DATA BASE APPLICATION FOR STOCK CONTROL

THISES SUPMITTED TO

THE

FACULTY OF ENGINEERING

AIN SHAMS UNIVERSITY

BY

ENGINEER

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IN THE PARTIAL FULFILMENT

FOR

THE DEGREE OF

M.Sc. MASTER OF SCIENCE

IN

[redacted]

FROM THE ELECTRONICS AND COMPUTERS ENINEERING DEPT.

UNDER THE SUPERVISION OF

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1981

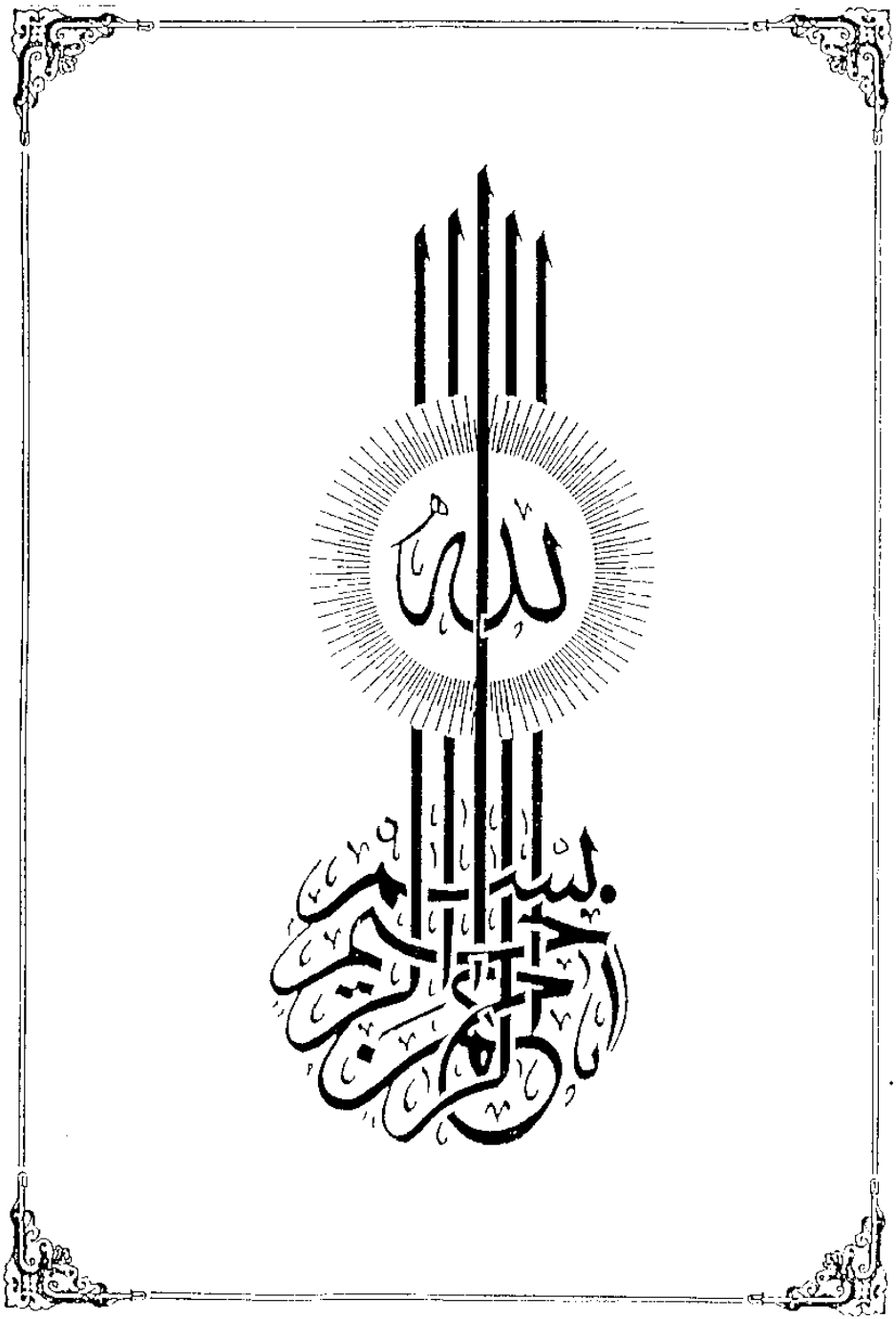
ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to my teacher Prof. Dr. Mohamed Adeeb Riad Ghonaimy for his sound advice and generous help which I feel that without it the completion of this thesis would have been very difficult.

Meanwhile I wish to thank Prof. Dr. Mohamed Reda El-Karaksy for his effort in reviewing the final form of this thesis and for his valuable comments.

Finally, thanks my God.

Eng. Galal Osman



Summary of the thesis presented for M.Sc. degree
By Galal El Dien Osman to the electronic and
Computer department, Faculty of Engineering,
Ain Shams University.

Title " Data base application for stock control "

The general objectives of this thesis are to present a systematic approach of the structured information systems development, and to establish a methodology for the fulfilment of the different development phases. The capabilities of data base management systems and their implications on developing a structured information system are also investigated.

A case study from real life stock control system is used, the environment of maintenance and repair of motor-vehicles and the relevant activities for a larg organization is selected to investigate the concepts of information systems and how they can be used in supporting the management level and the operational level as well. In addition it shows how the chronic problems of stock control in such large organization could be solved through a well designed information system based on an appropriate data base management system.

The thesis provides an insight to the nature of spare parts inventory control through a survey of the different inventory control models and the techniques of forecasting and requirement planning. It also presents a practical stepwise data base design methodology that derives a data base structure from a set of user's requirements in the form of desired outputs. Then work backward we finally arrive at the processing steps that are required and the data base we are needed, and finally the inputs we have to collect.

The modular approach is following during the implementation phase of our stock control information system (SCIS). According this approach the (SCIS) is divided into the following four modules

(1) Data Capture module.
(2) Daily processing module.
(3) Queries and reports generation module.
(4) Monthly and annual operation module.

TOTAL DBMS was used as a tool in the implementation phase, therefore its features were investigated in detail, and the implications of these features on deriving the data base structure was also discussed.

As the information systems moves toward ture operation phase, backup and recovery becomes a major concern, therefore the concepts and the different methods of back-up and recovery were investicated. Using the standard utilities provided by the operating system and TOTAL DBMS, some measurements of back-up and recovery times were taken to help in managing the problem of ansering the question, when to backup?, sample results for different queries and reports provided by the system were included.

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 GENERAL OBJECTIVES

The objectives of this thesis are to present a comprehensive collection of tools for the structured information systems development, and to establish a methodology for fulfilment of the different development phases. The capabilities of data base management systems and their implications in developing a structured information system are also investigated.

As a case study from real life case is a stock control system used in the environment of maintinance and repair of motor vehicles and the relevant activities for a large organization. The organization comprises several central stores of spare parts and several repair workshops representing the consumers of spare parts. The field of stock contral is selected to investigate the concepts of information systems, and how they can be used in real life in supporting the management level and the operational level as well. The chronic problems of stock control in such large organizations could be solved through a well designed information system based on an appropriate data-base management system.

1.2 OVERVIEW OF THE THESIS

In chapter 2 we give a review of the stock control domain. The different inventory models are discussed in detail. The discussed models are :

- Fixed order quantity model.
- Modified reorder point model.
- The replenishment model.
- The optional replenishment model.

The terminology used in stock control environment such as, buffer stock, reorder level, lead time,...etc are also addressed. Since the effectiveness of any stock management program deponds largely on the ability to make some sort of reasonably accurate future demands this is also discussed within chapter-2. Two techniques are considered. The first is the forecasting technique and it is based on the historical usage data(1) and the second is the material requirement planning technique(2). In principle forecasting is applicable only for items having independent demands, but for items with dependent demands the requirement planning technique is the more suitable one. In the field of motor vehicles spare parts we have many items characterized with independent demands and many items characterized with dependent demands, as well.

Chapter 3 is a rapid review of the evolution of information systems, starting from punched-cards-based-in-

formation systems to the emergence of data base management systems. Concepts of data models and some terminology are also presented. Network, hierorchical and relational data models are discussed. An idea about data languages is also included. Two network based DBMS'S are explained, the first is the CODASYL (Conference on Data Systems Languages) DBIG (Data Base Task Group) proposal, and the second is the TOTAL DBMS. TOTAL is the tool used in our stock control system implementation, so it is discussed in more detailes.

Data base management systems have evolved to the point of general acceptance and wide application, however a major problem still facing the users is the effective utilization of these systems. Achieving effective data base system usability is the matter of data base design. Chapter-4 presents a practical step-wise data base design methodology that derives a DBMS processable data base structure from a set of user information and processing requirements. Fig. (1-1) designates the data base design process. On the input side general information requirements represent various users' description of the organization for which data are to be collected and stored in the data base. Data base design based on the requirements is considered to be advantageous for long-term data bases that must be adaptable to changing processing requirements(3).

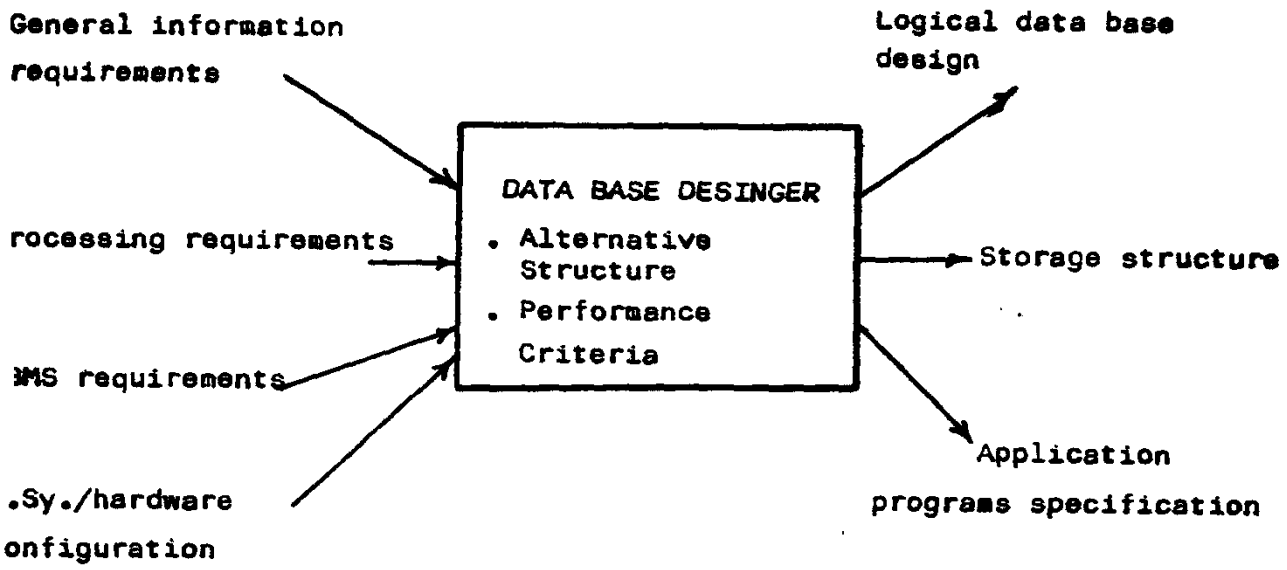


Fig. (1-1) Data base design inputs and outputs

The evalution of data base design methodologies is currently a dynamic process, and general agreement on a best approach does not appear to be immediately forthcoming (3). In this chapter we offer the design steps shown in Fig. (1-2), which present the major principles developed in the currently known general design methodologies. These steps must be considered as flixable guidelines or check points for the data base administrator or data base designer, i.e. they are not formal rules that encompars all possible design situiations. Fig. (1-2) also illustrates the general interactions between design steps. Details of each step is discussed in the contents of chapter 4.

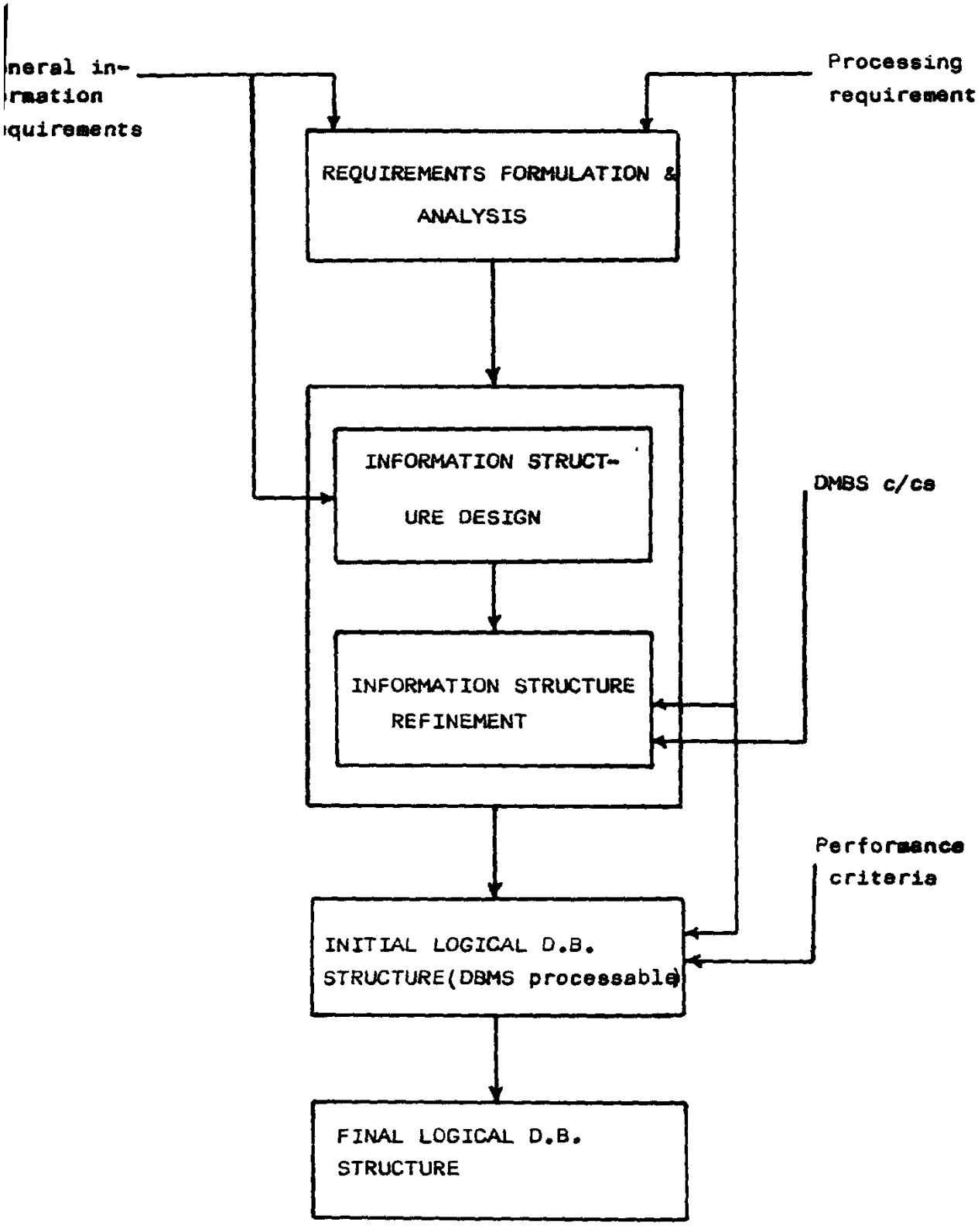


Fig.(2-1) Logical data base design steps

For requirements specification we shall use Warnier Diagrams (4) as a clear and compact method for requirement documentation. Appendix-A gives complete system requirements in the form of Warnier Diagrams. Performance measure of the logical design procedure are limited to logical records access counts, total bytes transferred to satisfy an application, and total bytes in the data base (storage requirement). These measurs attempt to predict physical data base performance in terms of elapsed time and physical storage space as closely as possible. The computations of logical data base structure performance is included in Appendix-B.

Chapter-5 represents the implementation phase in our system developing procedure. The final logical data base stracture and the initial data elements, which are considered as the outputs of the logical data base design procedure discussed in chapter-4, are used as inputs to the implementation procedure. The system moduling approach is used to enhance the implemintation procedure, which is a time consurning task, and to achieve the integrity between system components. The system is divided into the following four modules :

Module 1 : Data capture or data base creation module

Module 2 : Daily processing or transaction module

Module 3 : Queries and Reports generation module

Module 4 : Monthly and annual procedures module

Modules can be created and tested in an order independent of their final placament in the system hierarchy. Some additional data elements are added to the basic data elements to achieve some implementation and programming needs. For each module the complete flow diagram and a list of its programs and their functions are provided. Appendix-E includes detailed flow charts of the different programs.

Chapter 6 presents the operation phase. The main features of the system operation are investigated. From the system's users point of view the concepts of data base loading, real time query formulation and daily processing are discussed and the relevant system output samples are included. From system manager point of view, the houskeeping procedures and the concepts of backup and recovery are explaned and some results showing backup and recovery times are given.

CHAPTER 2

INVENTORY CONTROL ASPECTS

2.1 INTRODUCTION TO INVENTORY MANAGEMENT

- 2.1.1 Basic inventory model.
- 2.1.2 Modified reorder point system with periodic inventory count
- 2.1.3 The replenishment inventory system.
- 2.1.4 The optional replenishment system.

2.2 ANALYSIS OF THE MAIN INVENTORY MANAGEMENT PARAMETERS

- 2.2.1 Reorder, Buffer stock and service level,
- 2.2.2 Safety stock and lead time.
- 2.2.3 Demand distribution and buffer stock.

2.3 FORECASTING VERSUSS REQUIREMENTS PLANNING

- 2.3.1 Introduction
- 2.3.2 Forecasting
- 2.3.3 Requirement planning.

INVENTORY CONTROL ASPECTS

2.1 INTRODUCTION TO INVENTORY MANAGEMENT

1.1 Basic inventory model (1)

The logical starting point for a discussion of inventory is a basic inventory model. The model itself first appeared in the literature more than thirty years ago, and it illustrates effectively the typical assumptions and simplifications involved in building a model for inventory management. This basic model is the fixed order quantity system, and frequently referred to as the " Wilson Formulation ".

In this system the reorder quantity is fixed and reorder is placed for this quantity whenever the inventory on hand drops to a particular level, referred to as the reorder level. The system is based on slecting the order quantity which will minimize the total variable costs of managing inventory, this quantity is known as the economic order quantity. In determining this quantity the model assumes that the cost of managing inventory is made up solely of two parts : ordering cost and carrying cost.

2.1.1.A Ordering cost

It is the additional cost of placing an order, which is considered to be independent of the size of the order. If Co is the cost of placing an order and o is the order