# PASCAL

An Introduction to the Art and Science of Programming

Walter J. Savitch

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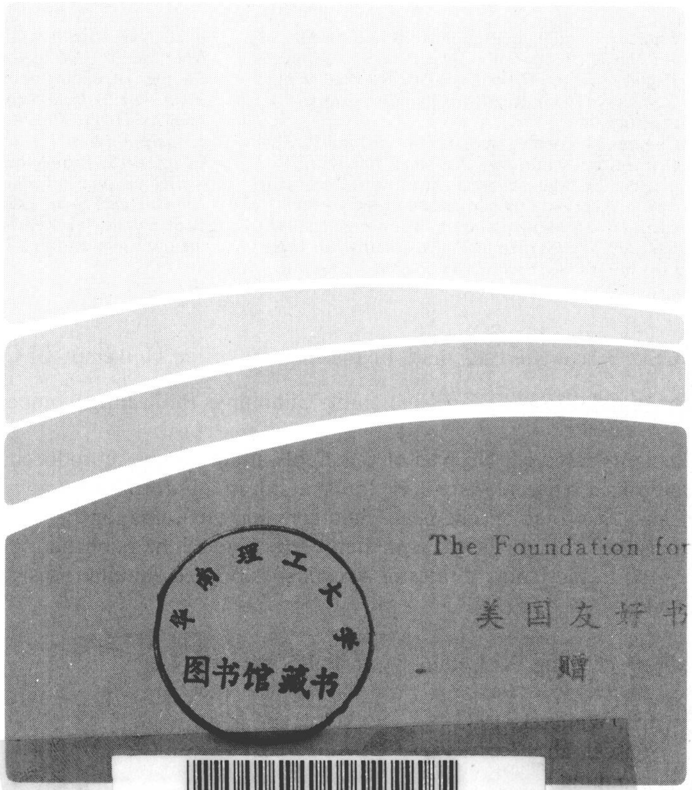

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# Preface

This book was designed for use in introductory programming courses that use the Pascal language. It can be used for courses as short as one quarter or as long as one academic year. The book includes both a thorough introduction to programming techniques and a complete description of the Pascal language. It assumes no previous knowledge of computers and no mathematics beyond high school algebra. Some additional details about the book are summarized below.

## Emphasizes Problem Solving and Programming Techniques

Chapters 1, 11, 12 and 15 are dedicated exclusively to problem solving and programming techniques. Every other chapter includes sections dedicated to such topics as top-down and other algorithm design techniques, programming style, testing techniques and debugging techniques. For ease of reference, these sections are tabulated in a separate table of contents. Additional discussion of these topics is integrated into the presentation of Pascal language constructs.

## Designed for Interactive Programming

This book can be used by those running programs in batch mode. However, the emphasis is on interactive use. All the programs were designed for use in an interactive environment.

## Many Sample Programs

Complete programs are presented very early. Thereafter, concepts are always illustrated with complete programs and procedures, rather than small fragments of code. Sample input and output are displayed along with the program text. Both long and short programs are presented. The longest program occupies four pages of text; the input and output extend to another two pages. Program displays of two or three pages are common.

## Introduces Procedures and Parameters Early

Like most newer texts on programming, procedures are introduced early, the reason being that this facilitates the teaching of modularity and top-down design.

Unlike other texts, this book adopts the approach without reservation. Not only procedures, but also a detailed discussion of parameters are presented very early, even before such basic Pascal constructs as ***if - then*** and loops. This allows virtually all the sample and exercise programs to be written using completely modular procedures. Programming without parameters invariably violates generally accepted modular design principles, and so forces students to practice techniques that must later be unlearned. Introducing parameters early eliminates the need to teach programming techniques that will later be rejected.

When we tested this approach in actual classes we found that it was not only possible to introduce parameters this early, but that the students found this approach easier than the traditional approaches. At the early stages of a programming course they have fewer new concepts to integrate and can thus concentrate without distraction on the notion of parameters.

## Self-Teaching Style

The chapters were designed so that they can be read by students before they attend lectures on the material. Material is covered completely, problems and questions are anticipated, and typical examples are given. This allows students to read ahead at their own pace and to come to lecture already primed to digest the material quickly. (This also makes the book suitable for self-teaching outside a classroom situation.)

## Covers Both Standard and UCSD Pascal

This book can be used in either a standard Pascal or a UCSD Pascal environment. All the UCSD Pascal detail is isolated into separate sections. Hence a standard Pascal user can read this book without seeing any reference to UCSD Pascal details. All the programs satisfy the ANSI/IEEE770X3.97-1983 Pascal standard (except for two short programs in optional sections about UCSD Pascal). They have all been compiled and tested using the Berkeley Pascal compiler and interpreter with the standard Pascal option. For a few programs dealing with files, alternative UCSD Pascal versions are needed and are given. However, those cases are the exceptions rather than the rule. If one programs with a view toward portability, the two dialects of Pascal are simply not that different. This does mean that the programming style in this book tends a bit more toward standard Pascal than UCSD Pascal. Still, a complete treatment of UCSD Pascal constructs is given in the appropriate chapters and not relegated to a brief appendix.

The point of including both versions of Pascal is not simply a compromise between two alternatives. One important programming technique that needs to be taught is portability. The two dialects of Pascal are close enough that they can both be taught without confusing the student. Yet they contain enough differences to illustrate portability techniques. If time permits, it is a good idea to cover some aspects of the "other" Pascal, whichever dialect that may be.

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## Flexibility

The dependency chart on p. xxiii shows the possible orders in which the chapters may be covered without losing continuity. A bit more than the first half of the book is a core course that must be covered first. The rest of the book contains topics such as recursion, some software engineering topics, some numeric programming techniques and a substantial amount on data structures including records, files and pointers. These later chapters may be covered in almost any order, or a subset of the chapters may be chosen to form a shorter course. The chapter on text files has been divided into two parts to allow for two possibilities, either postponing the topic entirely until later in a course or briefly introducing it early and giving more detail later on. To add even more flexibility, sections with optional topics are included throughout the book.

## Self-Test and Interactive Exercises

Each chapter includes self-test exercises with answers in the back of the book. In addition to these self-test exercises, students should be encouraged to learn by trying out small test programs; that is, by "playing" with the system. Unfortunately, most beginning students have trouble thinking of things to try out. For this reason, interactive exercises are also included. They consist of suggestions for writing short programs that help give a feel for the concepts presented in the chapter. More traditional exercises are also included. The book contains more than 370 exercises of various kinds.

## Support Material

A chapter-by-chapter instructor's guide is available. All the programs in the text are available in machine readable form. Thus it is possible to have all the programs available for students to run without having to type them in.

## Acknowledgments

I have received much help and encouragement from numerous individuals and groups while preparing this book. I am very grateful to the University of Washington (Seattle) Computer Science Department and to the EECS Department at the University of California, San Diego for providing facilities and a conducive environment for writing the book. My thanks also go to the following individuals for suggestions and comments on the book (unfortunately the size of the list makes it impractical to catalogue the many important contributions that each individual made): Guy Almes, Bill Appelbe, Andrew Black, Jim Bunch, John Donald, Mike Denisevich, Patrick Dymond, Klaus Eldridge, Jim Gips, Richard Kaufmann, Alean Kirnak, Keith Muller, Vijay Rao, Robert Rother, Gary Sackett, Joe Sandmeyer, Robert Streett, Sue Sullivan, Martin Tompa, Dennis Volper, Ann Wilson and Chin Wu. Special thanks go to the many students in my programming classes who tested and helped correct preliminary versions of the book. Finally, I express my appreciation to all the individuals at Benjamin/Cummings who organized the reviewing and production of the book; in particular Charlie Hibbard, Jo Andrews and my Editor Alan Apt contributed much to the final product.

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