Application Cases in MIS

Using Spreadsheet and Database Software

3.5 Version

James N. Morgan

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To my parents, my wife Teresa, and my children Angelee and Adam.

PREFACE

Application Cases in MIS: Using Spreadsheet and Database Software was written to support any MIS textbook that is used for courses which have a substantial hands-on component. For example, it can support MIS texts by James A. O'Brien and Shultheis and Sumner that are published by Richard D. Irwin, Incorporated. This casebook is designed to assist students in learning to design and develop hands-on computer applications to solve managerial problems. It is written for students who are prospective managerial users of computer systems, and not for potential IS professionals. The cases presented in this casebook are business oriented, because this casebook is intended primarily for use by students majoring in a business field. However, the methods and skills covered here should be useful to anyone working in a managerial level professional capacity in any type of organization.

The primary goal of this casebook is to help students learn to design and develop computer applications which use common end user software packages to solve real world managerial problems. The cases presented here are designed to be solved using common spreadsheet or database management packages. While there are no cases in this book centered on work with word processing packages, instructors may want to reinforce their students word processing skills by requiring the use of a word processor to complete the written portion of each case they assign.

This casebook is designed for use in classes where incoming students are expected to have some prior experience with the use of spreadsheet and database packages. Thus, the mechanics of using spreadsheet and database software packages are not covered in this casebook. However, only a minimal level of knowledge of the mechanics of spreadsheet and database operations are required to complete the cases presented here. Students entering the course with no previous experience in the use of spreadsheet or database packages will need to use supplementary materials, such as reference manuals or tutorial workbooks, to develop a minimal level of mechanical skills for the packages they will be using.

Students enter MIS courses with widely varied levels of experience in the other functional areas of business. The cases presented in this casebook have been designed to present real world business situations without requiring the use of advanced functional area skills that some students may not have. Brief explanations are provided when basic terminology or calculations based on functional area knowledge are used.

Building end user applications requires more than simply having a knowledge of spreadsheet and database packages. The end user developer must be able to identify situations calling for the development of an end user computer application and must be able to design and develop an application which will provide the appropriate information in as effective a manner as possible. These skills in identifying problem situations requiring computer applications and designing solutions are key to successful use of computer technology, and form the main thrust of this case book.

Two sets of cases are presented: one for spreadsheet applications and one for database applications. The set of database cases also includes some cases requiring the integrated use of both database and spreadsheet software. A chapter of material describing development tools and methods and applying them to a sample case is presented before each set of cases. Each set of cases is designed to help students learn these application development skills. The cases present real world problem situations in a narrative form. Application designs are presented for the first five cases in each set to help give students a better feel for the design process. However, the last five cases in each set require the student to design and develop an appropriate application based only upon the narrative problem description.

A data disk is provided to accompany this casebook. The data disk provides partially completed spreadsheet and database files for use on those cases requiring the use of substantial amounts of data. These files are provided in order to reduce the amount of repetitive data entry required to complete these cases. The data disk is designed to be usable on almost all personal computer systems using any of a number of popular commercial spreadsheet and database packages. The system hardware and software requirements to use the data disk are presented below along with a set of instructions for creating a working data disk.

System Requirements

In order to use this casebook effectively, students must have access to:

1. Spreadsheet software that can accept files created by Lotus 1-2-3. (Most commercial spreadsheet packages do accept Lotus format files.)

2. Database software that can accept files created by DBASE III+. (Most commercial database packages do accept DBASE format files.)

3. A microcomputer with enough memory to operate the software listed above (a minimum of 256K of RAM, more for many packages) and either a hard disk and a floppy disk or two floppy disks.

Creating a Working Data Disk

There is a data disk which comes with this casebook. This data disk provides files containing the data for many of the cases which can be used to minimize the need for tedious data entry. To ensure that you do not lose or destroy the data on your data disk, you should make a working copy of the data disk and save the original as a backup copy. Follow the appropriate instructions below to create a working data disk before you begin the hands-on operations described in this casebook.

If you have a system with two floppy diskettes -

1. Insert the data diskette that came with your casebook in drive A.

2. Insert a blank formatted diskette in drive B.

3. At the DOS prompt (A:) type the command **COPY A:*.* B:**

4. Set aside your casebook diskette and use the copy you just made as your working data disk.

If you have a system with a hard disk -

1. Insert the data diskette that came with your casebook in drive A.

2. At the DOS prompt (C:) type **DISKCOPY A: A:**
   The casebook diskette is the *source* disk for this copying operation.

3. When you are prompted to place the *destination* disk in drive A, remove your casebook diskette and replace it with a blank unformatted diskette which you will be using as a working data disk.

4. Continue swapping the casebook or *source* diskette and your blank *destination* diskette as directed until the copy is completed.

5. Set aside your casebook diskette and use the copy you just made as your working data disk.

NOTE: This last set of instructions assumes that users with hard disks will be keeping their data files on a floppy diskette. If you have your own hard disk PC system and wish to place your spreadsheet and database files in subdirectories on your hard disk, you can copy all files with a WK1 file extension to your spreadsheet subdirectory and all files with a DBF extension to your database subdirectory.

I wish to thank Jim O'Brien for encouraging me to undertake this project and for his thoughtful review of early drafts of the manuscript. Special thanks are also due to my wife Teresa and my mother-in-law Martha Fields, who provided crucial proofreading and editing support. The editorial and production staff at Irwin has been very professional, supportive, and responsive throughout the development of this book, and I wish to thank them for all their support. Thanks are especially due to Lena Buonanno who served as developmental editor on this book. I also owe special thanks to many colleagues at Northern Arizona University. I particularly wish to thank professors Neil Jacobs, Jim O'Brien, and Rudiger Wysk, whose discussion of frustrations and successes in teaching the MIS course have contributed to this book.

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CHAPTER 1: DEVELOPING SPREADSHEET APPLICATIONS

End user applications can vary greatly in scope and complexity. Some applications simply require the development of a single spreadsheet for one time use by a single user. At the other extreme, end users now often develop application systems involving multiple users accessing sensitive data which must be maintained for repeated use. Clearly, the need for an extensive set of design procedures is more extensive for the latter type of application.

In this chapter we will describe some design tools and methods that are useful even for very simple spreadsheet applications. We will be assuming that the applications we are designing have only one direct user, do not have extensive data storage and control requirements, and are applications which can appropriately be developed using a spreadsheet package. Other design tools and methods appropriate for use with more complex types of applications will be discussed later in this casebook.

The development process for simple end user applications can be viewed as having three components:

1. Analysis and Design
2. Coding
3. Testing and Documentation.

In the sections below we will present a sample case of a problem that can be addressed by a simple spreadsheet application and then describe how such an application might be developed.

THE WESTERN WATER COMPANY CASE

The Western Water Company has used a two-tier price structure for its industrial customers which was designed to encourage water usage. Industrial customers have paid 9 cents a gallon for the first 100,000 gallons used each month, and 7 cents per gallon for each gallon beyond the first 100,000.

Because of a water shortage in the area, and increasing consumer pressure, Western is planning to change its rate structure to one that encourages water conservation. The plan is to retain the two-tier pricing structure, but reverse the tiers so that a higher rate is paid for gallons used beyond some cutoff level. For example, the rates might simply be reversed so that customers would be charged 7 cents a gallon for the first 100,000 gallons and 9 cents a gallon for all additional gallons. Another possible rate structure might be 6 cents a gallon for the first 50,000 gallons and 9.5 cents for all additional gallons. The new rate structure should produce approximately the same revenue as the previous structure. It is important for Western to know how the new rate structure affects individual industrial customers, since opposition can be expected from any customers whose water costs are substantially increased. Western has asked us to create a spreadsheet model which will allow the analysis of the impact of alternative rates and cutoff levels.

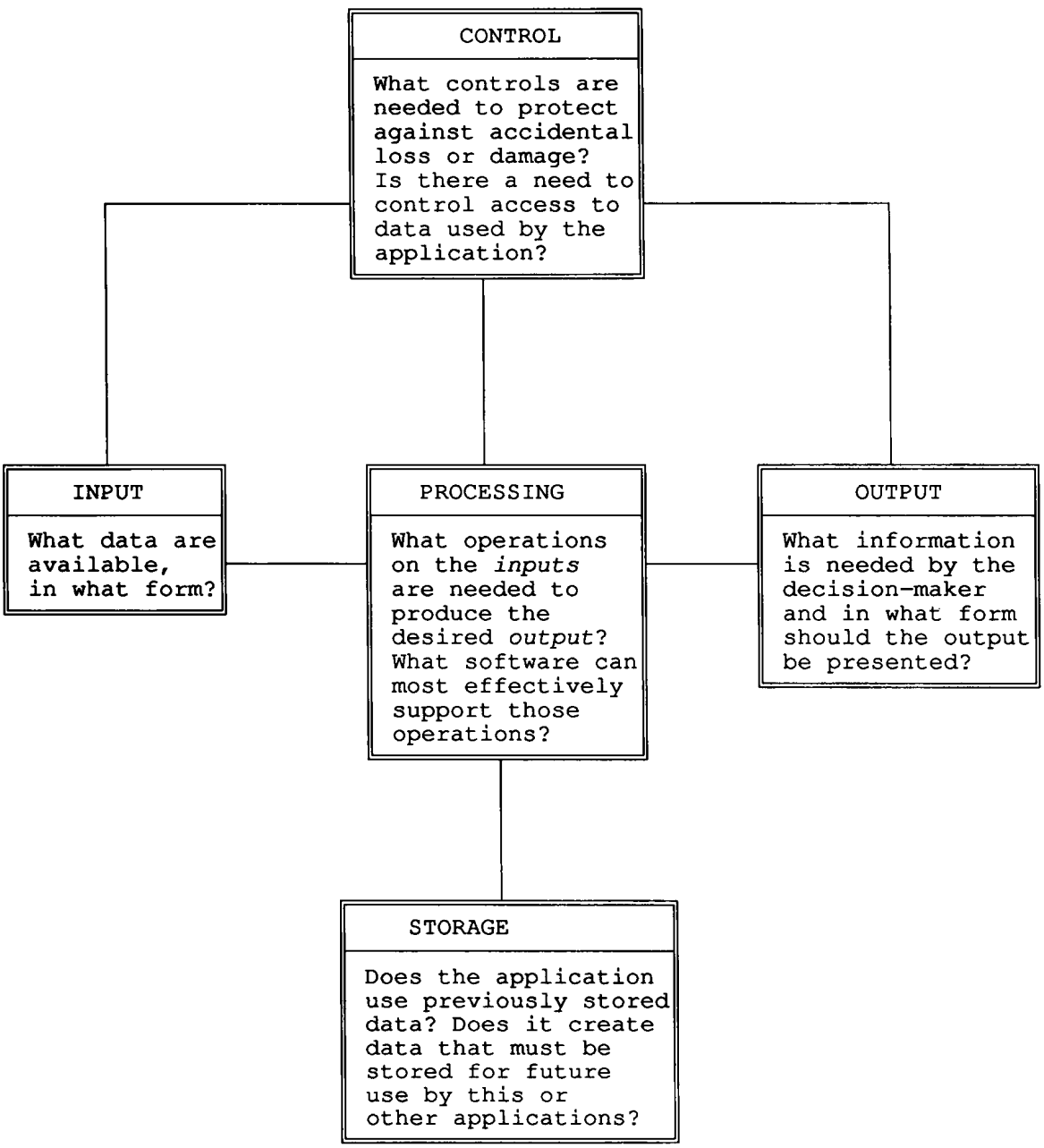
Although the price changes are designed to reduce water use Western does not have a good estimate of how much reduction will occur. Therefore, for the purpose of this spreadsheet analysis, we will assume that the number of gallons used by each customer is unaffected by the changes in the rate structure.

ANALYSIS AND DESIGN

Analysis of a potential end user application addresses the fundamental components of an information system: input, processing, output, storage, and control. Figure 1-1 provides a pictorial representation of these system components and the questions they address. In analyzing a potential application, attention focuses first on the *output* to be produced by the application. What information is needed and in what form should it be presented? Next we must look at the *input* data to be supplied to the application. What data are available? from what sources? and in what form? Then we must examine the *processing* requirements. What operations or transformation processes will be required to convert the available inputs into the desired output? Among software packages which the developer is able to use, which package can best perform the operations required? We may find that the desired output cannot be produced from the inputs that are available. If this is the case we must either make

Figure 1-1

The Components of an Information System



adjustments to the output we expect to produce or find additional sources of input data. The fundamental elements of input, processing, and output are present in all applications.

Storage and *control* elements may not be required for some small scale applications. Applications which require extensive use of stored data or the creation of data which must be stored for future use are better suited to database development. Thus, in this chapter we will assume that our applications do not require the storage element. We will describe the storage element in conjunction with our discussion of development methods for database applications in Chapter 3.

Necessary control measures for applications vary greatly depending upon the: scope and duration of the application, the number and nature of the users of the application, and the nature of the data involved. For the application presented here and the cases presented in Chapter 2, we will be assuming that no special procedures to restrict access to data are needed. We will also assume that each application will be utilized either by one individual serving as a developer/user or by a developer and a single additional user. Control measures will be needed to protect against accidental loss or damage to an application file. The most basic protection against this type of loss is simply to *make backup copies of application files on a frequent, and systematic basis*. If a spreadsheet application is to be used on a repeated basis or used by an individual other than its developer, it is also a good idea to *take advantage of the cell protection features of spreadsheet software to protect key cells from accidental erasure*.

LAYOUT FORMS - A BASIC DESIGN TOOL

The output requirements of applications are often depicted visually through layout forms. A layout form is simply a mock-up of what a report or screen should look like. It shows titles and headings for rows and columns along with either sample data or descriptions of the data that are to be presented in the report. In the case of spreadsheets, input, output, and processing activities are intermingled in a single spreadsheet file. A layout form can be used to record the input, processing, and output requirements of a spreadsheet application like that required by Western Water Company.

Figure 1-2 shows a layout form for our sample application. In general, the portions of the layout form enclosed in boxes or referenced by arrows contain samples or descriptions of what is to appear on the actual report. Nonboxed areas contain literal labels and values as they are to appear on the report.

Figure 1-2

A Sample Layout Form for the Western Water Company Application

IMPACT OF PROPOSED RATE CHANGES ON INDUSTRIAL CUSTOMERS

BILLING PARAMETERS:	Existing Rates	Proposed Rates	
Base Rate:	$.09	$.99	Parameter values to be entered repeatedly by users to evaluate proposed rates
Gallon Cutoff for Tiered Rate:	100,000	999,999	
Tiered Rate:	$.07	$.99	

ESTIMATED BILLINGS:

Customer Name	Average Monthly Water Use	Avg. Monthly Amount Billed Existing Rates	Proposed Rates	Change in Amount Billed
Baxter Mining	182,755	$999,999.99	$999,999.99	$999,999.99
X(20)	9,999,999	$999,999.99	$999,999.99	$999,999.99
(input data from paper records of last year's customers and use)		(computation: if Water Use < Cutoff Billing = Use x Base Rate else Billing = Base Rate x Cutoff Volume + Tiered Rate x (Water Use - Cutoff Vol))		(computed values: Proposed - Existing Amount Billed)
TOTAL	9,999,999	$999,999.99 (computed: sum of col above)		

NOTE: Once the spreadsheet has been developed and tested all cells except those containing the proposed rate parameters should be protected, and a backup copy of the spreadsheet should be maintained at all times.

Define Title and Heading Labels

We begin by selecting an appropriate title and then creating heading labels for the columns of data that need to be reported for each customer (the column headings under estimated billings in Figure 1-2). To meet the requirements of this problem we must identify the name of each industrial customer and record their average water use. We must also have columns showing water billings under current pricing and the new pricing for each customer. An additional column showing the change in the water bill for each customer can help us to quickly see which customers are benefitted and which are hurt by the new pricing. A total row is needed to indicate how alternative proposed rates will affect the amount billed to all industrial customers.

Identify and Describe Input Data Areas

After defining the appropriate row and column headings, we must determine where the data values for those rows and columns are to come from. The name of each industrial customer along with the customer's average monthly water use is to be obtained from existing records and entered onto the spreadsheet as input data. Thus we simply indicate an example of the data that will appear in each of these columns and describe its source. In the example, layout form descriptions of the source of data are enclosed in parentheses. Examples of data can be shown via literal values (Baxter Mining 182,755). Generic examples of the format of columns of data may also be used. Where generic format descriptions are used, X represents any alpha character and 9 represents any numeric digit. Thus the X(20) under Customer Name suggests that the actual names will be up to 20 characters in length and will contain label (nonnumeric) values. Values for the next two columns must be computed based upon the Average Monthly Water Use for each customer and the prices charged per gallon. The rate structure parameters must appear on the layout form before the billing columns can be defined.

Identify and Describe Parameter Storing Cells

Information about the current and proposed pricing structure is a key element of the spreadsheet. Parameter values for the new pricing structure are to be adjusted repeatedly to evaluate their effects on billings and the parameters that are entered here