1 FACTS FINDING TECHNIQUES

To design a computerised record keeping system, a careful observation and analysis have to be made based on facts rather than guesses. To achieve the aim for which the study was carried out, the following methods were employed: -

- a) **Record Searching:** - This method helps to establish quantitative information such as volumes, frequencies, trends etc. It involves going through the records of an organisation to obtain relevant information. It is regarded as secondary but it is very relevant to studies of this nature.
- b) **Observation:** - This involves watching an operation for a period to see for one's self exactly what obtains in the area under study. The researcher took time to observe the arrival of patients, collection of specimen, up to the

stages of recording and issuance of result slips to the patients at the subunits under study.

c) **Interviewing:** - If well planned this method is the most effective and economical. The researcher asked the chief medical laboratory scientist at the Minna, General Hospital Laboratory unit the following questions: -

1. For how long have you been a chief medical laboratory scientist?
2. Have you any experience of computerisation in your job so far?
3. If yes, how effective is/was it?
4. How many sub-units have you and what are the functions of each?
5. Is it the same in all hospitals?
6. If no, why is it different here?
7. Do you wish to see your unit go computer wise?

These questions were asked after a brief introduction of self and statement of reason for research by the researcher.

1.10.2 OBSERVATIONS

- a) Specimen(s) taken from patients are not given proper identification numbers. This will encourage fraud and samples could also be mixed up.

- b) Test result records are kept in long notebooks from which several leaves containing records could be lost.
- c) Retrieving records of tests conducted becomes difficult after some time.
- d) The manual record keeping system is rather cumbersome and inefficient.
- e) Computerisation will be welcomed by the staff of the unit if proper and adequate awareness is given to them before it is introduced.

CHAPTER TWO

COMPUTER TECHNOLOGY AND RECORD KEEPING IN A MEDICAL LABORATORY

2.1 INTRODUCTION

A computer is an electronic system which can accept process store and retrieve information very rapidly. When applied in a clinical laboratory it becomes a powerful tool for improved management and services, allowing expansion without loss of quality and proportionately increased cost.

Computerization of the laboratory to a large extent, can be considered as an extension of automation with some similarities but also with significance in application. In as much as the laboratory computer processes request from various part of the hospital and generates reports sent to locations outside the laboratory, the computer has an impact on almost every individual in the hospital directly involved in patient care.

In former times, the history (interview) of the patient and the information gained from direct physical examination were practically the total sum of data for patient care. In recent times, the role of medical laboratory in providing information which is used directly in the diagnosis and treatment of patients can not be overemphasised. This increasing importance of laboratory data has placed a burden

upon the laboratory to produce considerably more results of greater accuracy with higher speed.

Before the impact and benefits of the computer can be fully appreciated, we must thoroughly understand the laboratory's problem of managing specimens and data. It is not only the increased number of laboratory tests per se, but also the increased tendency to centralize laboratory services which has led to a significant management problem of handling and identifying specimens submitted for analysis to the laboratory.

Also, because of the critical nature of the data involved, efficient flow of laboratory information to other areas of the hospital, including nurses' station, physicians, patient record rooms and business offices is of great importance. Since laboratory data are mostly numeric with only brief English statements, the clinical laboratory was probably one of the first major areas selected to computerize medical information.

There are two sets of components to a computer system, the hardware and the software. These two components are analogous to the division of the analytical process into the instrument and the chemical method. Just as the best instrumentation in a laboratory cannot produce good result without a good method designed especially for clinical analysis neither can a computer be used effectively

without programs (software) specifically designed for clinical laboratory application.

Although it was recognized in the 1950s that computers could have a significant impact on health care, earlier investigation were hindered significantly by the types of hardware available. Computers were quite expensive and were unable to communicate directly with the laboratory personnel. These limitations brought with then the need for punched cards and different types of personnel such as keypunch operators.

The development of solid-state components, made possible the production of very sophisticated computers at low cost. This new generation of hardware, coupled with the experience with earlier equipment, made it possible to develop highly efficient "interactive software" which allow for communication directly between the computer and the laboratory personnel without the intervention of programmers or other types of skilled personnel.

2.2 RECORD KEEPING SYSTEMS

A collection of facts and figures about events and activities is referred to as a RECORD.

Transactions of an organisation, material and otherwise become a record. An account of a material or activity written or kept in any other permanent form for the purpose of evidence or future reference is a record.

Every organisation keeps record in one form or the other. Hence efforts are directed towards identifying, collecting and making available the most urgently needed information at all levels of organisations. The type of services rendered by an organisation determines the type of record it will keep. For instance, the type of records kept by an educational institution will be different from that kept by a hospital.

Record keeping is the method by which facts and figures are recorded and stored. However, the ease of record retrieval and the speed with which findings are retrieved when needed has a direct bearing on the chosen method.

2.3 THE ROLE OF RECORD KEEPING IN A MEDICAL LABORATORY

The laboratory produces services for all patients in the hospital and therefore interacts with almost all personnel associated with patient care. The processes involved can be separated into four basic steps request, laboratory workflow, analytical testing and finally, reporting. The laboratory personnel, aside from performing the actual analysis, are confronted with a complete administrative task, which requires a considerable portion of working time and frequently represents a

major bottleneck in the laboratory workflow. In addition many of these manual tasks, such as transcription of doctor's order onto laboratory requisition forms, or transcription of test data from the laboratory log to the report form leave considerable room for error. It is therefore not surprising that early attempts on computerization of the laboratory focused primarily on the clerical and administrative aspects. Figure 2.1 below illustrates the manner in which a computer can have an impact on the flow of information and work produced by the laboratory, if the latest features of computer capability are available. It is apparent that, in general, the greatest degree of laboratory automation coupled with appropriate computer capability is most efficient and will have the greatest impact on the efficiency of health care-delivery by laboratories.

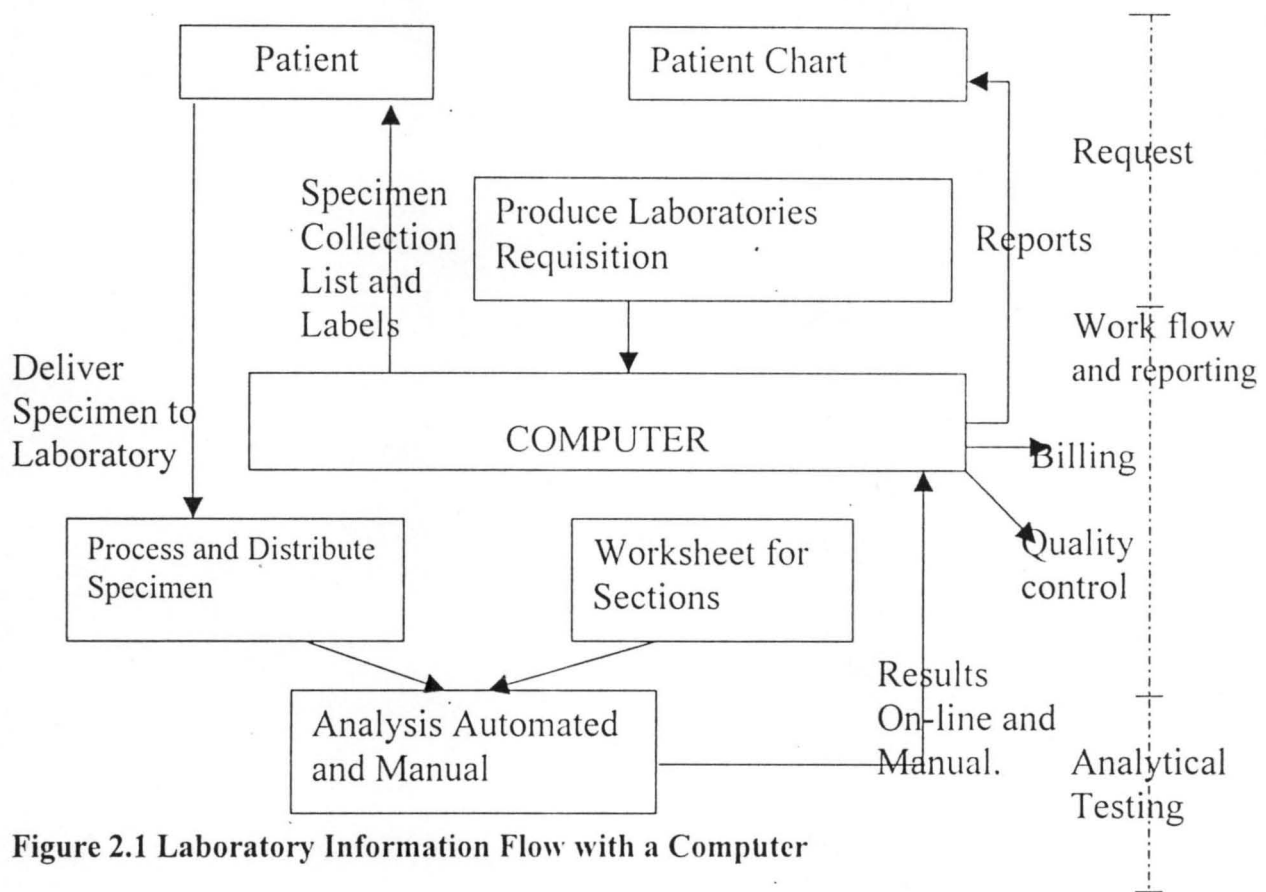


Figure 2.1 Laboratory Information Flow with a Computer

For the sake of continuity and understanding of the overall operation of a typical computer system, all basic elements from the requisitioning process to the final patient report will be described in this section in chronological order.

- A) **Admissions:** - Patients are “admitted to the computer” in one of a variety of ways. At mount Sinai hospital medical centre in Chicago, Illinois, the data. Processing centre generates punched cards containing all vital patient demographic data, which are then read into the laboratory computer. Similar

cards are issued if the patient is transferred during his hospital stay and at the time of discharges. This data can also be entered by means of magnetic tape or by manually using any of the terminals in the conversational mode.

- B) **Requisitions:** - The capability of the computer to read mark-sense cards makes it possible to consolidate many of the previously used manual requisition forms. Since these forms are used solely for entering requisitions into the computer, they are no longer convenient for certain sections of the laboratory but instead can be designed to simplify the ordering process at the nurses' station. In accordance with the needs of the individual institution, many types of mark-sense cards have been designed for use in hospitals with computers.

Requisition cards are designed not only to represent convenience to the laboratory staff but also to safeguard against errors, including duplicate orders. A single enzyme test for example, may have been ordered but only and as part of a liver profile. Such redundancy can be detected by the computer and called to the attention of the operator.

Requisition can also be entered in the conventional mode. When specimens are received intermittently. Manual entry is actually more efficient than processing only a few cards with the card reader.

C) **Logs:** - In a typical laboratory, pertinent information related to patients, to specimens received, and to results obtained is manually recorded. The computer in the form of different types of logs can quickly produce this significant amount of information.

Fig 2.2 shows a log listing the laboratory number, the time, the date, the name and hospital number of each patient on whom laboratory work was ordered, and the codes for those tests and tests combinations which have been requested. Test codes with no symbol affixed indicate that the test or the entire test package has not been completed, while a square bracket preceding the test code indicates that the test is requested and that the assay has already been completed. A percent sign before the code for a test battery (e.g. % ELYT) indicates that such a battery has been ordered and that a portion of these test, e.g. sodium and potassium, have been completed, while (e.g.) CO₂ and chloride determination are still pending.

Incomplete tests are listed on such a log regardless of the day they were ordered and the request will re-appear on subsequent logs until the test is completed. This greatly reduces the chances that pending work from a previous day may be overlooked. Logs of this type may be printed for the entire laboratory (master logs) or for individual sections (section logs).

These and other computer printouts, such as "patient directory" (containing all administrative data on all patients in the hospital) indicate the versatility of the computer and its effectiveness as a management tool in a laboratory.

MASTER LOG 11.33AM 3/23/1974 PAGE 1

ACCH	REQUISITIONS	TIME DATE	NAME	HOSPITAL	N.S
365	CHOL SGOT	7AM 3/23	JOHN JAMES	6783456	4WST
401	INA K CL	7AM 3/23	JONES DOROTHY	6543217	2WST
455	% ELYT BGAS	7AM 3/23	CARL DALE F.	3451234	5EST
567	CA (CHOL (SGOT	9.20AM3/23	SHUTE DALE F.	4567123	2WST
600	INA CO2	7.AM 3/23	CARL PETERS	4567123	4WST
605	% ELYT PH	12.00AM 3/23	MARY LUKAS K.	1234567	5EST

END OF LOG

Computer- Generated Laboratory Log Fig 2.2

- 1) Laboratory computers in general, are programmed to produce two types of worksheets, manual worksheets, to be used for all tests which are performed manually, and tray-loading worksheets, to be used to load specimens on instrumentation which is connected on-line to the computer.

Fig 2.3 below is an example of manual worksheet for urine electrolysis. Note that in each case the patients name, laboratory number, date of request, nursing station, Hospital number, and time of specimen acquisition are included on the worksheet. In addition, the worksheet indicates how a test was requested. If, for example urine

sodium is ordered individually, the code UNA is printed, while the code ULEY indicates that a complete urine electrolyte set is ordered.

MANUAL WORKSHEET 11:48AM 3/23/1974

PAGE 1

ACC#	DATE	TIME	NAME	HOSP#	N.S.	UNA	UK	UCL	VOL	HRS
5001	3/23	8am	John James	654317	2WST	UELY	UELY	UELY	4280	24.0
5002	3/23	8am	Jones Dorothy	345123	5EST		UK		1225	24.0
5003	3/23	8am	Carl Dale F.	456712	2WST	UNA			345	12.0
5010	3/23	9am	Shute Dale F.	234567	2EST	UNA			1350	24.0

Computer-printed manual worksheet fig 2.3

E) **Data Entry:** - Manual entry cards can be designed to meet the requirements for any number of applications. The laboratory without the modification or addition of programs can define the format of such cards, in a well- designed computer system.

Keyboard entry of laboratory data is convenient if only a small number of data have to be entered, or if online entry or card reader entry is not available. Such manual entry of data can be simplified if the computer, on the basis of information already available to it, automatically prints the laboratory number, patients name, test codes, and so forth, and requires the technologist to enter only the final result. Where applicable, the computer can also perform a series of calculations, which are frequently done by a desk calculator. Examples of such calculations include computation of electrolysis result, creatine clearance, and blood gases.

2.4 RECORD MANAGEMENT AND ITS OBJECTIVES

Many methods of regulating the volume of records are currently available. Records may be destroyed either due to changes in law and regulations or change in business practice and the needs of the user. Record management is the system of controlling these records.

A sophisticated system which could collect, evaluate, store, remove, reproduce and reference information through mechanization and automation was developed to support information retention and retrieval at optional level. This could be achieved with out spending much money and time on elaborate and expensive equipment and methods.

The most elementary concepts and techniques of record management could be employed in processing and storing records in order to provide easier and accurate records and in the identification and retrieval of essential records.

CHAPTER THREE

3.0 SYSTEMS ANALYSIS AND DESIGN

3.1 INTRODUCTION

This chapter deals specifically with the analysis and the design of the proposed system. To achieve this, the present record keeping system of the medical laboratory unit (specifically the biochemistry sub-unit) of the General Hospital, Minna will be analysed. The findings there from, will be of great importance in evolving the basis of operating the computerised system.

Some other issues of importance to this chapter include, the logical design in the form of input and output specifications and formats, the basis of data validation as well as the physical design of the proposed system.

3.2 THE CURRENT SYSTEM AND ITS ASSOCIATED PROBLEMS

Generally, a patient is admitted to the laboratory through a request made by a doctor within or outside the hospital. The request form in most cases comprises the Name, hospital number, the age, sex, address, and tribe etc of the patient as well as the name of the doctor making the request.

On accepting the request form, the medical laboratory technologist issues the patient with a laboratory number, which is unique. He then collects the appropriate sample(s) and labels them with the given laboratory number.

After carrying out the requested test(s) the result(s) and the information on the request form are entered into a big hardcover exercise book (Logbook). Although, the principles and concept of manual method of record management are universal, each organisation has its specific features and problems, which need to be identified before a suitable solution can be found.

The problems associated with the manual record keeping system in the medical laboratory unit of the General Hospital, Minna are as follows.

- i) Inaccurate, incomplete and incorrect documentation, which arises from lapses such as lack of proper safekeeping of request forms.
- ii) Lack of confidentiality of patient's medical laboratory test results.
- iii) Explosive volume of records, which is tantamount to loss of records.
- iv) Increasing retrieval time, which is a manifestation of poor retention and retrieval procedures.
- v) Loss of revenue due to lack of proper records of tests carried out.

3.3 DESCRIPTION OF THE COMPUTERISED SYSTEM

To design a system that will meet the needs of the users and take into cognisance the computer literacy of an end user, the procedures have to be simplified. For the purpose of this project, the following procedures were simplified.

a) **Request Forms:** - The system demands that one request form, which contain all relevant patients' individual data and properly indicated tests request should be issued for the whole laboratory unit instead of separate forms for each subunit. This will ensure that each patient has a unique laboratory number to be used by all the different sub-units.

Bi) **Centralization Of Information Processing:** Request forms need not be despatched to the various sub-units. Rather, the sub-unit should supply their sample requirements for each test to the sample collection centre where the appropriate samples would be collected according to the individual requests. Each sub-unit will or may send a representative to verify the accuracy of the work done by the sample collection centre..

ii) Relevant information pertaining a patient should be extracted by an assigned officer trained for the task.

iii) All the extracted data are to be inputted into the computer immediately, irrespective of the order.

- iv) The computer sorts the tests according to the sub-units concerned.
- v) The computer performs the manipulation of data, assigning results entered by the laboratory technologist to appropriate tests and determine whether the result is normal or not.

3.4 REQUIREMENT SPECIFICATION FOR THE PROPOSED SYSTEM

- a) A central sample collection centre
- b) A single request format containing comprehensive information on a patient. The format should be able to serve all the sub-units of the laboratory unit.
- c) Routine for data entry, modification deletion and viewing
- d) Report generation on the screen and production of hard copies
- e) Data to be stored on the magnetic storage medium
- f) Data base Management System (DBMS)
- g) Formation of the systems management committee to coordinate the task.

3.5 COST AND BENEFIT ANALYSIS

We shall discuss this under two subheadings namely: -

- * Cost analysis of the system
- * Benefit of the system

3.5.1 COST AND BENEFIT ANALYSIS OF THE SYSTEM

a) **Development Cost:** -This is sketched as follows for three working weeks or one hundred and fifty man hours: -

	N	:	K
i) System Analysis/Design	150,000.00		
ii) Software Development & Implementation	100,000.00		
iii) Equipments			
* Computer			
1 No Pentium 11 350 MH3			
64KB RAM			
4.3 GB Hard Disk			
SVGA Colour Monitor			
3.5" Disk Drive			
CD – ROM Drive			
Windows keyboard			
Mouse & mouse pad			
Windows 2000 software pre-installed	255,000.00		
* Computer Printers			
1 No Epson printers			
(DFX 5000)	150,000.00		

* Uninterrupted Power		
Supply 1.No APC Back up pro		80,000.00
* Installation cost (software)		100,000.00
* Procurement & Installation of 2 Nos		
Air-conditioners (N150,000.00 each)		300,000.00
* Personnel Training		
2 operators @ N 17,500.00 for 2 months		35,000.00
<u>Total Development Cost</u>		1,155,000
(b) SYSTEM OPERATING COST		N : K
i) Program maintenance per Annum		75,000.00
ii) Equipment maintenance per Annum		120,000.00
iii) Supplies of computer stationeries		120,000.00
iv) Labour cost		
- 1 No. System analyst/programmer 120,000 per Annum		120,000.00
- 2 Nos Computer Operators per Annum (N84,000 each)		168,000.00
v) Miscellaneous expenses		25,000.00
Total System Operating COST		648,000.00
GRAND TOTAL of (a) and (b)	=	1,833, 000.00

3.5.2 BENEFIT OF THE SYSTEM

The laboratory unit of General Hospital, Minna, would derive the following benefit from the new system.

- i. Enhancement of efficiency of the laboratory in terms of managing patients record
- ii. Creation of speedy ways of generating reports of laboratory data for each patient at any desired time and in a meaningful form to the physician.
- iii provide administrative data which readily provide statistics with respect to requests received, results produced and the sources of such requests. It also documents the arrival time of specimens to the laboratory and the time the reports were issued. Hence, it will help in the management of the laboratory and in the documentation of workload and personnel requirements.
- iv A series of statistical procedures, helpful in a quality control program, can readily be performed by the system.
- v Accurate billing information can be provided by generating a billing list which identifies the patient by an appropriate hospital number, lists the test which were performed together with billing codes and charges. This will also help in checking fraud.

- vi Maintenance of data security
- vii Allow for the possibility of carrying out major changes in the design of the system as the need arise. This is because the new system is fully documented.

3.6 PROPOSED SOFTWARE APPLICATION

A database package would be used for the software design.

DBMS is a suite of programmes used for the purpose of maintaining and manipulating a database. A database is a store for data.

A Database Management System is a software that perform the following functions on a database:

- i. Add records
- ii. Modify records
- iii. Display records
- iv. Delete records
- v. Organise records
- vi. Summarise records
- vii. Extract records
- viii. Print records

DBMS is a collection of packages such as foxpro, dBASE, Clipper, Oracle, etc. With the intended design objectives dBASE (dBASE IV) is used for the software application

3.7 OBJECTIVES OF DBMS

The overall objectives of development of a database technology is to treat data as an organisational resource and as an integrated whole. DBMS allows data to be protected and organised separately from other resources (e.g. hardware, software and program).

Database technology is characterised by the following features: -

1. **Data Co-ordination and Accessibility:** Information in a database file is coordinated, accessed and operated upon as if they are contained in a single file in a data base environment. In a data base environment data base technology allows for logical centralization of information even though, the data may be physically located on different devices. The user therefore, gains valuable information by linking data across the organisation.
2. **Data Elimination:** DBMS does not allow for duplication of stored data. In order to achieve this, database technology utilizes data validation routines such as normalization and courting techniques.

3. **Data Independence:** Database technology separates data from the application program without necessarily changing the data and vice versa.
4. **Maintenance of Data Integrity:** DBMS allows for high level of data integrity because it does not allow duplication of data (data redundancy). Hence, generates consistent information.
5. **Central Collection And Control Of Data:** This is an important feature of DBMS. In database environment, data and operations on data are centrally controlled. This leads to better management of data because it allows for proper security of information stored.

3.8 OUTPUT AND INPUT DESIGNS

Output is determined by input in software development. The output presented in the form of reports determines the input data required. This is because some of the information on the report will have to be captioned via the use of input form.

The following reports are expected to be produce by the proposed system:

- i) Logs (ii) Worksheets (iii) Interim report (iv) Cumulative report
- v) Revenue reports (vi) Final report.

3.9 DATA VALIDATION

Data validation is the process of identifying the data needs of an organisation as well as defining the structure of files. It is also used as a tool to segregate data into separate files or the integration of data structure when developing a database software. The necessary tools of data validation used in this study are normalisation and courting.

In the design of the proposed system, the normalisation technique was used to pinpoint the data needs of the system. And the courting technique was applied to ensure that similar data are not duplicated. For the purpose of this study, the database files shown below are required. The files are namely REQ-DBF, RESULT-DBF, TESTS-DBF, CHARGE-DBF AND possibly another file (named PAT-DBF) may be required if the patient record keeping system of the hospital is not computerised as well.

REQ-DBF: - A Data Base File that contains information on requests made to the laboratory. The structure of this file is as shown below.

4.4 SYSTEMS AND PROGRAM TESTING

To ensure that the system works accurately and efficiently before life operation commences, systems testing are done. This stage ensures that there is no logic error inherent in the program design.

At this stage, both the logical and physical designs are examined thoroughly to ensure that the new system works when implemented. It serves as a confirmation that all is correct and it is also an opportunity to show and convince the potential users that all is well with the new system.

A user acceptance test was performed on the new system where the users formed an integral part of the test. It was done using a set of carefully selected test data which was entered into the system. The result was compared with the result obtained from that of the manual operation and they were found to be the same.

In view of this, it was observed and concluded that the new system is working accordingly. This, therefore, gives the required confidence for the installation of the system.

4.5 PROPOSED CHANGEOVER PROCEDURES

The three basic methods of changeover are:

- * Direct Changeover

- * Parallel Changeover
- * Pilot Running

Direct Changeover: - This method entails the replacement of the old system as a whole by the new one at once. This method is suitable when the computerisation is less complex and small.

Parallel Changeover: - In this case, the old and new systems run concurrently, using the same inputs. The outputs are compared and if there are differences, the reasons for the differences are resolved. Distribution of outputs from the old system continues until the new system has proved satisfactory. At this point, the old system is discontinued and the new one takes its place. This system is very reliable but costly to use.

Pilot Running: - This involves a gradual replacement of the old system by the new one. The bit by bit changeover continues until the old system is completely replaced. This method is always recommended for large computerisation in order to reduce its complexity.

In view of the above options, a parallel changeover is recommended for the introduction of this new system because of its reliability and simplicity.

4.6 DOCUMENTATION

This stage in the development of software, describes how it works. Documentation helps the users to have a better understanding of the system. It provides information on how the system can be started and its operation.

4.6.1 STARTING THE SYSTEM

Installation of dBASE IV into the system is necessary for the execution of the programs. The source program would then be copied into a directory (e.g Biochemistry) on the hard disk (i.e Drive C). the procedure for starting the system is as follows:

- * Type CD\BIOCHEMISTRY + <ENTER> key
- * Type DBASE + <ENTER> key
- * At the dot prompt of dbase IV, type DO BIOCHEMISTRY + <ENTER> key.

On the execution of the above steps, the first level menu will appear on the screen from which the user would select an appropriate choice.

4.6.2 MENU DESCRIPTION

The first level menu consists of three options as displayed in figure 1 of appendix C. They are itemised and discussed as follows:

- * Laboratory Data
- * Lab. Report
- * Exit

LABORATORY DATA

This option contains four sub-options as displayed by figure II. It is used to update the data file as regards patient admission requisition and results obtained from Assay. The submenu Exit is used for moving out of the sub-option. The sub-menu patient admission under this sub-menu is further divided into five sub-menus. These are add for adding records, mod for modifying records, view for displaying records and Exit for moving out of the sub-option. The screen designs for each of these is represented by figures IV – X of Appendix B.

LABORATORY REPORT

This option contains seven sub-options as displayed by figures III. It is used to produce reports from the system. The system was designed to produce six reports as shown on figures XI – XVI of Appendix B. The submenu Exit is used for moving out of the sub-option.

EXIT

This option is used to move out of the SYSTEM.

CHAPTER FIVE

5.0 SUMMARY AND RECOMMENDATION

5.1 LIMITATION

On the long run, my aim to computerise the test records keeping system of the General Hospital, Minna was achieved but it was not without problems. I wanted to use visual fox-pro, which is the most interactive of the Data Base Management System (DBMS) packages but it was impossible due to time constraints.

Another major set back, which wasted a lot of my limited time, was the acceptability of computers as a basic solution to most of the laboratories record keeping problems. Even though the chief medical laboratory scientist was willing and really assisted me, some of his subordinates were reluctant to assist. I perceive it was for the fear of losing their jobs to computer application.

5.2 CONCLUSION

Substitution of manual procedures by computer-based system is inevitable in modern days, because it has become the vogue worldwide. This is due to the relevance of computer application in virtually all aspects of human endeavour. The substitution of manual systems by computers is further enhanced by its ability to perform a given set of procedures with maximum efficiency and accuracy.

Therefore, there is no option but to agree that the introduction of a computer based system for storing information about laboratory records would enhance the operational efficiency of the laboratory unit of General Hospital, Minna.

5.3 RECOMMENDATION

To realise maximum benefits from the new system the following recommendations should be adopted.

1. **Manpower Requirement:** - For efficient use of computers in an organisation, trained professionals in computer science are required. Therefore, it is recommended that computer professionals need to be recruited. Some of the old staff like the typist will have to be trained to use the word processing packages. The computer professional to be employed needs to be knowledgeable about the concept of Database Management Systems. This is to ensure future modification of the suite of programs that constitute this proposed system.
2. **Training Requirement:** - There is a need for training of staff in the organisation on how to use the new system and other areas of computer application. This could take the form of seminar. It is important that this should be done before the installation of the system.

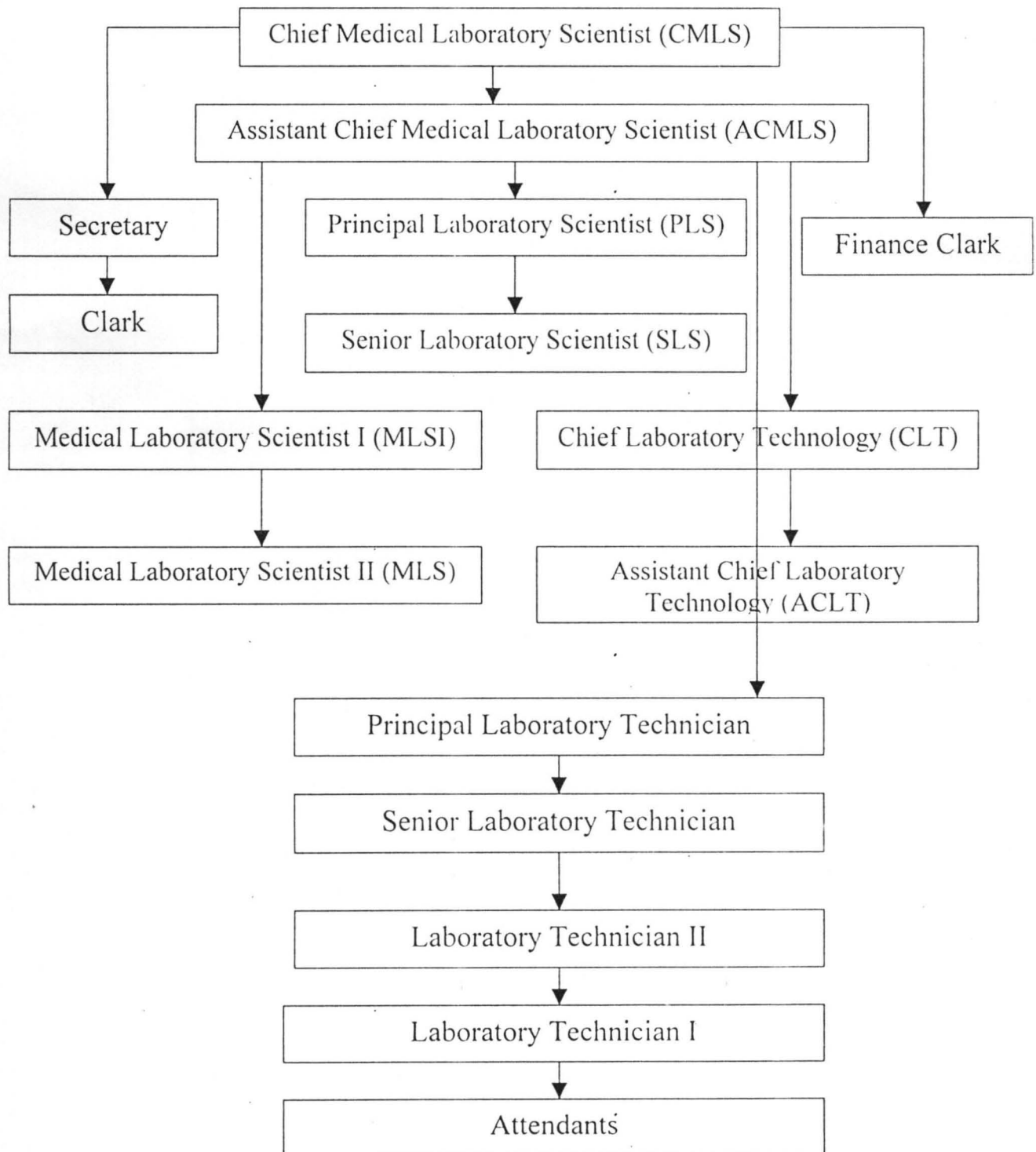
3. **Security:** - Security is an important issue in any computer-based system in order to avoid both logical and physical problems. Both staff and outsiders should not be given access to the computer room.
4. **Computer Environment:** - A computer environment should be air-conditioned. The hospital authority should provide a good cooling facility for the computer so as to ensure durability of the system.
5. **Power Supply:** - A constant source of power supply should be made available since computers cannot be operated without electricity.
6. **Attitude to Job:** - The staff should take their jobs more seriously as computers work only with human assistance.

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APPENDIX A

THE ORGANISATIONAL CHART (ORGANOGRAM) OF MINNA GENERAL HOSPITAL MEDICAL LABORATORY



COMPUTERIZED MEDICAL LABORATORY TEST RECORD
GENERAL HOSPITAL, MINNA

M A I N M E N U

- [A] LABORATORY DATA MENU
- [B] LABORATORY REPORT MENU
- [C] EXIT PROGRAM

Select option [A/B/C]

DEVELOPED BY: SIDI AMINA, PGD/MCS/2000/2001/1028

Figure I

COMPUTERIZED MEDICAL LABORATORY TEST RECORD
GENERAL HOSPITAL, MINNA

LABORATORY DATA MENU

- [A] PATIENT DATA
 - [B] REQUISITION
 - [C] LABORATORY RESULTS
 - [D] RETURN TO MENU
- Select option [A/B/C/D]

DEVELOPED BY: SIDI AMINA, PGD/MCS/2000/2001/1028

Figure II

COMPUTERIZED MEDICAL LABORATORY TEST RECORD
GENERAL HOSPITAL, MINNA

LABORATORY REPORT MENU

- [A] WORKSHEET REPORT
- [B] MASTER LOG REPORT
- [C] INTERIM REPORT
- [D] CUMMULATIVE REPORT
- [E] REVENUE REPORT
- [F] FINAL REPORT
- [G] EXIT

Select option [A/B/C/D/E/F/G]

DEVELOPED BY: SIDI AMINA, PGD/MCS/2000/2001/1028

Figure III

COMPUTERIZED MEDICAL LABORATORY TEST RECORD
GENERAL HOSPITAL, MINNA

PATIENT RECORD MENU

- [A] ADD NEW RECORD
- [B] MODIFY PATIENT RECORD
- [C] DELETE PATIENT RECORD
- [D] VIEW PATIENT RECORDS
- [E] EXIT

Select option [A/B/C/D/E]

DEVELOPED BY: SIDI AMINA, PGD/MCS/2000/2001/1028

Figure IV

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
ADDING NEW PATIENT RECORD

LAB. NO. [0=EXIT] 101605
SURNAME : SHAMSIDEEN
FIRST NAME : BATURE
AGE : 41
S E X : F
DATE : 10/04/02
TIME : 11:30
PHONE NO. : 066-222193
HOSPITAL NO : 109605
OCCUPATION : BUSINESS
ADDRESS : KWANGILA
STATUS : MARRIED
TRIBE : GWARI
STATE : NIGER
RELIGION : ISLAM
NEXT OF KIN : IBRAHIM JATAU
NEXT OF KIN ADDR: KWANGILA, MINNA
NEXT OF PHONE : 066-221709
ARE THESE ENTRIES CORRECT ? (Y/N)

Figure V

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
MODIFYING PATIENT RECORD

LAB. NO. [0=EXIT] 101603
SURNAME : AUDU
FIRST NAME : AHMED
AGE : 45
S E X : M
DATE : 04/03/02
TIME :
PHONE NO. : 066-223105
HOSPITAL NO : 109603
OCCUPATION : TAILOR
ADDRESS : KETEREN GWARI
STATUS : MARRIED
TRIBE : IGALA
STATE : NIGER
RELIGION : ISLAM
NEXT OF KIN : DANLADI DAUDA
NEXT OF KIN ADDR: TUNGA, MINNA
NEXT OF PHONE : 066-221904
ARE THESE ENTRIES CORRECT ? (Y/N)

Figure VI

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
DELETING PATIENT RECORD

LAB. NO. [0=EXIT] 101605
SURNAME : SHAMSIDEEN
FIRST NAME : BATURE
AGE : 41
S E X : F
DATE : 10/04/02
TIME : 11:30
PHONE NO. : 066-222193
HOSPITAL NO : 109605
OCCUPATION : BUSINESS
ADDRESS : KWANGILA
STATUS : MARRIED
TRIBE : GWARI
STATE : NIGER
RELIGION : ISLAM
NEXT OF KIN : IBRAHIM JATAU
NEXT OF KIN ADDR: KWANGILA, MINNA
NEXT OF PHONE : 066-221709
DELETE ABOVE REOCD? (Y/N)

Figure VII

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
VIEWING PATIENT RECORD

LAB. NO. 101602
SURNAME : JAMES
FIRST NAME : IBRAHIM
AGE : 27
S E X : M
DATE : 04/08/02
TIME :
PHONE NO. :
HOSPITAL NO : 109602
OCCUPATION : CIVIL SERVANT
ADDRESS : TUNGA
STATUS : [
TRIBE : NUPE
STATE : NIGER
RELIGION : CHRISTIANITY
NEXT OF KIN :
NEXT OF KIN ADDR :
NEXT OF PHONE :
VIEW NEXT RECORD? (Y/N)

Figure VIII

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY RESULTS
CHEMICAL PATHOLOGY REQUEST

LAB. NO. [0=EXIT] 101603

DOCTOR	:	DR JAMES	
WARD/CLINIC	:	B	
SPECIMEN	:	URINE	
DATE	:	11/04/02	CHARGES
TIME	:	02:45	-----
TEST TYPE 1	:	BILE SALT	50.00
TEST TYPE 2	:	CALCIUM	100.00
TEST TYPE 3	:		0.00
TEST TYPE 4	:		0.00
TEST TYPE 5	:		0.00
		TOTAL	150.00
AMOUNT PAID	:		150.0

ARE THESE ENTRIES CORRECT ? (Y/N)

Figure IX

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
CHEMICAL PATHOLOGY RESULTS

LAB. NO. [0=EXIT] 101602
ENTER DATE : 03/04/02
BILE SALT TEST RESULT : 10
KETONES TEST RESULT : 11

TIME OF ASSAY : 10:20
DATE OF ASSAY : 03/04/02
PATHOLOGIST : SIDI AMINA

ARE THESE ENTRIES CORRECT ? (Y/N)

Figure X

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
WORKSHEET REPORT

DATE: 12/04/02
TIME: 02:16:56
PAGE: 1

AB.NO	PATIENT NAME	HOSP.NO.	TIME	REQUISITION
01601	HASSAN DAUDA	109601	12:15	SGOT
01602	JAMES IBRAHIM	109602	09:40	BILE SALT
01603	AUDU AHMED	109603	10:15	CALCIUM

Press any key to continue...

Figure XI

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
MASTER LOG REPORT

DATE: 12/04/02
TIME: 01:14:14
PAGE: 1

B.NO	REQUISITION	TIME	DATE	PATIENT NAME	HOSP.NO.
1602	BILE SALT KETONES	09:40	09:40	JAMES IBRAHIM	109602

Press any key to continue...

Figure XII

COMPUTERIZED MEDICAL LABORATORY TEST RECORD
GENERAL HOSPITAL, MINNA
INTERIM REPORT

PATIENT NAME : HASSAN DAUDA
LAB. NUMBER : 101601
HOSP. NUMBER : 109601
TIME : 01:15:07
PAGE : 1

DATE	NORMAL	RESULTS
01/01/02	UP TO 18	15
01/03/02	9 - 11	10

Figure XIII

COMPUTERIZED MEDICAL LABORATORY TEST RECORD
GENERAL HOSPITAL, MINNA
CUMMULATIVE REPORT

PATIENT NAME : HASSAN DAUDA
LAB. NUMBER : 101601
HOSP. NUMBER : 109601
DOCTOR : DR IBRAHIM
WARD/CLINIC : C
AGE : 34
SEX : MALE
ADDRESS : BOSSO, MINNA
TIME : 11:15:27
PAGE : 1

DATE	NORMAL	RESULTS
01/01/02	UP TO 18	15
01/03/02	9 - 11	10
01/03/02	70 - 300	210

Figure XIV

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
REVENUE REPORT

DATE : 12/04/02

PAGE : 1

TEST	PRICE
SGOT	300.00
BILE SALT	50.00
CALCIUM	100.00
CALCIUM	100.00
SGOT	300.00
BILE SALT	50.00
TOTAL =	900.00

Press any key to continue...

Figure XV

GENERAL HOSPITAL, MINNA. NIGER STATE
COMPUTERIZED MEDICAL LABORATORY TEST RECORD
FINAL REPORT

PATIENT NAME: HASSAN DAUDA
LAB. NUMBER : 101601
HOSP. NUMBER: 109601
DOCTOR : DR IBRAHIM
WARD/CLINIC : C
AGE : 34
SEX : M
ADDRESS : BOSSO
TIME : 01:33:33
PAGE : 1
TOTAL CHARGES : 450.00

TEST	NORMAL	DATE	TIME	RESULTS
SGOT	UP TO 18	01/01/02	11:30	15
CALCIUM	9-11	01/03/02	12:10	10

Press any key to continue...

Figure XVI

APPENDIX C

***** WORKSHEET REPORT MODULE *****

```
CLEAR
STORE 0 TO TOTSUM,L,P
STORE 60 TO L
SELE 1
USE PAT
SELE 2
USE REQ
STORE 0 TO MLABNO
*
SET DEVICE TO PRINT
SELE 1
*
SET FILT TO LDATE=DATE()
GO TOP
DO WHILE .NOT. EOF()
  IF L > 22
    P=P+1
  @ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
  @ 2,15 SAY "          COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
  @ 3,15 SAY "          WORKSHEET REPORT"
    @3,66 SAY "DATE: " + DTOC(DATE())
    @4,66 SAY "TIME: "+ TIME()
    @5,66 SAY "PAGE: "+LTRIM(STR(P))
    @6,01 SAY REPL('-',79)
    @7,01 SAY "LAB.NO"
    @7,10 SAY "PATIENT NAME"
    @7,28 SAY "HOSP.NO."
    @7,39 SAY "TIME"
    @7,56 SAY "REQUISITION"
    @7,66 SAY ""
  @8,01 SAY REPL('-',79)
  L=9
ENDIF

  @L,01 SAY LABNO
  @L,07 SAY RTRIM(SNAME)+" "+FNAME
  @L,28 SAY HOSPNO
  MLABNO=LABNO
  SELE 2
  LOCATE FOR LABNO=MLABNO
  @L,39 SAY STIME
  @L,56 SAY TEST1
  @L,66 SAY ""
    L=L+1

  SELE 1
  SKIP
ENDDO

  @L,1 SAY REPL('-',79)
  SET FILT TO
  CLOSE DATABASE
  WAIT
*
  EJECT
*SET DEVICE TO SCREEN
RETURN
***** MASTER LOG REPORT MODULE *****
```

CLEAR


```

STORE 0 TO TOTSUM,L,P
STORE 60 TO L
SELE 1
USE PAT
SELE 2
USE REQ
STORE 0 TO MLABNO
*
SET DEVICE TO PRINT
SELE 2
SET FILT TO STAT="["
GO TOP
DO WHILE .NOT. EOF()
  IF L > 22
    P=P+1
  @ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
  @ 2,15 SAY "          COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
  @ 3,15 SAY "          MASTER LOG REPORT"
    @3,66 SAY "DATE: " + DTOC( DATE() )
    @4,66 SAY "TIME: " + TIME()
    @5,66 SAY "PAGE: "+LTRIM(STR(P))
    @6,01 SAY REPL('-',79)
  @7,01 SAY "LAB.NO"
  @7,10 SAY "REQUISITION"
  @7,28 SAY "TIME"
  @7,39 SAY "DATE"
  @7,51 SAY "PATIENT NAME"
  @7,66 SAY "HOSP.NO."
  @8,01 SAY REPL('-',79)
L=9
ENDIF

  @L,01 SAY LABNO
  @L,10 SAY RTRIM(TEST1)+" "+RTRIM(TEST2)+" "+RTRIM(TEST3)
  @L,28 SAY STIME
  @L,39 SAY STIME
  MLABNO=LABNO
  SELE 1
  LOCATE FOR LABNO=MLABNO
  @L,51 SAY RTRIM(SNAME)+" "+FNAME
  @L,66 SAY HOSPNO
    L=L+1

  SELE 2
  SKIP
ENDDO

  @L,1 SAY REPL('-',79)
  SET FILT TO
  CLOSE DATABASE
  WAIT
*
  EJECT
*SET DEVICE TO SCREEN
RETURN
***** REVENUE REPORT MODULE *****

  CLEAR
STORE SPACE(8) TO D1,D2
@12,20 SAY "ENTER DATE FROM: " GET D1 PICT "99/99/99"
@13,20 SAY "ENTER DATE TO : " GET D2 PICT "99/99/99"
  READ
    STORE 60 TO L
  SELE 1
  USE REQ

```

```

SELE 2
USE CHARGES
STORE 0 TO MLABNO,P,TOTL
STORE SPACE(10) TO NML
*
SET DEVICE TO PRINT
SELE 2
SET FILT TO DATEF >= CTOD(D1) .AND. DATEF <= CTOD(D2)
GO TOP

CLEAR
SELE 1
DO WHILE .NOT. EOF()
    IF L > 22
        P=P+1
    @ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
    @ 2,15 SAY "      COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
    @ 3,15 SAY "          REVENUE REPORT"
    @4,65 SAY "DATE : "+DTCO(DATE())
    @5,65 SAY "PAGE : "+LTRIM(STR(P))
    @6,01 SAY REPL('-',79)
    @7,10 SAY "TEST"
    @7,35 SAY "PRICE"
    @8,01 SAY REPL('-',79)

L=9
ENDIF

        MLABNO=LABNO
        @L,10 SAY TEST1
        SELE 2
        LOCATE FOR LABNO=MLABNO
        @L,30 SAY PAID
        TOTL=TOTL+PAID
        L=L+1
        SELE 1
        SKIP
ENDDO
        @L,1 SAY REPL('-',79)
        @L+1,20 SAY "TOTAL =" +STR(TOTL)
        SET FILT TO
        CLOSE DATABASE
        WAIT
*
        EJECT
*SET DEVICE TO SCREEN
RETURN
***** PATIENT FINAL REPORT MODULE *****

CLEAR
        STORE 60 TO L
        SELE 1
        USE PAT
        SELE 2
        USE RESULT
        SELE 3
            USE NORMALS
        SELE 4
            USE REQ
            STORE 0 TO MLABNO,P
            STORE SPACE(10) TO NML
*
            SET DEVICE TO PRINT
            SELE 1

CLEAR
@12,20 SAY "ENTER LAB. NUMBER : " GET MLABNO
READ

```

```

LOCATE FOR LABNO = MLABNO
IF EOF()
  @13,20 SAY ""
  WAIT +"
  RETURN
ENDIF
clear
  IF L > 22
    P=P+1
  @ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
  @ 2,15 SAY "    COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
  @ 3,15 SAY "          FINAL REPORT"

      @4,10 SAY "PATIENT NAME: "+RTRIM(SNAME)+" "+FNAME
      @5,10 SAY "LAB. NUMBER : "+LTRIM(STR(LABNO))
  @6,10 SAY "HOSP. NUMBER: "+HOSPNO
      @7,10 SAY "DOCTOR      : "+DOCTOR
      @8,10 SAY "WARD/CLINIC : "+WARD
      @9,10 SAY "AGE        : "+LTRIM(STR(AGE))
      @10,10 SAY "SEX        : "+SEX
      @11,10 SAY "ADDRESS    : "+ADDR
      @12,10 SAY "TIME       : "+TIME()
      @13,10 SAY "PAGE       : "+LTRIM(STR(P))
      @13,40 SAY "TOTAL CHARGES : "+LTRIM(STR(PAID))
      @14,01 SAY REPL('-',79)
  @15,10 SAY "TEST"
  @15,20 SAY "NORMAL"
  @15,30 SAY "DATE"
  @15,40 SAY "TIME"
  @15,50 SAY "RESULTS"
  @16,01 SAY REPL('-',79)

L=17
ENDIF
SELE 2
*SET FILT TO LABNO=MLABNO
*GO TOP
DO WHILE .NOT. EOF()
  IF LABNO=MLABNO
    SELE 4
    LOCATE FOR LABNO = MLABNO
    T1=TEST1
    SELE 3
    LOCATE FOR TEST=T1
    NML=NORMAL
    SELE 2
    @L,10 SAY T1
    @L,20 SAY NML
    @L,30 SAY RDATE
    @L,40 SAY RTIME
    @L,50 SAY RES1
    L=L+1
  ENDIF
  SKIP
ENDDO
  @L,1 SAY REPL('-',79)
  *
  SET FILT TO
  CLOSE DATABASE
  WAIT
  *
  EJECT
*SET DEVICE TO SCREEN
RETURN

```

***** CUMMULATIVE REPORT MODULE *****

```

CLEAR
  STORE 60 TO L
  SELE 1
  USE PAT
  SELE 2
  USE RESULT
  SELE 3
  USE NORMALS
  SELE 4
  USE REQ
  STORE 0 TO MLABNO,P
  STORE SPACE(10) TO NML
*
  SET DEVICE TO PRINT
  SELE 1
  GO TOP
CLEAR
DO WHILE .NOT. EOF()

  IF L > 22
    P=P+1
    @ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
    @ 2,15 SAY "      COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
    @ 3,15 SAY "          CUMMULATIVE REPORT"

    @4,10 SAY "PATIENT NAME: "+RTRIM(SNAME)+" "+FNAME
    @5,10 SAY "LAB. NUMBER : "+LTRIM(STR(LABNO))
    @6,10 SAY "HOSP. NUMBER: "+HOSPNO
    @7,10 SAY "DOCTOR      : "+DOCTOR
    @8,10 SAY "WARD/CLINIC : "+WARD
    @9,10 SAY "AGE        : "+LTRIM(STR(AGE))
    @10,10 SAY "SEX        : "+SEX
    @11,10 SAY "ADDRESS     : "+ADDR
    @12,10 SAY "TIME       : "+TIME()
    @13,10 SAY "PAGE      : "+LTRIM(STR(P))
    @14,01 SAY REPL('-',79)
    @15,10 SAY "DATE"
    @15,20 SAY "NORMAL"
    @15,40 SAY "RESULTS"
    @16,01 SAY REPL('-',79)
L=17
ENDIF

  SELE 4
  LOCATE FOR LABNO = MLABNO
  T1=TEST1
  SELE 3
  LOCATE FOR TEST=T1
  NML=NORMAL
  SELE 2
  @L,10 SAY RDATE
  @L,20 SAY NML
  @L,40 SAY RES1
  L=L+1
  SELE 1
  SKIP
ENDDO

  @L,1 SAY REPL('-',79)
  SET FILT TO
  CLOSE DATABASE
  WAIT

```

```

*          EJECT
*SET DEVICE TO SCREEN
RETURN
***** INTERIM REPORT MODULE *****

      CLEAR
STORE SPACE(8) TO D1,D2
@12,20 SAY "ENTER DATE FROM: " GET D1 PICT "99/99/99"
@13,20 SAY "ENTER DATE TO   : " GET D2 PICT "99/99/99"
      READ
          STORE 60 TO L
      SELE 1
      USE PAT
      SELE 2
      USE RESULT
      SELE 3
          USE NORMALS
      SELE 4
          USE REQ
          STORE 0 TO MLABNO,P
      STORE SPACE(10) TO NML
*      SET DEVICE TO PRINT
      SELE 1
      SET FILT TO LDATE >= CTOD(D1) .AND. LDATE <= CTOD(D2)
      GO TOP

CLEAR
DO WHILE .NOT. EOF()
      IF L > 22
          P=P+1
@ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
@ 2,15 SAY "      COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
@ 3,15 SAY "          INTERIM REPORT"

          @4,10 SAY "PATIENT NAME: "+RTRIM(SNAME)+" "+FNAME
          @5,10 SAY "LAB. NUMBER : "+LTRIM(STR(LABNO))
@6,10 SAY "HOSP. NUMBER: "+HOSPNO
          @7,10 SAY "TIME           : "+TIME()
          @8,10 SAY "PAGE           : "+LTRIM(STR(P))
          @9,01 SAY REPL('-',79)
@10,10 SAY "DATE"
@10,20 SAY "NORMAL"
@10,40 SAY "RESULTS"
@11,01 SAY REPL('-',79)

L=12
ENDIF

          SELE 4
          LOCATE FOR LABNO = MLABNO
          T1=TEST1
      SELE 3
      LOCATE FOR TEST=T1
          NML=NORMAL
          SELE 2
          @L,10 SAY RDATE
          @L,20 SAY NML
          @L,40 SAY RES1
          L=L+1
      SELE 1
      SKIP

ENDDO

          @L,1 SAY REPL('-',79)
          SET FILT TO

```

CLOSE DATABASE

WAIT

```
*          EJECT
*SET DEVICE TO SCREEN
RETURN
SET TALK OFF
SET BELL OFF
SET ESCAPE OFF
SET STATUS OFF
SET SAFETY ON
SET DATE BRIT
SET SCOREBOARD OFF
PUBL OPT,TAG
SET COLOR TO RG+/B, G+/R++
DO WHILE .T.
CLEAR
@1,1 TO 23,77 DOUB
@3,20 SAY "COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
@4,20 SAY "          GENERAL HOSPITAL, MINNA"
@5,2 TO 5,76
@8,2 TO 8,76
@19,2 TO 19,76
@07,31 SAY "M A I N   M E N U"
@10,25 SAY "[A]  LABORATORY DATA MENU"
@12,25 SAY "[B]  LABORATORY REPORT MENU"
@14,25 SAY "[C]  EXIT PROGRAM"
TAG="DEVELOPED BY: AMINA SIDI (MRS), PGD/MCS/2000/2001/1028"
@21,10 SAY TAG
OPT=SPACE(1)
@17,25 SAY "Select option [A/B/C]" GET OPT PICT "A"
READ
DO CASE
    CASE UPPER(OPT) = "C"
        EXIT
    CASE UPPER(OPT) = "A"
        DO DATAMENU
    CASE UPPER(OPT) = "B"
        DO REPMENU
ENDCASE
ENDDO
CLEAR ALL
SET COLOR TO
CLEAR
RETURN
***** DATA FILE MAINTENANCE MODULE *****
DO WHILE .T.
CLEAR
@1,1 TO 23,77 DOUB
@2,23 SAY "COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
@3,23 SAY "          GENERAL HOSPITAL, MINNA"
@6,2 TO 6,76
@19,2 TO 19,76
@05,25 SAY "          DATA FILE MAINTENANCE"
@08,30 SAY "[A]  PATIENT DATA"
@10,30 SAY "[B]  REQUISITION"
@12,30 SAY "[C]  LABORATORY RESULTS"
@14,30 SAY "[D]  RETURN TO MENU"
OPT=SPACE(1)
@21,10 SAY TAG
@16,30 SAY "Select option [A/B/C/D]" GET OPT PICT "A"
READ
```

```

DO CASE
    CASE UPPER(OPT) = "D"
        RETURN
    CASE UPPER(OPT) = "A"
        DO PATMENU
        CASE UPPER(OPT) = "B"
        DO REQ
        CASE UPPER(OPT) = "C"
        DO RESULTS
    ENDCASE
ENDDO
CLOSE ALL
RETURN
***** PATIENT RECORD MAINTENANCE MODULE *****
DO WHILE .T.
    CLEAR
    @1,1 TO 23,77 DOUB
    @2,23 SAY "COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
    @3,23 SAY "          GENERAL HOSPITAL, MINNA"
    @6,2 TO 6,76
    @19,2 TO 19,76
    @05,25 SAY "          PATIENT RECORD MENU "
    @08,30 SAY "[A]  ADD NEW RECORD"
    @10,30 SAY "[B]  MODIFY PATIENT RECORD"
    @12,30 SAY "[C]  DELETE PATIENT RECORD"
    @14,30 SAY "[D]  VIEW PATIENT RECORDS"
    @16,30 SAY "[E]  EXIT"
    OPT=SPACE(1)
    @21,10 SAY TAG
    @18,30 SAY "Select option [A/B/C/D/E]" GET OPT PICT "A"
    READ
    DO CASE
        CASE UPPER(OPT) = "E"
            RETURN
        CASE UPPER(OPT) = "A"
            DO NEWPAT
            CASE UPPER(OPT) = "B"
            DO MODPAT
            CASE UPPER(OPT) = "C"
            DO DELPAT
            CASE UPPER(OPT) = "D"
            DO VIEWPAT
        ENDCASE
    ENDDO
    CLOSE ALL
    RETURN
    ***** MODIFY PATIENT RECORD PROGRAM MODULE
    USE PAT
    DO WHILE .T.

    MLABNO=0

    CLEAR
    @ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
    @ 2,15 SAY "    COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
        @ 4,10 TO 4,64
    @ 3,15 SAY "          MODIFYING PATIENT RECORD"
        @05, 24 SAY "LAB. NO.[0=EXIT]" GET MLABNO PICT "99999"
        READ
        IF MLABNO = 0
            EXIT

```

```

                ENDIF
LOCATE FOR LABNO = MLABNO

IF EOF()
    @23,0 SAY ""
    WAIT+"          RECORD DOES NOT EXIST, PRESS ANY KEY."
    @23,12 SAY SPACE(50)
    LOOP
ENDIF
DO WHILE .T.
    @06,24 SAY "SURNAME           : " GET SNAME PICT "@!"
    @07,24 SAY "FIRST NAME        : " GET FNAME PICT "@!"
    @08,24 SAY "AGE                : " GET AGE
    @09,24 SAY "S E X              : " GET SEX PICT "!"
    @10,24 SAY "DATE               : " GET LDATE PICT "99/99/99"
    @11,24 SAY "TIME               : " GET LTIME PICT "99:99"
    @12,24 SAY "PHONE NO.         : " GET PHONENO
    @13,24 SAY "HOSPITAL NO       : " GET HOSPNO
    @14,24 SAY "OCCUPATION        : " GET OCCUPATION PICT "@!"
    @15,24 SAY "ADDRESS           : " GET ADDR PICT "@!"
    @16,24 SAY "STATUS            : " GET STATUS PICT "@!"
    @17,24 SAY "TRIBE             : " GET TRIBE PICT "@!"
    @18,24 SAY "STATE             : " GET STATE PICT "@!"
    @19,24 SAY "RELIGION          : " GET REL PICT "@!"
    @20,24 SAY "NEXT OF KIN       : " GET NOKIN PICT "@!"
    @21,24 SAY "NEXT OF KIN ADDR: " GET NOKADDR PICT "@!"
    @22,24 SAY "NEXT OF PHONE    : " GET NOKPHONE

    READ
    CH=SPACE(1)
    @ 23,24 SAY "ARE THESE ENTRIES CORRECT ? (Y/N)" GET CH PICT "!"
    READ
        IF CH = "N"
            LOOP
        ENDIF
    EXIT
ENDDO

    CH=SPACE(1)
    @22,15 SAY SPACE(60)
    @ 23,15 SAY "DO YOU WANT TO MODIFY ANOTHER RECORD? (Y/N)" GET CH PICT "!"
    READ
        IF CH = "Y"
            LOOP
        ENDIF
    EXIT
ENDDO

    CLEAR
    .CLOSE DATABASE
    RETURN

***** NEW PATIENT RECORD PROGRAM MODULE
USE PAT
DO WHILE .T.

MLABNO=0

CLEAR
@ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
@ 2,15 SAY "          COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
    @ 4,10 TO 4,64

```



```

@ 3,15 SAY "          ADDING NEW PATIENT RECORD"
      @05, 24 SAY "LAB. NO.[0=EXIT]" GET MLABNO PICT "99999"
      READ
          IF MLABNO = 0
              EXIT
          ENDIF
      LOCATE FOR LABNO = MLABNO

IF .NOT. EOF()
    @23,0 SAY ""
    WAIT+"          RECORD ALREADY EXISTS, PRESS ANY KEY."
    @23,12 SAY SPACE(50)
    LOOP
ENDIF
    APPE BLAN
DO WHILE .T.
    @06,24 SAY "SURNAME          : " GET SNAME PICT "@!"
    @07,24 SAY "FIRST NAME       : " GET FNAME PICT "@!"
    @08,24 SAY "AGE              : " GET AGE
    @09,24 SAY "S E X           : " GET SEX PICT "!"
    @10,24 SAY "DATE            : " GET LDATE PICT "99/99/99"
    @11,24 SAY "TIME            : " GET LTIME PICT "99:99"
    @12,24 SAY "PHONE NO.       : " GET PHONENO
    @13,24 SAY "HOSPITAL NO     : " GET HOSPNO
    @14,24 SAY "OCCUPATION      : " GET OCCUPATION PICT "@!"
    @15,24 SAY "ADDRESS         : " GET ADDR PICT "@!"
    @16,24 SAY "STATUS          : " GET STATUS PICT "@!"
    @17,24 SAY "TRIBE           : " GET TRIBE PICT "@!"
    @18,24 SAY "STATE           : " GET STATE PICT "@!"
    @19,24 SAY "RELIGION        : " GET REL PICT "@!"
    @20,24 SAY "NEXT OF KIN     : " GET NOKIN PICT "@!"
    @21,24 SAY "NEXT OF KIN ADDR: " GET NOKADDR PICT "@!"
    @22,24 SAY "NEXT OF PHONE  : " GET NOKPHONE

    READ
    CH=SPACE(1)
    @ 23,24 SAY "ARE THESE ENTRIES CORRECT ? (Y/N)" GET CH PICT "!"
    READ
        IF CH = "N"
            LOOP
        ENDIF
        EXIT
    ENDDO
    REPLACE LABNO WITH MLABNO
    CH=SPACE(1)
    @22,15 SAY SPACE(60)
    @ 23,15 SAY "DO YOU WANT TO ADD MORE RECORDS ? (Y/N)" GET CH PICT "!"
    READ
    IF CH = "Y"
        LOOP
    ENDIF
    EXIT
ENDDO
    CLEAR
    CLOSE DATABASE
    RETURN

```

```

***** REPORT MENU PROGRAM MODULE *****
DO WHILE .T.
CLEAR

```

```

@1,1 TO 23,77 DOUB
@2,23 SAY "COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
@3,23 SAY "          GENERAL HOSPITAL, MINNA"
@6,2 TO 6,76
@19,2 TO 19,76
@05,25 SAY "          LABORATORY REPORT MENU "
@08,30 SAY "[A] WORKSHEET REPORT"
@09,30 SAY "[B] MASTER LOG REPORT"
@10,30 SAY "[C] INTERIM REPORT"
@11,30 SAY "[D] CUMMULATIVE REPORT"
@12,30 SAY "[E] REVENUE REPORT"
@13,30 SAY "[F] FINAL REPORT"
@14,30 SAY "[G] EXIT"
OPT=SPACE(1)
@21,10 SAY TAG
@16,29 SAY "Select option [A/B/C/D/E/F/G]" GET OPT PICT "A"
READ
DO CASE
    CASE UPPER(OPT) = "G"
        RETURN
    CASE UPPER(OPT) = "A"
        DO WKS
            CASE UPPER(OPT) = "B"
                DO MLOG
            CASE UPPER(OPT) = "C"
                DO INTERIM
            CASE UPPER(OPT) = "D"
                DO CUMMUL
            CASE UPPER(OPT) = "E"
                DO REVENUE
            CASE UPPER(OPT) = "F"
                DO FINAL
        ENDCASE
    ENDDO
CLOSE ALL
RETURN
***** DELETE PATIENT RECORD PROGRAM MODULE
USE PAT
DO WHILE .T.

MLABNO=0

CLEAR
@ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
@ 2,15 SAY "          COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
    @ 4,10 TO 4,64
@ 3,15 SAY "          DELETING PATIENT RECORD"
    @05, 24 SAY "LAB. NO.[0=EXIT]" GET MLABNO PICT "99999"
    READ
        IF MLABNO = 0
            EXIT
        ENDIF
    LOCATE FOR LABNO = MLABNO

IF EOF()
    @23,0 SAY ""
    WAIT+"          RECORD DOES NOT EXIST, PRESS ANY KEY."
    @23,12 SAY SPACE(50)
    LOOP
ENDIF
DO WHILE .T.

```

```

@06,24 SAY "SURNAME           : " GET SNAME PICT "@!"
@07,24 SAY "FIRST NAME        : " GET FNAME PICT "@!"
@08,24 SAY "AGE                : " GET AGE
@09,24 SAY "S E X             : " GET SEX PICT "!"
@10,24 SAY "DATE              : " GET LDATE PICT "99/99/99"
@11,24 SAY "TIME              : " GET LTIME PICT "99:99"
@12,24 SAY "PHONE NO.         : " GET PHONENO
@13,24 SAY "HOSPITAL NO       : " GET HOSPNO
@14,24 SAY "OCCUPATION         : " GET OCCUPATION PICT "@!"
@15,24 SAY "ADDRESS           : " GET ADDR PICT "@!"
@16,24 SAY "STATUS            : " GET STATUS PICT "@!"
@17,24 SAY "TRIBE             : " GET TRIBE PICT "@!"
@18,24 SAY "STATE             : " GET STATE PICT "@!"
@19,24 SAY "RELIGION          : " GET REL PICT "@!"
@20,24 SAY "NEXT OF KIN       : " GET NOKIN PICT "@!"
@21,24 SAY "NEXT OF KIN ADDR : " GET NOKADDR PICT "@!"
@22,24 SAY "NEXT OF PHONE    : " GET NOKPHONE

```

CLEAR GETS

CH=SPACE(1)

@ 23,24 SAY "DELETE ABOVE REOCD? (Y/N)" GET CH PICT "!"

READ

IF CH = "Y"

DELETE

PACK

ENDIF

EXIT

ENDDO

CH=SPACE(1)

@22,15 SAY SPACE(60)

@ 23,15 SAY "DO YOU WANT TO DELETE ANOTHER RECORD? (Y/N)" GET CH PICT "!"

READ

IF CH = "Y"

LOOP

ENDIF

EXIT

ENDDO

CLEAR

CLOSE DATABASE

RETURN

***** REQUISITION PROGRAM MODULE

SELE 1

USE PAT

SELE 2

USE REQ

SELE 3

USE NORMALS

SELE 4

USE CHARGES

DO WHILE .T.

STORE 0.0 TO C1,C2,C3,C4,C5,AMT, TOTL

STORE SPACE(10) TO T1,T2,T3,T4,T5

MLABNO=0

MSDATE=SPACE(8)

CLEAR

@ 1,15 SAY " GENERAL HOSPITAL, MINNA. NIGER STATE"

@ 2,15 SAY " COMPUTERIZED MEDICAL LABORATORY RESULTS"

@ 4,10 TO 4,64

@ 3,15 SAY " CHEMICAL PATHOLOGY REQUEST"

@05, 24 SAY "LAB. NO.[0=EXIT]" GET MLABNO PICT "99999"

```

READ
        IF MLABNO = 0
            EXIT
        ENDIF
SELE 1
    LOCATE FOR LABNO = MLABNO

IF EOF()
    @23,0 SAY ""
    WAIT+"          RECORD DOES NOT EXIST, PRESS ANY KEY."
    @23,12 SAY SPACE(50)
    LOOP
ENDIF
SELE 2
    APPE BLAN
DO WHILE .T.
    @07,24 SAY "DOCTOR           : " GET DR PICT "@!"
    @08,24 SAY "WARD/CLINIC      : " GET WARD_CLIN PICT "@!"
    @09,24 SAY "SPECIMEN         : " GET NAT_O_SPEC PICT "@!"
    @10,24 SAY "DATE             : " GET SDATE
    @11,24 SAY "TIME             : " GET STIME PICT "99:99"
    @12,24 SAY "TEST TYPE 1      : " GET TEST1 PICT "@!"
    @13,24 SAY "TEST TYPE 2      : " GET TEST2     PICT "@!"
    @14,24 SAY "TEST TYPE 3      : " GET TEST3 PICT "@!"
    @15,24 SAY "TEST TYPE 4      : " GET TEST4 PICT "@!"
    @16,24 SAY "TEST TYPE 5      : " GET TEST5 PICT "@!"
    READ
    MSDATE=DTOC(SDATE)
    REPL LABNO WITH MLABNO
    T1=TEST1
    T2=TEST2
    T3=TEST3
    T4=TEST4
    T5=TEST5
    SELE 3
        LOCATE FOR TEST = T1
        C1=BILL
        GO TOP
        LOCATE FOR TEST = T2
        C2=BILL
        GO TOP
        LOCATE FOR TEST = T3
        C3=BILL
        GO TOP
        LOCATE FOR TEST = T4
        C4=BILL
        GO TOP
        LOCATE FOR TEST = T5
        C5=BILL
    @10,50 SAY "CHARGES"
    @11,50 SAY "-----"
    @12,50 SAY C1
        @13,50 SAY C2
    @14,50 SAY C3
    @15,50 SAY C4
    @16,50 SAY C5
    @17,42 SAY "TOTAL"
    TOTL=C1+C2+C3+C4+C5
    @17,47 SAY TOTL
    @18,20 SAY "AMOUNT PAID           : " GET AMT
    READ

```

```

CH=SPACE(1)
@ 23,24 SAY "ARE THESE ENTRIES CORRECT ? (Y/N)" GET CH PICT "!"
READ
    IF CH = "N"
        SELE 2
        LOOP
    ENDIF
EXIT
ENDDO
SELE 2
REPL CHG1 WITH C1, CHG2 WITH C2, CHG3 WITH C3, CHG4 WITH C4, CHG5 WITH
C5
SELE 4
APPE BLAN
REPLACE LABNO WITH MLABNO, CHARGE WITH TOTL, PAID WITH AMT
REPL DATEF WITH CTOD(MSDATE), BAL WITH TOTL-PAID
CH=SPACE(1)
@22,15 SAY SPACE(60)
@ 23,23 SAY "DO YOU WANT TO ADD MORE RECORDS ? (Y/N)" GET CH PICT "!"
READ
    IF CH = "Y"
        LOOP
    ENDIF
EXIT
ENDDO
CLEAR
CLOSE DATABASE
RETURN

***** RESULTS PROGRAM MODULE
SELE 1
USE RESULT
SELE 2
USE REQ

DO WHILE .T.
STORE 0.0 TO C1,C2,C3,C4,C5,AMT, TOTL
STORE SPACE(10) TO T1,T2,T3,T4,T5,T
MLABNO=0
STORE SPACE(8) TO MDATE,MSDATE
CLEAR
@ 1,15 SAY "          GENERAL HOSPITAL, MINNA. NIGER STATE"
@ 2,15 SAY "          COMPUTERIZED MEDICAL LABORATORY TEST RECORD"
    @ 4,10 TO 4,64
@ 3,15 SAY "          CHEMICAL PATHOLOGY RESULTS"
    @05, 24 SAY "LAB. NO.[0=EXIT] " GET MLABNO PICT "99999"
    @06, 24 SAY "ENTER DATE      : " GET MDATE PICT "99/99/99"
    READ
        IF MLABNO = 0
            EXIT
        ENDIF
    SELE 2
        LOCATE FOR LABNO = MLABNO .AND. SDATE = CTOD(MDATE)

IF EOF()
    @23,0 SAY ""
    WAIT+"          RECORD DOES NOT EXIST, PRESS ANY KEY."
    @23,12 SAY SPACE(50)
    LOOP
ENDIF

```

```

T1 = TEST1
T2 = TEST2
  T3 = TEST3
T4 = TEST4
T5 = TEST5
SELE 1
  APPE BLAN
DO WHILE .T.
  IF T1 <> SPACE(10)
    @07,24 SAY T1+" TEST RESULT : " GET RES1 PICT "@"
  ENDIF
  IF T2 <> SPACE(10)
    @08,24 SAY T2+"TEST RESULT : " GET RES2 PICT "@"
  ENDIF
  IF T3 <> SPACE(10)
    @09,24 SAY T3+"TEST RESULT : " GET RES3 PICT "@"
  ENDIF
  IF T4 <> SPACE(10)
    @10,24 SAY T4+"TEST RESULT : " GET RES4 PICT "@"
  ENDIF
  IF T5<> SPACE(10)
    @11,24 SAY T5+"TEST RESULT : " GET RES5 PICT "@"
  ENDIF
  @12,24 SAY "TIME OF ASSAY : " GET RTIME PICT "99:99"
  @13,24 SAY "DATE OF ASSAY : " GET RDATE
  @14,24 SAY "PATHOLOGIST : " GET PATHOLOGIST PICT "@"
  READ
  * MSDATE=DTOC(SDATE)
  REPL LABNO WITH MLABNO
  CH=SPACE(1)
  @ 23,24 SAY "ARE THESE ENTRIES CORRECT ? (Y/N)" GET CH PICT "!"
  READ
  IF CH = "N"
    LOOP
  ENDIF
  EXIT
ENDDO

  SELE 2
  REPL STAT WITH "["
  @23,23 SAY SPACE(60)
@ 23,23 SAY "DO YOU WANT TO ADD MORE RECORDS ? (Y/N)" GET CH PICT "!"
  READ
  IF CH = "Y"
    LOOP
  ENDIF
  EXIT
ENDDO

  CLEAR
  CLOSE DATABASE
  RETURN

```