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Understanding Computers:

What Managers and Users Need to Know

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Understanding Computers

to Diana

Preface

For over twenty years, I have worked in the field of electronic data processing. I've worked as a control clerk, as a tab operator, as a computer operator, as a computer operations supervisor, as an application programmer, as an operations and facilities coordinator, as a manager of systems and programming, as a director of computer systems and operations, as an information systems consultant and most recently as a director of data base systems. During these last twenty years, I have been exposed to virtually every aspect of commercial data processing. In writing this book, I am attempting to share with you the benefits of my experience. If I have done well, you will have a foundation, a beginning, from which you may commence further study. At the very least, you will have an understanding of the fundamentals of commercial data processing.

The book is in three parts: the first deals with computer basics, the second with more sophisticated concepts, and the third with commercial data processing and management information systems. In the first part there are five chapters. The first describes a computer in functional terms. Chapter 2 examines peripheral or auxiliary storage devices, the equipment which holds the large volumes of data that are processed by a computer. A description of the equipment used for getting data into and out of a computer configuration is also found in chapter two. Chapter 3 looks at data and how they are grouped. Computer programs, that is, the sets of instructions that tell a computer how to solve a particular problem, are also discussed in chapter three. Groups of programs, sometimes referred to as systems, receive attention in chapter 4. Some of the more advanced computer technology are also introduced. Chapter 5 describes computers in a little more detail. The basic components of a computer are explained in such a way as to give you a working knowledge of components such as transistors and fabrications such as semiconductors.

The second part also contains five chapters. They deal with computer systems software. Software is a combination of computer programs

and sets of data that enable computers to perform complex chores. Chapter 6 examines operating systems, those collections of computer programs and sets of data that enable a computer to execute a number of programs concurrently. Data bases and their management, that is, complex arrangements of sets of data on auxiliary storage devices and their management receive attention in chapter 7. Chapter 8 explains how data base elements are stored and retrieved from files and data bases. Descriptions of teleprocessing and distributed processing are found in chapter 9. Teleprocessing involves computer processing with input and output devices that are remotely located and physically connected to the computer by means of telephone lines. Distributed processing involves computer processing where two or more computers share work and are connected to each other locally or over telephone lines. Teleprocessing and distributed processing are becoming known as computer networking. Moving data around these networks is the subject of chapter 10.

The third part of the book deals with commercial data processing and information systems. Chapter 11 traces the evolution of commercial data processing. The process of getting an application "onto the computer," is the subject of chapter 12. Chapter 13 deals with some contemporary electronic data processing developments, while chapter 14 attempts to briefly take a look at the computer situation at the beginning of the decade of the 1980s.

The appendices are included to enhance the text. Appendix A describes a broadcasting network's election system. In it, there are elements of nearly everything described in the first two parts of the book. The glossary strives to explain some terms that are sometimes a source of confusion. Other more common terms found in other glossaries and explained well there are not found in this book's glossary. There's no sense trying to redo what has been done well elsewhere.

This book thus attempts to take a functional look at computers and several aspects of commercial data processing; it is, for managers and users, a place to begin.

MYLES E. WALSH

New York, New York
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Acknowledgments

This book was developed to provide a simple, easy-to-understand overview of computers and their application in a commercial environment. My objective in this work is to describe computers in a working or operational sense. Other, more definitive, works on computers go into greater detail than is necessary for those wishing an overview. The person wishing to go further would lose little if he read this book first. Most of my 20 years' experience has been with IBM computers and peripheral devices. Consequently, it may appear that I am biased in favor of IBM equipment. This bias is unintentional and to some degree unavoidable. However, it is not the purpose of this book to pass judgment on the merits of one manufacturer's computers and peripheral devices relative to another's. IBM's equipment is most familiar to me, but as far as I am concerned, Burroughs, Univac, CDC, Honeywell, DEC, Data General, and others, have similar equipment, equivalent to IBM's.

Several individuals were instrumental in getting this book published. Jim Andrews of the Association of System Management, himself a publisher, encouraged me to "hang in there." Stephen Kippur introduced me to Jerry Papke, who decided to publish the book. Julia Van Duyn's editing imposed the discipline necessary to transform the work from a spotty and somewhat disorganized manuscript into a book worthy of publication.

All authors owe thanks to many individuals. I am no exception. First, foremost, I thank my wife Diana for motivating me. I am also grateful to the professionals in the computer field at CBS, where I have worked in several capacities for 15 years. CBS is an above-average corporation as far as talent is concerned, and this includes those in the computer or MIS groups. My association with them was instrumental in prompting me first to write this book and secondly to persevere in getting it published. At the risk of missing a few, I mention several individuals who provided me with particular motivation. John Hurley, a director of systems for the Columbia House Division of CBS, put up

with me in my first managerial position. Max Pinkerton, a vice-president in the same division, provided a model of professional competence. David Allen and Jim Walsh, CBS corporate vice-presidents of MIS at different times, Pete Schementi, and John Lalli, MIS directors, taught me things not found in managerial text books. The list could go on for pages; Ray Vail, Mike McSweeney, Richard Silverman, Warren Mitofsky, Bob Chandler, all helped or inspired me to this work. I am also in debt to Dianne Bowman and Carol Resta, who typed and retyped until a completed manuscript was produced. Dick Pierce, Babe Lanzetta, Bob Syvarth, Betsy Meehan, and Ed Leary are peers who read parts of the manuscript and made helpful suggestions. There is also another group including Joan Chalk and Ron and Janet Proudley, with special gifts, who were instrumental in getting this book into production. To all of them, I am grateful.

M.E.W.

Understanding Computers

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introduction

Within the past several years, an ever-increasing number of individuals have been somewhat intimately involved with computers. Along with this intimacy there is a degree of intimidation. Several half-truths or misconceptions are the root cause of the intimidation that individuals feel when confronted by computers or computer people. The first is that a computer is a mysterious “black box” understandable only by the wizards of the computer industry. This is a half-truth. Although the specific technology for building computers and making them do things can be quite complex, understanding the basic concepts of a computer is significantly less difficult. The wizardry is a myth. Manufacturing computers is a sophisticated process, but it is done by human beings, not wizards. Making them do things (computer programming) can be sophisticated, but it is also done by humans, not wizards, and in some cases it is being done by near or total incompetents.

Another misconception is that computers are used mostly for performing monumental mathematical calculations impossible for men to do. This is also a half-truth. Computers do perform complex computations otherwise virtually impossible for men, but this represents only a fraction of their use. Computers, or more accurately, computers and computer peripheral equipment,* are used more often for applications that are somewhat mundane in contrast to large computational tasks. These applications include: payroll processing, order entry, inventory, accounts payable, and accounts receivable, keeping track of student records in schools, the printing of previously typed text, and a host of other applications that do not require large computations.

Another serious misconception is the idea that computers can develop solutions to problems. Individuals and organizations that have believed this have run into severe difficulties when implementing computer systems. A computer is merely a machine that can do exactly

**Computer peripheral equipment* is those devices such as printers, magnetic tape and disk-storage devices and cathode-ray tubes (CRTs) that are entities separate from a computer, but electronically connected to a computer. These devices receive detailed attention within this book.

what it is told and do it with phenomenal rapidity. If a well-thought-out method or problem solution is programmed into a computer system, the results will almost always be satisfactory. If, on the other hand, a computer system is applied in a chaotic situation, it will merely produce the chaos more quickly.

Still another half-truth deals with the threat posed by computers. Many individuals feel threatened by computers, expecting that their jobs will be eliminated. These fears are largely unfounded. Computers are here to stay. Rather than feeling threatened, individuals can attempt to live with computers, by learning something about them. This book can be a step in that direction. For many, this book may be enough; for others it may be only the beginning of a new learning experience. Computers are not to be feared; they are to be used. Trying to resist or ignore the spread of computer systems is both foolish and futile.

Other misconceptions are also still around. Some can be mentioned in passing. It is not true that you have to know "math" to work with or even program a computer. Although some computer systems require skilled technicians to operate and program them, technological improvements are constantly being developed that make it easier for nontechnical individuals to operate and even to program computers.

It is the goal of this book to provide the reader with an operational knowledge of computers and computer systems. Once you have read it, you, as an individual, will have accomplished the following:

- 1 As a potential computer user, you will be able to discuss computers intelligently with a computer vendor. Any vendor that uses terms and concepts beyond the scope of this book is providing nothing more than a "snow job."
- 2 You will have established a conceptual foundation upon which a more detailed study may rest, if you wish to pursue the subject further.
- 3 If you now feel uneasy because computers are suddenly "all over the place" (such as in banks, retail establishments, offices, warehouses, and factories) you will perceive the computer as a new tool to be used, not some mysterious "black box."
- 4 Finally, if you are a student in a discipline other than computer science, you will also find the book helpful. It can be used as a supplementary text in commercial courses.

Computer Basics

The material in this section explains the fundamental concepts and facilities of commercial data processing. Examined in this section are the computer itself and auxiliary devices like printers, magnetic tape and magnetic disk storage units, and terminals. This equipment is known as hardware. Also examined are the ways in which data are stored, such as fields, elements or segments, records, files, and data bases. How data are processed and converted into information by computer programs and systems is discussed. And for those wishing more detail on computer fabrication, there is description of electronic computer components.

Processor and Computer Storage

A DATA-PROCESSING ILLUSTRATION

Before describing computer technology, I wish to offer an analogy. Each year, I am obliged to prepare and file four income-tax returns. This ritual includes several tasks. Carrying out the tasks is similar to the processes performed by a computer to complete a job. The analogy, while describing the preparation and filing of income tax forms, introduces some terminology described more fully later in the book. OK, its tax time.

On the day I begin the ritual, I first prepare my data for processing. I go to my file of medical bills, tax receipts, canceled checks, and savings account passbooks. Let's call this stuff *input*. I must also retrieve my booklet of instructions on how to fill out the tax forms. Let's call the set of instructions a *program*. There is, then, a set of precise instructions on how to extract data from my input and do various kinds of arithmetic on those data, transforming them into information that the IRS wants to see on my tax forms.

As I do the arithmetic, I place the results in those places on the tax forms specified in the instructions. Let's call the tax form *output*.

In my case, I must prepare tax forms for the federal government, the State of New York, the State of New Jersey, and the Big Apple. There is a set of instructions for each, four programs. The tax returns must be prepared in sequence, federal first, New York State second, New York City third, and New Jersey last, since certain calculations on one produce results that are used on another. Let's call the entire process of preparing my tax forms, executing all four sets of instructions (four programs), a *system*.

The tools I use in preparing the tax returns are my eyes an *input reader*, my mind and a pocket calculator, a *computer processor*, my memory *computer storage*, a scratch pad *peripheral storage*, and my hand and a pencil an *output writer*.