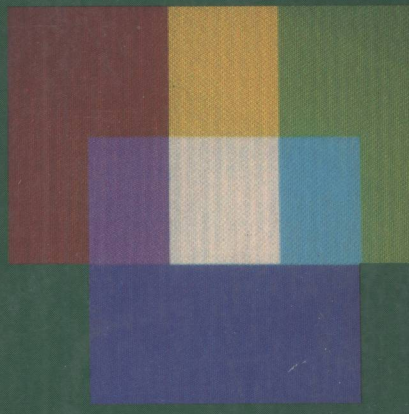
Wilson T. Price

Programming the IBM Personal Computer:

Business BASIC



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Preface

Virtually every Basic book that comes on the marketplace is described as using structured programming techniques. For most of them the use of structured methods is relegated to lip service. A few do a good job of sticking to the three basic structures (sequence, selection, and looping) in presenting solutions to programming examples. However, the nature of Basic makes it difficult to write programs that are truly structured. For instance, a Basic program of any substance that does not use a GOTO is difficult to imagine. Yet it *is* possible to incorporate use of the GOTO into a framework that achieves the goals of good program design and functions within the three basic components of structured programming. That is the top priority in this book.

This book is not one on learning Basic; it is one on *how to systematically solve business-related problems while learning Basic*. From the first page of the book the stress is on organizing a problem into logical components: *program modularization*. Heavy emphasis is put on breaking problems into components and

then programming the components relatively independently of one another. Programming methods used in this book draw heavily on proven techniques now widely used in structured Cobol programming. For instance, in business data processing, there is a wide class of problems that can be broken down to three main modules:

- Initialization module
- Processing module
- Termination module

Normally, the processing module (which may consist of multiple submodules) is executed repeatedly until there is no more data to process. To this end, the PERFORM-UNTIL is commonly used in Cobol. Programs in this book use precisely the same approach with the WHILE/GOSUB combination. In fact, the GOSUB is a central focus from almost the very beginning.

This significantly reduces the need for using the GOTO statement. Overall, specific constraints are placed on use of the GOTO. In a nutshell, it must be used within the limit that every routine or sequence of statements has a single entry point and a single exit. Of course, there are a few exceptions to this, necessitated by the nature of IBM PC Basic. (System error trapping is the main exception.) Needless to say, good judgment must be used in every situation; after all, the objective is to learn good programming methods—not to contrive program structure solely for the purpose of being able to say, "Look, it is structured."

Overall, the attempt has been to make this a reader's book. Some of its important features are:

1. In all examples, modularization of programs is emphasized. This is especially important to the beginning student when covering advanced topics where example programs necessarily become much larger than earlier examples. Not only does modularization provide the student with examples that are easy to follow but it illustrates programming techniques that are critical to writing good, easy to maintain, and readable programs.

2. Emphasis is placed on using structured techniques and minimizing use of the GOTO statement. Because IBM Personal Computer Basic does not include a true block IF-THEN-ELSE, this concept is simulated to maintain good, structured techniques.

3. Each new topic is introduced through and oriented around a simple example. Each example is described in detail, its implications are discussed, it is solved, and important features of the solution are discussed. The progression is always from the concrete to the abstract.

4. As a rule, example programs are kept short—with primary focus on the topic being introduced. For the beginning reader the value of an example program or sequence in illustrating a concept is felt to be inversely proportional to the amount of code that is extraneous to that particular concept.

5. Each chapter includes "mind-jogger" exercises within the chapter; the answers to these exercises are at the end of the chapter. The intent is to provide a reinforcement vehicle for important concepts. In many cases they relate the significant point(s) concerning an example program and give the student a better insight to some of the fine points. The reader should be urged to complete each exercise as it is encountered and then refer to the answer to be certain of comprehending it.

6. Chapter 11 is devoted to random file handling. The intent of this chapter is to present the general topic of random processing in a simple fashion. To this end, blocking of records and other sophisticated techniques are ignored. However, the main focus—basic principles of random processing—is intact.

7. The book contains eight appendixes, which include reserved words; the ASCII character set; summaries of IBM PC Basic commands, statements, functions, and error messages.

Concerning the topical organization of this book, the detailed table of contents speaks for itself. However, some important points may not be evident from this list.

First, many of the early concepts of Basic are presented in the context of a simple inventory-reporting application. Chapter 1 involves the processing of a *one-record* data file (using the READ and DATA statements) with a five-line program. Thus the reader is given a first exposure to something complete and meaningful, albeit limited and contrived. Fundamental concepts introduced involve both entering and running a program and how input, output, and calculation operations work in Basic. Chapter 2 expands upon Chapter 1; use of Basic commands is stressed. The most significant aspect of this chapter is the introduction of modularization of programs. It is here that the simple inventory problem (program) is broken down to a main module and three submodules: initialization, processing, and termination. Execution of these modules is achieved using the GOSUB statement.

Second, the concept of files is stressed throughout the book. After all,the user of a microcomputer is quite accustomed to the notion of "things" being stored on a disk. Thus basic principles of processing sequential files is introduced in Chapter 3. In addition to the very important early introduction of using sequential files, this chapter provides the automatic loop control vehicle essential to structured programming. The precise vehicles for this are the WHILE-WEND looping structure and the automatic end-of-file (EOF) detection built into the EOF variable. Thus a complete data file can be processed with a form such as

```
WHILE NOT EOF(1)
  GOSUB 3000              'Process routine
WEND
```

Third, the GOTO statement is downplayed and is used only within certain constraints. In fact, it is not even introduced until Chapter 4. This late introduction is not the result of contriving in the design of the book but rather because *it is simply not needed* until that point.

Fourth, because this is a *business* Basic book, emphasis is given to report generation and totaling—in particular, to group totals and level breaks.

Chapter 7 is designed to allow the reader simply to touch the surface (use the first portion of the chapter then get out) or to go into it in detail.

Acknowledgments

My first appreciation must go to my students, who have provided me with many of the ideas in this book and who have endured some of my "less than successful" experiments. Certainly, I also owe a real debt to my many colleagues, who have offered their support, ideas and criticism. I wish to express my special appreciation to Brete Harrison, senior editor, who has been outstanding in suggesting ideas for creative writing projects. I thank Steve Brown regional manager of Software Centres International, who offered numerous remarks and observations and provided me with valuable access to the Centres' facilities. Regarding preparation of this manuscript, I had the good fortune of making the acquaintance of Jane Nishi, who has done a superb typing job for me. She has and richly deserves my very special thanks.

Finally, I wish to thank users of my books who have taken their valuable time to send me their reactions, observations, and critical remarks; many of them are reflected in this book. I will sincerely appreciate any and all comments about this book. They may be sent to me at Merritt College, 12500 Campus Drive, Oakland, CA 94619.

Wilson T. Price

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OBJECTIVES

To many, the computer and its terminology are very foreign. Furthermore, the rigorous way of thinking imposed by programming has a tendency to throw many people for a loss. The purpose of this introduction is to provide the basis on which to begin learning the discipline of programming. Concepts and topics discussed in this chapter are as follows:

1. The basic notion of what programming a computer is all about. This is illustrated by a simple analogy.
2. The principles of top-down design. Very large and complex problems can often be nearly impossible to comprehend. However, if broken down into small, independent components (modules), they are easily understood.
3. The fact that structured programming is basically a set of rules for solving programming problems. The use of flowcharts, which are pictorial representations of the program logic, is described.
4. The computer itself, called *hardware*. The modern computer consists of input and output devices (for getting information in and out of the computer), memory, a control unit, and auxiliary storage.
5. Programs that make the computer work for us, commonly referred to as *software* systems. Specialized systems for controlling the computer are called *operating systems* and provide for automatic control of the computer.

BASIC CONCEPTS OF PROGRAMMING

A Story of Success

To gain a little insight into the world of the computer, let us consider the story of a very bright college student who had a strong dislike for conventional "work." When faced with the prospect of financing his college education, he decided to do so by playing the horses—a means of earning an income that he considered infinitely superior to pumping gas or washing dishes. Since his hobby had long been horse racing, he had an extensive file of information on the horses that generally raced at the local tracks. This file consisted of a set of 5 × 7 cards: one for each horse. Each card showed the past record of the horse (including best running times), information on how well the horse did under various weather conditions, and so on.

The information file was the key to the student's success. Prior to each weekend, he would select from his file the record of each horse running that weekend. Armed with this stack of cards, a summary form, a pencil, his brilliant mind, and his system, he would sit down to work (Figure 1). His system consisted of a series of calculations that gave each horse a performance score between 0 and 100. Past experience had shown that the horse with the highest score in each race was usually the winner.

The procedure the student followed was simple: