GRADUATE PROJECT

DENTAL CLINIC MANAGEMENT SYSTEM

( A Relational Data Base Design )

by

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>1</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1 - 4</td>
</tr>
<tr>
<td>PROGRAM STRUCTURE AND LOGIC</td>
<td>5 - 9</td>
</tr>
<tr>
<td>MENUS AND INTERFACES WITH OPERATING SYSTEM</td>
<td>10 - 12</td>
</tr>
<tr>
<td>CONCLUSION AND SUGGESTIONS FOR FUTURE WORK</td>
<td>13 - 15</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>1 - 22</td>
</tr>
<tr>
<td>USER MENU</td>
<td></td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>1 - 9</td>
</tr>
<tr>
<td>DOCUMENTATION</td>
<td>1 - 37</td>
</tr>
</tbody>
</table>
INTRODUCTION

The objective of this project is to design a computer software package "DENTAL CLINIC MANAGEMENT SYSTEM", for the IBM Personal Computer to fulfill business need for a small dental clinic successfully for at least five years.

The dental clinic started business in 1980 at Portland Texas. Now they have over 10,000 patient files, about one third of which are active customer files. Besides maintenance of the patient file, the receptionist will also have to keep a day sheet, general ledger and receipt for patients. By the end of month she reviews all accounts and checks for uncollected accounts receivable that have been overdue for a month and mails them a bill to remind them of this fact, but for those who have been overdue for three months, a list is constructed and then sent to a collection agency.

The business of this clinic is thriving, with three to four hundred patients per month, the doctor's schedule is tight however they never reject any patients, in the near future, then plan to either hire a new doctor or a new dental assistant for help. Therefore, with the great potential of expanding business, increased patient file handling as well as late payment collection, this clinic needs an efficient method to handle their routine business work. After carefully study and system analysis a computer system to handle tedious filing and paperwork was chosen to be the best solution.
The main purpose of "DENTAL CLINIC MANAGEMENT SYSTEM" is to perform the following primary functions:

1. Keep track of all patient files for the purpose of fast and accurate response to patient and doctor inquiries.
2. Through the accounts receivable file, to maintain control over all transaction for processing and collection analysis to increase cash flow, and thus increase income.
3. Increasing personal productivity by reducing redundant paper work and the posting of accounts.
4. Generating report for the understanding of the collection activities which will also give a summary of procedures performed and an accounting statement on a timely basis.
5. Insurance claims processing information can be accessed through the information stored in the patient file. It can be accessed as one claim per patient or one claim for an entire family. This is because some of the family might be covered by more than one insurance company.

In order to implement these functions, dBASEII on the IBM Personal Computer was chosen. dBASEII provides many data management facilities since it is a database management tool. English like commands also allow easy manipulation of small and medium size database. With dBASEII programmer can perform the following functions:
1. Create complete database systems.
2. Easily add, delete, edit display, and print data from the database created, with a minimum of data duplication.
3. Gain a large measure of program and data independence by the fact that if you change your data, you do not have to change your programs and vice versa.
4. Generate reports from one or more databases and automatically do multiplication, division, subtotals, and other data manipulation every time the databases are used.
5. Use the full-screen editing capability to set up a screen format the full-screen editing capability allows users to see what they are going to get and to enter data by filling in the blanks. Also, with combined command and full-screen editing skill the system can be designed as a menu-driven system, with a limited number of options, each option will bring up another menu which will allow the user to edit files, generate reports or call up data entry screen. The inexperienced end user need only to choose the "multiple choice" options.
6. dBASEII only allows a single user inquiry at a time, therefore the overall design is for the single user's application on a single microcomputer.
Throughout the design and implementation of this project, many principles of sound information processing were continually used. One of the basic aspects of many effective designs is that the relational database structure is chosen to represent the information store in the system. The book "DATA STRUCTURES FOR COMPUTER INFORMATION SYSTEMS" by "ROY S. ELLIOT" and "COMPUTER DATABASE ORGANIZATION" by "JAMES MARTIN" were constantly used as a guide in order to choose an appropriate data structures.

"dBASEII REFERENCE MANUAL" and "USER'S GUIDE" developed by "ASHTON- TATE", were constantly used as a guide to detailed design and program coding as well.

Although most of the accounting procedures used in this project had been developed by the clinic's accountant, Knowledge of basic accounting practices was helpful in various stages of the project, especially the income statement and monthly report. These practices may be found in "INTERMEDIATE ACCOUNTING" by "KIES HERNANDEZ".
PROGRAM STRUCTURE AND LOGIC

The design of "DCMS" system is based on the theory of a relational database model, through the facilities of the dBASEII data base software package.

dBASEII is marketed by "Ashton-Tate" a software company in California. It comes on diskettes which are formatted especially for the IBM Personal Computer DOS Operation System.

dBASEII is a package of computer programs and documentation that let a programmer set up and use data base. A data base is a collection of interrelated data, pointers, tables, indexes, directories and so on.

dBASEII uses a relational data base management system to maintain the data structure and file organization physically. The relational model is based on a foundation of theory from relational mathematic (such as normal forms) and to present data as it is. The relationship between data elements can be considered as a two dimensional table called a tuple (row or record) and a attribute (column or field), sometimes it is customarily referred to a 'flat file'. The table is usually stored on disk as a file.
The Data dictionary is a full description of all the fields, it also describes the relationship among various fields. An index is a table of record number called pointer, indexes enable quick access by key to retrieve record and to insert new records.

The key in a relational data base management system denote properties of information content. A key implies a primary key or a secondary key, there is no required relationship between data content and actual physical storage of data. Hence this orientation is in sharp contrast to other data base management model. In all, the relational model exits only on flat files – an exceedingly simple concept in storage structure.

dBASEII uses a structure called Btree for indexes. Btree use the physical model of dBASEII to set up an index file, it is similar to a binary tree but uses storage much more efficiently and is a great deal faster.

The index program starts at the root node and traversals the Btree until the index matches the key, then the data that was asked for is retrieved.

Besides Btree, dBASEII also supplies sequential, indexed sequential and direct access functions.
dBASEII hides the physical structure of the data and present only a logical view. Separating dBASEII reveals a two-level system.

On the first level, there is an interactive data storage and retrieval package, which means data is totally monitored and manipulated by the dBASEII data base management system, not by an individual application programs. It can simplify application program development by performing automatically many I/O routine and housekeeping software functions. All of the application systems have access to all the data without direct involvement.

On the second level, dBASEII is a system development package, containing its own programming language (called query language). A skilled programmer can use it to create various systems and develop multiframe business application like the "DCMS" system.

Sophisticated file structures offer powerful cross referencing capabilities that eliminate redundant data and make possible fewer files.

In dBASEII's creating environment, each of the items that have been entered a single related grouping is called a field, the grouping is called record. However, each field must contain the following information:

* the name of the field
* the type of data in the field
* the size of field
# the number of decimal places, if field is numeric.

In this system four basic programming structures with command files are used:

* sequence

* choice /decision: IF...ELSE...ENDIF

* repetition: DO WHILE.... ENDDO

* procedures: subsidiary command file, procedures are a command file that can be called by other programs. DO CASE...OTHERWISE...ENDCASE

"DO CASE" is rather interesting command in dBASEII, actually DOCASE is a structured procedure. The individual CASEs in the construct can be viewed as the exceptions to the rule that defines the OTHERWISE. If some condition needs some special processing, then the condition would be a CASE and all the other conditions would be the OTHERWISE. OTHERWISE can also be viewed as the default condition.

In general, most of the data structures in command files are self explanatory.

There are two basic ways of allowing users to communicate with
computers. They are through menus or query languages. Most commonly used programs are "menu-driven", in which a list of options is displayed. A typical example would be a menu as the following shows:

```
MAIN MENU

1. PATIENT FILE
2. ACCOUNT FILE
3. MONTHLY REPORT
4. INSURANCE CLAIM PROCESSING
5. RETURN TO DBASE
6. RETURN TO SYSTEM
```

PLEASE SELECT ONE

If a number on the MAIN MENU is chosen, a second menu would allow the selection of various application functions. Someone unfamiliar with the program is lead through any operation.

Four data base files were used in this project; for the relational data base management system not allow repeating fields.
The Patient file stores the patients personal data, account balance and last payment day, among these, the balance as well as the last payment day are updated currently by passing the latest information from the Account Receivable file automatically. This application requires processing more than one file at a time, although dBASEII provides for multiform file processing, however, only two files may be active at one time, the ability to generate instructions allows one to process more than two files at a time. This system activates files only when they are needed and allows them to be deactivated when they are not.

The Account Receivable file consists of ID no., description of service procedure #, amount cost, payment and balance. It also provides part of the information for insurance claims processing.

The Report is done on a timely basis and prints delinquency reports for managerial purposes and shows collection information, income and accounts receivable. Report file also provides the ability to print "daily ledger" as well as single patient data.

dBASEII also offers the capability to create format files, as in the DCMS system all the custom design data entry screens, it allows the user to place the data fields exactly where desired and permits the use of pre-printed business forms such invoices. DCMS uses a couple of these kind of format files for such things as input screen and output screen.
USER MENUS AND INTERFACES WITH THE OPERATING SYSTEMS

Since few if any field office personnel have ever worked with a computer, one of the primary desires of DCMS system was to make the entire series of programs described in this project extremely easy to use. Toward this end, certain measures to insure robustness of the programs have been described in earlier chapters and fully noted in program listings. There were, however, three additional steps necessary for making the system even more user-friendly.

1. It was necessary to make the programs automatically execute after an operator had entered only the password and some essential system information.

2. Use of a Winchester disk (hard-disk) to store information which will allow mass information storage and faster operation.

3. The process of backing up transaction and main files to floppy diskettes had to be an automatic process; if backup procedures were too difficult, past experience showed that most operators would not do it.

Fortunately, each of these goals are easily accomplished by using dBASEII and DOS (DISK OPERATING SYSTEM) efficiently; for dBASEII provides the programmer with easy access to operating system routines.
The main computer used in developing "DCMS" system was the IBM Personal Computer. This machine uses some of the most modern technology presently available to the commercial microcomputer. It is a totally unbundled computer, has the ability to expand to meet almost any future computer need; a 16-bit microprocessor able to perform more complex computer operations faster than most other personal computers and its memory can be expanded to 640K.

The main operating system of the IBM Personal Computer is DOS 2.10 (Disk Operating System) with a minimum of 128 kilobytes main memory storage. Disk storage space for a minimum unit is 360 kilobytes by using a dual-sided double density 5 1/4" floppy diskette. The other components of the IBM PC are the IBM console set and IBM matrix printer. A Winchester disk is highly recommended.

Since dBASEII is used routinely, the copying of the DOS operating system and dBASEII application program to a double sided diskette, so called system/application diskette, has been made. By doing this, the user has to use only one diskette and all the data will be stored on a Winchester hard disk. This allows the user to start the operating system and also run dBASEII programs concurrently.
The hard disk is sealed in the hard disk drive to keep it dust free. It provides spaces for 10 million characters (about 6,600 pages), compared to the space on a flexible diskette which can store 400,000 characters about 260 pages). Data from 25 or more diskettes can be stored and accessed from the hard disk drive.

A hard disk not only provides mass storage spaces, but also has shorter seek time than a floppy diskette, thus it provides faster access.

To begin the automatic execution of a program, one simply types <DBASE DCMS>. The "DCMS" is a "supervisor" type of program which controls the execution of other programs within it.

However, there is no built in security system in dBASEII, so the issue of security was given ample consideration. Through embedded and changeable passwords, at least a certain degree of confidential information can be protected.

Another alternative is to disable the "ESCAPE" key to the dBASEII command, this will help deter someone from entering the dBASEII command mode.
CONCLUSION AND SUGGESTIONS FOR FUTURE WORK

dBASEII provides many data management facilities. Among these are an interactive query language, (which means you can "talk" to it), a report writer to create tabular reports, and a powerful programming language allowing a knowledgeable person to adapt dBASEII to the needs of those who are less familiar with computers. Many other features make dBASEII ideally suited to solving business applications.

"DCMS" is designed to perform specific tasks for the inexperienced end user with a limited budget. Using the facilities of dBASEII this system provides small business organizations with the ability and functionality previously only possible on a minicomputer.

Besides this, dBASEII offers the ability to read data from BASIC, COBOL and many other programming languages, letting the new user transfer old data to the new system without the extra time consuming and inefficient reentry of data.

In a data base environment, all the data is supposed to be shared by everyone, but some of the data, especially data involved with money, is strictly confidential, available to authorized personnel only. Therefore, the issue and design of security was taken to consideration.
A password capability is built right into the file in "DCMS". Security levels for fields are entered in the data dictionary along with field length, data type, and so on. Passwords are entered in a special section of the data dictionary with the understanding that it takes a special high security code to access and modify the password themselves.

As mentioned in a previous section, this system is designed to have all of the programs easily usable by field personnel with little or no computer literacy or training. As with any new system, management is aware that some training of personnel will be required; they wish, however, to have the new system as "user-friendly" as possible. The obvious catch is the word literacy "DCMS" is totally "menu-driven", in which a list of options is displayed by the full screen editor and the selection of an option will bring up a different menu for a different application.

The primary disadvantage of this is the time it takes to present the menus and recieve the next instruction. Five to six menus may have to be displayed before the desired function is reached. The main menu may then have to be returned to before starting a new operation. Menu driven programs are useful when dealing with first time users, but after awhile, increasing
familiarity with the system may create a desire to get the job done more directly.

Although a winchester disk has faster access ability, a menu-driven approach cannot compare with command-driven approach, in which the tasks to be performed are described with a special language (query language). These commands have specific meanings, and require strict adherence to a proper syntax. A knowledgeable user may quickly perform any desired tasks without working through menus.

How to train the user to use simple command expressions will be the suggestion for future work. For after six months to a year, the user gradually gets used to the system. This as well as the fact that with increasing files, the application might become considerably slow. Although the training might have to deal with user's willingness, after a period of time plus a slowed downed application, the end user might want to have one to two hours of a simple command course, in order to access the files directly.