Includes 3.5" Disk IBM and Compatible

Computerized Business Statistics

Fourth Edition

Owen P. Hall, Jr.

COMPUTERIZED BUSINESS STATISTICS

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Pepperdine University

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PREFACE

COMPUTERIZED BUSINESS STATISTICS

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OPTIONS: C = Configuration Menu, M = Main Menu, N = Next

OVERVIEW

The growing demand for increased productivity throughout both business and government has brought about a growing interest in statistical analysis. These developments, in turn, have prompted an increased focus on statistics in many business and engineering schools. The primary purpose of this courseware package is to provide the student with the capability to solve a wide range of statistically based problems quickly and accurately. The author believes that substituting computer modeling for traditional hand calculation methods increases the amount of time available for problem formulation and allows for a more in depth analysis of the results.

COMPUTERIZED BUSINESS STATISTICS (CBS)

CBS consists of this instructional text, a courseware package and a data base. The text provides a general overview on the operation of the courseware. The courseware package contains fourteen of the most frequently used statistical methods. CBS's user friendly system has been designed to minimize the need for specialized computer training. In fact, most users can be operating CBS within a few minutes. Each of the technical chapters included in this text contain a brief program description, a technical overview of the basic statistical principle, the data input requirements, the standard model output and several demonstration exercises. The first exercise presented in each chapter has been incorporated as an example problem in the courseware.

Additionally, the technical modules contain a brief review of the basic principles associated with the specific statistical technique. This review capability helps the user develop a better understanding of the application potential and limitations of each statistical model.

CHANGES TO THE THIRD EDITION

This text and the accompanying courseware package have been significantly updated as a result of user feedback over the past several years. The following new features have been added:

- Data base capability expanded to 1000 observations
- VGA Graphics
- Two Business Mini Cases per Chapter
- Homework Problems
- Several Large Scale Business Data Bases
- Direct Capability of Inputting Excel Data Files

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TABLE OF CONTENTS

1.0 INTRODUCTION

COMPUTERIZED BUSINESS STATISTICS (CBS) is a collection of fourteen mathematical models which have been designed to facilitate a wide range of statistical analyses. The CBS system also contains a data management module for creating and editing data files. Presented below is a list of the options available (similar to the Main Menu):

- Data Base Management
- Descriptive Statistics
- Probability Theory
- Probability Functions
- Survey Design
- Random Sampling and Estimation
- Hypothesis Testing
- Simple Correlation and Regression
- Multiple Regression Analysis
- Time Series and Forecasting
- Chi-Square Analysis
- Analysis of Variance
- Nonparametric Methods
- Decision Analysis
- Statistical Quality Control

This text has been organized into chapters that correspond to the Main Menu selections. The chapters that involve statistical models are organized as follows:

- **Description:** A brief description of the statistical model.
- **Overview:** A summary description of the type of problem that can be solved with the model.
- **Data Input:** A concise summation of the data or data transformation required to use the model.
- **Model Output:** A brief explanation of the results.
- **Exercises:** Several demonstration exercises that represent typical uses of the statistical tools, with brief descriptions of the output.

- **Problems:** A variety of homework problems which feature the various program options.

- **Mini Cases:** Business based applications which highlight the basic principles.

1.1 EQUIPMENT

The minimum system configuration requires an IBM PC (or true compatible) with 512k memory and one disk drive. A printer and a color monitor are optional. When a VGA monitor is not available, the graphic displays use the special text characters.

A separate disk is required to store files generated by the data disk operations and MUST be PRE-FORMATTED or PRE-INITIALIZED. Approximately 120 files can be stored in a directory. Tree-structured directories can be used for applications involving more than 120 files.

When your data disk is full the screen listing of files will sometimes show only 84 file names. (This happens because the program overwrites those at the bottom.) You will then need to either exit to DOS and use the DOS "directory" command, or use the Data Base Management program (#2) and the "catalog" program as described in chapter 2.

1.2 KEYBOARD

The keyboard is your method of communicating with CBS. The programs will display messages informing you of the input that is expected whenever interaction with the computer is required.

To operate **CBS** simply type in numbers or letters appropriate to your current activity and then press the <enter> or <return> key. CBS will expect you to press the <enter> or <return> key after you type any complete response (i.e. a number from a menu, a file name, a number for a data value). Forgetting to press <enter> is a common source of frustration for many new users. If you do not press <enter> after you are done typing in a response, the computer will sit and wait, and wait...

On the "standard" IBM keyboard, the <enter> key has the following symbol:↵ Some IBM compatible keyboards have a <return> key to the right of the alphanumeric keys and an <enter> key to the right of the numeric keypad; both of which act as <enter>. Generally, IBM terminology will be used throughout this text to describe the keyboard functions.

Typing mistakes can usually be easily corrected by pressing the left arrow key and retyping the offending character(s). Do not enter a comma as part of a number. Commas are special characters to the computer. If you do enter a comma, the value entered will be equal to the digits to the left of the comma (i.e. entry of 12,500 would equal the value 12). The keyboard is designed to be sensitive to a light touch and has auto-repeat; which means that it will repeatedly generate a character if you press it long enough (or too hard). The editing keys are the left, right, up, and down arrows, [home], [end], [pg up], [pg dn], [insert], and [delete] keys on the numeric keypad, and the [backspace] key. The "standard" IBM keyboard uses the same keys for a cursor pad and a 10 key pad. The [num lock] key controls these keys. *You may wish to set the [num lock] key to enable the cursor pad, and use the row of numbers on top of the letter keys.*

1.3 PRINTER

CBS supports a standard parallel printer, and uses the device label LPT1. Other printer configurations can be used with CBS if the output normally sent to LPT1 is redirected for the specific configuration. To use a printer other than the one connected to LPT1 you will need to execute several commands after booting DOS, and before starting CBS. These commands may be entered from the keyboard or executed from an autoexec.bat file. The MODE file (from the DOS system disk) must be present to perform these commands.

If the printer is a standard parallel printer, but is hooked up to port two, simply enter MODE LPT1:=LPT2 (and press the enter key) to redirect the output. Redirection of output for serial printers is more complex, simply because there are more options and there is no true standard for interfacing. Several parameters may need to be set (i.e. parity, databits, stopbits) in addition to the baud rate. The baud rate is the only required parameter, and the baud rates available are 110, 150, 300, 600, 1200, 2400, 4800 or 9600. The defaults for the optional parameters are parity=even, databits=7, stopbits=either 2 if baud is 110, or 1 if baud is not 110. Refer to the printer manual and the DOS's MODE command (option 3) for more information on asynchronous communication.

Assuming that the serial printer is hooked up to communication port one, the baud rate is 1200, and the default parameters are acceptable, execute the following:

MODE COM1:1200,,,,P ↵
MODE LPT1:=COM1 ↵

For any printer, if printing is attempted and the printer is not hooked up, you will get a message asking you if you want to proceed. If the printer is hooked up and turned on, but is not 'on-line', the computer will stop and wait (and wait...) for you to push the printer's on-line button.

1.4 DISK HANDLING

The CBS program disk is actually a very fragile electromagnetic film "record", protected by a plastic cover. Avoid any disk contact with water, high heat, direct sunlight, or a magnetic field (such as a stereo speaker, a TV, or even a radio). Electric motors also generate magnetic fields. Do not bend your disks or store them in an overly dirty or dusty environment (such as the bottom of your lunch box or bookbag). A plastic storage box is recommended for all of your computer disks. The disk drive has a red light which is on while the drive is in use. NEVER, NEVER, NEVER remove or insert a disk while the 'in use' light is on. This will surely destroy the information on the disk and may ruin the drive.

1.5 GETTING STARTED

Presented below is the sequence of steps needed for loading and using CBS directly from a hard drive or a single disk drive. Operating CBS from a **hard drive** is the preferred option. CBS can be used in a **Windows** environment. An icon can be created for directly accessing CBS through Windows.

Hard Drive System

1. Insert the CBS program disk in drive A.
2. Create a CBS subdirectory on the hard drive (drive C).
    a. If you are not in drive C, type C: and press [**ENTER**]
    b. Type MD CBS and press [**ENTER**].
    c. Type CD CBS and press [**ENTER**] to get into the CBS subdirectory.
3. Copy the CBS program files from the program disk to the subdirectory you have just created on the hard disk.
    a. Type COPY A: *.* and press [**ENTER**]
    b. Remove the program disk from drive A
4. Make sure you are in the correct drive (C) and in the CBS subdirectory.
5. Type: CBS (and press [**ENTER**]).

Single Disk Drive System

1. Change to the A directory.
2. Insert the CBS program disk in to the drive A.
3. Type: CBS (and press [**ENTER**]).
4. Follow the instructions for configuring CBS to operate from the A drive.

The program will instruct you when to swap your program disk for your data disk and vice versa. While it is recommended that input and output files be stored on a separate disk, you can store files on the program disk. In these instances simply press [**ENTER**] when prompted to exchange disks.

ADVISORY MESSAGE

The disk drive settings **may** need to be changed to conform to the hardware configuration of your machine. CBS input and output files can be stored on the harddrive or a separate data disk. Excel and Lotus files may be imported into CBS. The process for converting Excel and Lotus files is outlined in section 2.3.

1.6 CONFIGURATION

The Configuration menu allows you to select the number of disk drives, the program disk drive, and the data disk drive. This menu also allows you to set the program for color or black & white video output. Throughout this manual references will be made to a *program* disk and a *data* disk.

- **Program Disk** - the CBS disk found in this manual. Given the limited amount of space available on each disk, you should **not** try to save your data on this disk.

- **Data Disk** - the disk upon which you will save your input and output files. This is the disk that will contain the actual information (data) that you want to process.

For speed and simplicity, loading CBS onto your hard drive (e.g. C drive) is the recommended course of action. If that has been done, the actual program disk will not be needed, and you should select C as your Program Disk Drive. If you have not loaded the program onto your hard drive, then you will need to insert the program disk into one of your disk drives. If you only have one drive, then you will have to do a lot of switching from your data disk to your program disk. Generally, your disk drive will have been labeled the A drive, if this is the case you will then insert a formatted disk into the disk drive -- this will be your data disk, and you will type an A at the Data Disk Drive prompt.

1.7 MODEL SELECTION

A specific statistical model can be selected by simply moving the highlight bar to the model of interest listed on the Main Menu and pressing return. After selecting a model, the red 'in-use' light will appear on the drive containing the program disk while the selected program is loaded into memory. At that point, the Program Options Menu will appear on the screen.

1.8 OPTIONS MENU

Each of the fourteen statistical modules displays a Program Options Menu. This menu is nearly identical for every module. There are a few exceptions where certain selections are not applicable and these are noted at the end of this section. Each model option is numbered. To execute a selection, either move the highlight bar to the desired selection or type the specific number and press the enter key. Note that any option requiring data (such as view, edit or run current problem) will respond with the message 'ENTER DATA ' if you have not entered data. Figure 1 presents the standard Program Options Menu screen display.

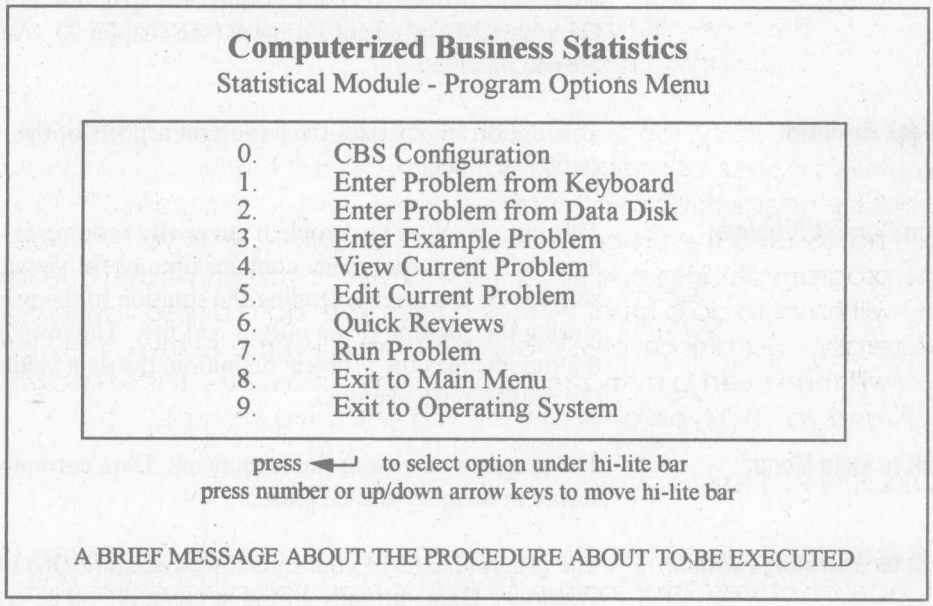


Figure 1

0. CBS Configuration: This selection allows you to specify the computer's drive and monitor configuration. (see section 1.6).

1. Enter Problem from Keyboard: CBS prompts you through the steps for entering the data values for a new problem. Data currently stored in memory will be erased. The entered data can be saved on a data disk.

2. Enter Problem from Data Disk: CBS guides you through the steps for loading a data file from your data disk. Data currently stored in memory will be erased. **NOTE: output files can not be used to enter problems.**

3. Enter Example Problem: An example problem will be loaded into memory. This problem is generally the first demonstration exercise in the chapter for the specific model. Data currently stored in memory will be erased.

4. View Current Problem: This option displays the definition, input statistics, and data values for the problem. An output options menu provides selections for screen viewing or printing.

5. Edit Current Problem: An editing options menu provides selections for changing the individual data values, the column labels, and the model sub-options. The data structure cannot be modified. Editing is either fully prompted and/or follows the structure of the Data Base Management Program (see chapter 2). An edited file can be saved.

6. Quick Reviews: This option summarizes the important aspects of the statistical model.

7. Run Current Problem: This option solves the problem **currently** residing in memory. An output menu contains options for viewing the solution on the screen, sending the solution to the printer, or storing the solution on an output text file. The output from the run includes the problem definition, the data values and the resultant calculations.

8. Exit to Main Menu: The program returns to the main menu. Data currently stored in memory will be erased.

9. Exit to Operating System: The program exits to your operating system (DOS) or Windows. Data currently stored in memory will be erased.

1.9 OUTPUT OPTIONS

The user can choose from the following output options:

1. **Screen:** output is displayed only on the monitor.
2. **Printer:** output is sent to a standard line printer.
3. **Disk:** output is saved on data disk (standard ASCII format).

A separate pre-formatted data disk is required to store the output disk file. An output file may be viewed via the **view** option in the Data Base Management module or via a word processor which accepts standard ASCII files.

2.0 DATABASE MANAGEMENT

2.1 PROGRAM DESCRIPTION

CBS is designed to create, view, transform, edit and save data files for use with one or more of the statistical programs. A pre-formatted (or pre-initialized) data disk is needed to save data on a disk. This program is a collection of tools for creating and manipulating data files.

DATA FILE OVERVIEW

Data files can be thought of as orderly stacks of paper. Each stack of paper is organized in a specific manner, and has a name to identify it and separate it from the other stacks. These stacks of paper are called files because you retrieve and store them in a manner similar to opening and closing a paper file in a filing cabinet. Each time you create a file you are assembling a group of data points in a manner which you have specified. This data can now be accessed in the various formats necessary to be analyzed by the available models.

Data files have four distinct characteristics:

1. **Name:** You must give each file a unique name. It is recommended that file names be related to the specific problem. The file name can be 1-10 characters in length. A two-character prefix (I- or O-) will be added to the data file name. The purpose of this prefix is to distinguish between input (I-) data files, and output (O-) text files.

2. **Size:** Each data file is structured in a matrix format with columns representing the variables, and rows the data points. A file may have from 1 to 10 variables(columns) and 1 to 200 data points(rows) for any variable.

   The basic format for a data file is as follows:

   Variable #1 ..... Variable #M
   Row #1
   :
   Row #N

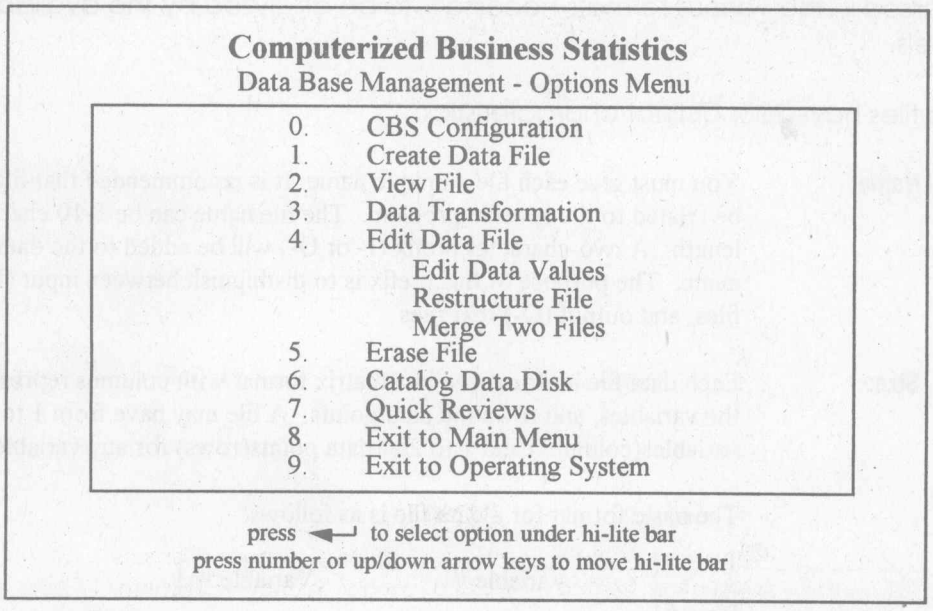
3. **Variables:** You are given the option of labeling each variable(column) with any 0-5 character name.

4. Data Values: The values of the data points (numbers inside the boxes) are the last (and most important) component of the data file. While the values of the data points can be of any magnitude, it is recommended that you avoid a data set where all the numbers are in the millions or billions. If this is the case, you may wish to go through and divide all numbers by 1000, or some appropriate number.

For a two disk drive system, the data disk should be placed in the second disk drive during the start-up procedure. For a one disk drive system, the CBS program disk and the separate data disk will need to be switched before and after each data disk operation. CBS will prompt you for these disk changes. Do not change disks unless you are prompted.

2.2 OVERVIEW

The CBS Database Management Model (DBAS) Options Menu offers the following selections:



CBS CONFIGURATION

This menu allows you to select the number of disk drives, the program disk drive, and the data disk drive. This menu also allows you to set the program for color or black & white video output. (see section 1.6).

CREATING A DATA FILE

The following prompts will guide you through the process of creating a new data file:

- Number of Variables (Columns) in Data File*
- Number of Data Points:

  Number of Data Points for Variable (Column) #1
  ⋮
  Number of Data Points for Variable (Column) #M

- Variable Names:

  Name for Variable (Column) #1
  ⋮
  Name for Variable (Column) #M

  NOTE: Once you are "in the spreadsheet," you can end the data entry process at any time by pushing the "END" key. If you have not entered numbers for any cells, CBS will save the zeros, or if you are editing a file, whatever number is currently in the remaining cells. This is also true of the data entry portions of the other CBS statistics programs.

- Variable Values:

  Numerical Value of Data Point in Row #1, Column #1
  ⋮
  Numerical Value of Data Point in Row #N, Column #1
  ⋮
  Numerical Value of Data Point in Row #1, Column #M
  ⋮
  Numerical Value of Data Point in Row #N, Column #M

- Name of Data File

---

* In creating a data input file outside of CBS, e.g., EXCEL, you will need to add an additional data value at the beginning of the data file. This value corresponds to the number of variable groups. Usually, the value is one (1). The exception involves a two-way analysis of variance data set where the first entry represents the number of row groups (2-5) and the second entry represents the product of the number of row groups and the number of column groups.