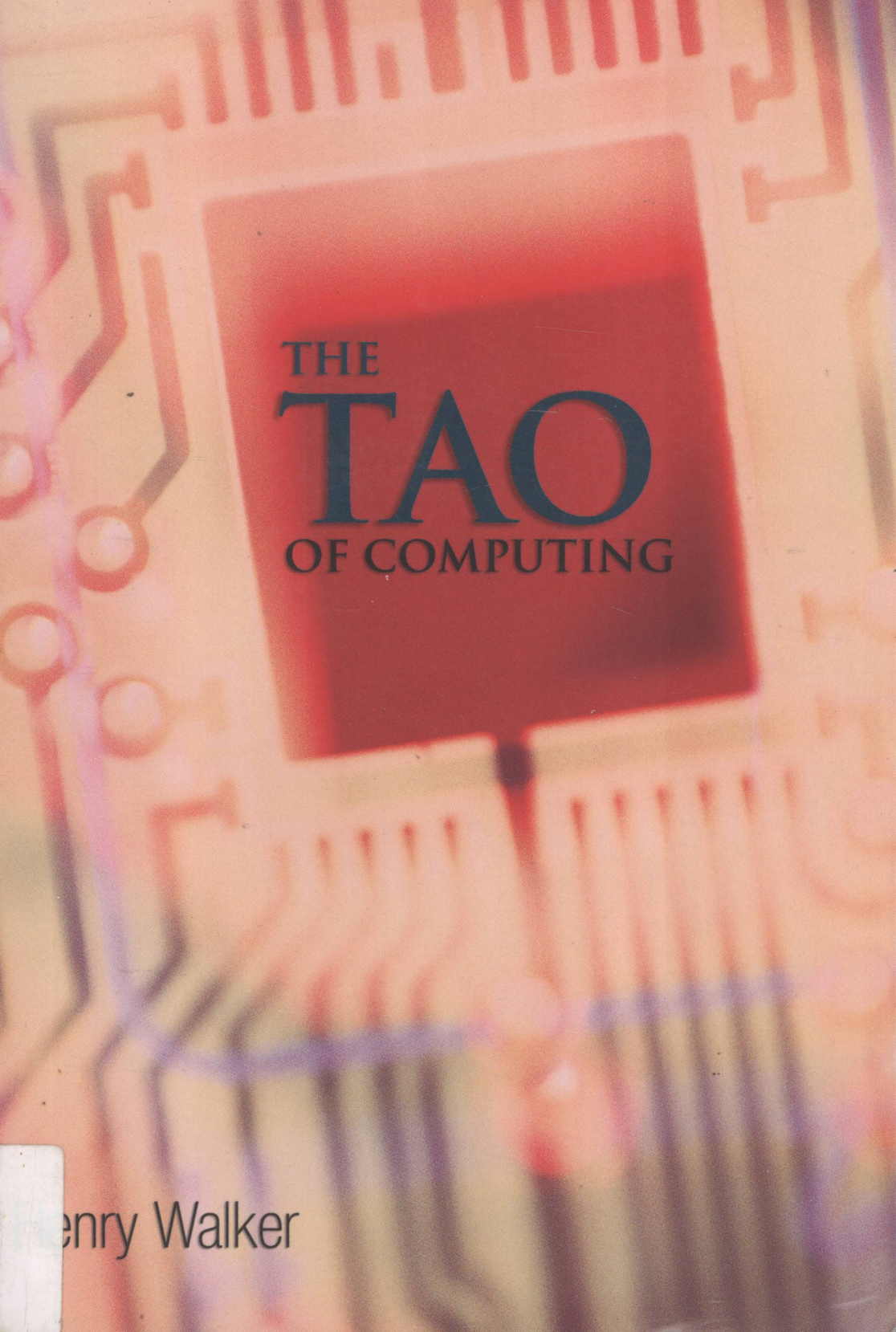
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Dedication

To my wonderful family—my wife Terry and daughters Donna and Barbara—for their encouragement and support throughout my professional career, and particularly for their remarkable tolerance and understanding in the writing of this book.

Preface

What should every citizen know about computers and computer technology? For better or worse, answers typically depend upon who is asked.

- Students commonly have a practical bent: How can one get the computer to perform specific tasks, why does a machine act the way it does, what is involved in getting computers to interact, and so on.
- Computing faculty typically emphasize the need to understand concepts and problem solving.
- The National Research Council (NRC) identifies appropriate general knowledge and skill as computer fluency, and summarizes its perspective in a 1999 report, *Being Fluent with Information Technology*.

On the surface, such perspectives may seem unrelated or contradictory. The practical details of interest to students may seem quite different from the high-level concepts and abstractions highlighted by faculty. Some textbooks written by faculty may do a fine job in covering foundational material, but often omit the practical issues that motivate students. Other books may describe pragmatic elements about how to run specific software (e.g., how one can utilize a bold type font in a word processing document), thus satisfying some students, but such books rarely provide adequate coverage of more general and lasting concepts.

Practical Questions with Thoughtful Answers

This book takes a different approach. The starting point is the observation that thoughtful answers to common, practical questions often require an understanding of ideas and principles. Simple, narrow, superficial answers can avoid deep issues, but these are rarely satisfying over the long run. Students want serious answers to their genuine questions, and such responses require the material that faculty wish to cover and the NRC has identified.

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Question-Based

The second principle motivating this book is that students learn best when material connects with their experiences, backgrounds, and perspectives. To capture student interest, this book is organized around questions typically asked by general computer users. Common general questions provide the title and theme for each chapter, while more detailed questions provide a focus for each section within a chapter.

The style reflects the circumstances of a conversation. The reader has many questions about computing and information technology, and the book seeks to provide answers. Throughout, the starting place for discussion is a question—often a real question heard from a computer user or raised by actual students in class.

Computer Fluency

A third principle behind this book concerns the need to cover adequate material to allow readers to function effectively in today's computer-based society. Such background sometimes is described as *computer fluency*. More precisely, in 1999 a study group of the NRC produced the report *Being Fluent with Information Technology*, which addresses what every informed citizen should know about computers and technology. The report identifies ten high-level "intellectual capacities," ten "information technology concepts," and ten practical "information technology skills" that cover basic computer fluency.

Planning this book included a regular review of these areas, so that all fluency topics are addressed. The Appendix presents more detail of this coverage, with a table that maps fluency topics to chapters.

Of course, in some cases, faculty may wish to supplement this material with lab-based experiments and experiences. In such cases, this book provides appropriate background for the lecture/discussion component of a course, while a lab might use specific hardware/software manuals and exercises.

This Book as *The Tao of Computing*

"Tao" is a Chinese word meaning "the way," and many references to "Tao" are related to the ancient spiritual text *Tao Teh Ching*, or the *Way of Life*, according to Lao Tzu. *Tao Teh Ching*

presents a humble, simple, clear, and elegant philosophy of life and behavior. The text consists of 81 short passages, many in blank verse; each passage provides insight for some component(s) of human living.

The Tao of Computing, of course, focuses on computer systems rather than spiritual philosophy. Within this focus, the book presents a clear and direct explanation of computer systems through a series of separate, but coordinated, answers to diverse questions.

Overall, this book seeks to unlock the mysteries of computers and provide a basis for further study and reflection, just as the *Tao Teh Ching* explains a path for the way of life.

Content Organization

Although practical questions of computer users may seem simple, these answers often draw upon important elements of computer design, software development and use, network connectivity, elements of the Internet, human–computer interactions, and applications. For efficiency in presentation, therefore, chapters are grouped into parts by broad subject (low-level issues, software design and problem solving, elements of networking, Web issues, and social and ethical matters). Within a part or chapter, material flows so that answers from early questions provide relevant background for later questions.

Terminology

One objective fact of life within computing is the use of technology to express ideas concisely. For example, computer terminology arises frequently in discussions of hardware and software, claims about new products and features, and projections for the future. Although general users need not know many of the more technical terms, they do need some basic vocabulary to understand what is said, and they need basic concepts and ideas to be able to evaluate claims (such as, is a new approach or product really revolutionary, or just a minor refinement?).

To establish this foundation, this book presents about a dozen basic terms in each chapter—not as isolated words, but as part of the natural flow of ideas. This inclusion of terminology complements the

discussion of ideas and principles. At the end, readers should understand the important concepts and the words that support those ideas.

Other Pedagogical Features

Each chapter contains several additional features to promote learning and discussion:

- A summary at the end of each chapter highlights main concepts and ideas.
- Discussion questions raise ideas to promote productive group conversations. Some questions explore ideas presented within the chapter, others develop related ideas, and still others require personal reflection or research.
- Exercises reinforce topics within each chapter, emphasizing personal understanding and the application of ideas.

Credits to be specified in the Preface

Figures in this Book

Color versions of many pictures in this book are available on the World Wide Web at http://www.cs.grinnell.edu/~walker/fluency-book/. Some laboratory exercises also are available at this site.

Credits

Several passages in this book are edited versions of sections of *The Limits of Computing,* written by this author and published by Jones and Bartlett in 1994. Part of Chapter 11 is a revised version of material from *Abstract Data Types: Specifications, Implementations, and Applications* by Nell Dale and this author, published by Jones and Bartlett in 1996.

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Chapter 1

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Chapter 2

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Chapter 13

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Chapter 15

Material from Kevin Engel's *The Strategic Guide to Quality Information in Biology, Chemistry, Computer Science, Medicine, Physics, and Psychology* appears with the author's permission.

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Finally, the author thanks his wife Terry and daughters, Donna and Barbara, for their encouragement and support throughout his professional career. Book development requires a focus. In writing, the world can seem wonderful when directions are clear and words flow, but an author can be grumpy and worse when progress seems slow. Terry, Donna, and Barbara demonstrate remarkable tolerance, understanding, and support throughout all these times; this book is dedicated to them.

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