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SAGE PUBLICATIONS
Beverly Hills London New Delhi

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SAGE Publications, Inc.
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Beverly Hills, California 90212

SAGE Publications India Pvt. Ltd.
C-236 Defence Colony
New Delhi 110 024, India

SAGE Publications Ltd
28 Banner Street
London EC1Y 8QE, England

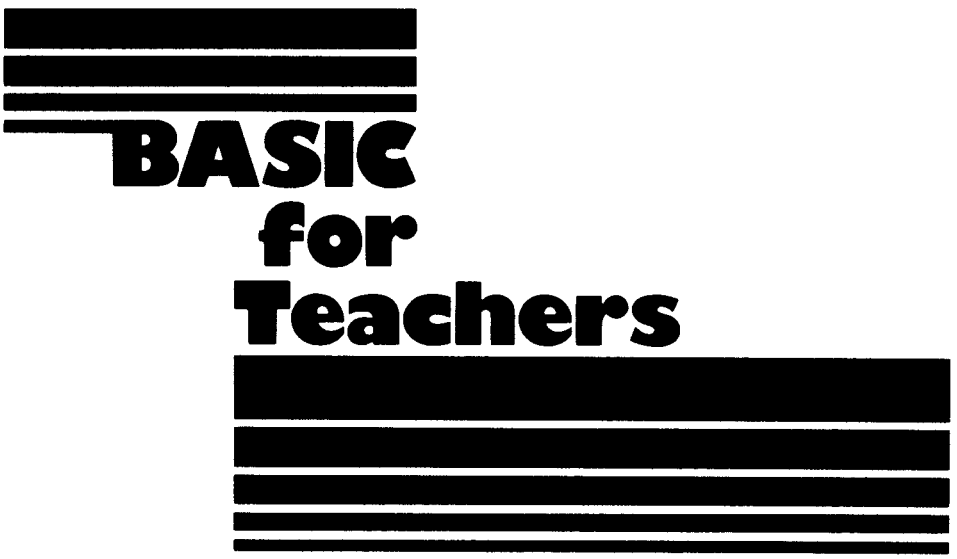
Printed in the United States of America

Library of Congress Cataloging in Publication Data

Besag, Frank P.
BASIC for teachers.

1. BASIC (Computer program language) I. Levine, Leonard P. (Leonard Phillip), 1932- . II. Title.
III. Title: B.A.S.I.C. for teachers.
QA76.73.B3B49 1984 001.64'24 84-6953
ISBN 0-8039-2329-5 (pbk.)

FIRST PRINTING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INTRODUCTION

This text is part of a two-volume set. This volume is devoted to learning a skill, namely, how to program in the computer language code, BASIC. The other volume is devoted exclusively to the history of science, technology, and the computer, and to computer literacy.

Neither volume can be considered the first part—they are merely two parts of the same topic. The reason for the two volumes is that educators need to learn both aspects of computer technology: the skill and the literacy.

The only way to learn any computer code is to sit down at a computer and use it. This means that you should be introduced to both the machine and the language code immediately. However, educators are more than skill trainers. We also need to have an understanding of the history or English or physical education. We teach the values and ethos of our subject as well.

In order to facilitate both purposes, we have divided the subject into two companion volumes. Either can be used independently although the information is most complete when using them in tandem. In order to facilitate their independent use, we have included a brief summary of the computer literacy volume as Chapter 1 of this volume.

A word should be said about the *tasks* interspersed throughout the chapters. Rather than emphasizing exercises at the end of chapters or sections, we have designed tasks that illustrate the textual discussion. If you complete the tasks without difficulty, you will have mastered that particular material. Some of the tasks are simple in structure because the intent is not to use the tasks as programming tools, but to illustrate some particular aspect of BASIC.

The exercises at the ends of chapters serve a different function. Here the purpose is to program some significant aspect of your educational situation. If the particular exercise is not useful to you, supplant it with one that is. Make sure that you use the same general BASIC construct, however; for example, our exercise may suggest that you develop a grade sheet containing the students' names and grades and that you calculate the average and standard deviation. If you coach football, you may wish to supplant our exercise with a football roster and the number of tackles, assists, and missed tackles and take the average and standard devation for the team as a whole. In brief, keep the program largely the same but change the specifics to suit your individual needs.

Many of the tasks and exercises will not have "right" answers. There is no list of "right" answers in the back of the book. Rather, you will determine how to perform the task or exercise. In many cases, you will design your own. If the answer you get is the one you wanted, then the programming procedure is correct. Through discussion with

your instructor or work group or through experience, you may find more-efficient ways of programming but that does not make your present answer wrong, just less efficient. Efficiency comes with practice and experience.

With these brief remarks, we send you on your way. Whether you are using this text in a class setting or not, we recommend that you work with others. Group efforts and discussions of problems are extremely valuable in learning computer language codes.

As a final note, we have used the word "work" when describing learning about computers. We hope that the time you spend with the computer and BASIC will be more akin to the way children view the computer—as fun. Too often, we tend to view a learning experience as work. We hope that this one can be fun.

1 Values, Computer Literacy, and the Machine

- Values and Computer Literacy
- Computer Skills
- Types of Computers
- Current Computer Usage
- The Computer as an Information Processing Machine
- The Input Process
- The Output Process
- Memory
- Long-Term Memory
- Coding the Problem
- Summary

We, as teachers, teach more than just subject matter, we teach values and understanding. This is no less true when we teach computer languages. We need to know the background of a subject just as much as the subject itself. We will summarize the value questions implicit in the use of computers, the history of computers, and their present use.

This chapter is a compilation of material that is more fully developed in a companion volume, *Computer Literacy for Teachers*. That volume includes a history of science and technology, a discussion of information theory, and a full description of how the machine works and "thinks."

In this chapter, we begin with a definition of computer literacy and move to the values implied by this definition. Specific emphasis is put on the role of the educator as the transmitter of knowledge in this new technological revolution, and particularly on the role of education in providing needed computer skills to the less affluent members of the society.

This is followed by a discussion of the computer skills needed by any computer literate person, including types of computers and computing as information processing. In the latter section, we discuss the differences and similarities between computer and human information processing. The five major processes of human and machine logic are also introduced: logic, input, output, memory, and long-term memory.

Finally, we discuss computer codes, such as the language BASIC and the coding of computer applicable problems. We cover these topics rather briefly since the primary purpose of this text is to teach the skill of programming in BASIC while the purpose of the companion text is to discuss computer literacy and values.

VALUES AND COMPUTER LITERACY

On the simplest level, literacy is the ability to read and write in our native language. A broader definition, however, implies that we are not just able to read but that we use that ability. Literate persons are those who have read widely and have used that reading to increase their understanding of the world around them.

The same distinction exists in computer literacy. On the simplest level, we can learn to program computers, understand the file structure, and so on. However, on the broader level, we should be just as familiar with how we intend to use that knowledge and how it will increase our understanding of the world around us. The truly computer literate person is one who understands the role of the computer in the world.

The computer literate person understands that this new technology influences our daily lives: Computers can affect our right to privacy; people who are computer literate could become a new elite class with power over those who are not knowledgeable; computer literate persons must question whether they are morally obligated to share and disseminate this knowledge.

Task 1

1. List 5 areas in which computers affect your daily life.
2. Indicate how that use of the computer impacts on your daily life.
3. Indicate the possible value judgments implied by each use and impact.

Because of microcomputers, there is now one computer for every 250 families in the United States. This makes computers and the computer age accessible to many. However, the distribution is not equitable since the more affluent have more computer hardware available to them.

This inequity is one of the reasons that schools have become so important in computer usage and teaching. Schools are again the great equalizers, as has been so often true in American history. In every age, as new knowledge has become available to the elite, the schools have distributed it to the nonelite. The purpose of this book is to aid in the process of making teachers and other persons concerned with equal educational opportunity computer literate.

Task 2

1. List three historical technological innovations that were initially available only to the elite and that the schools made available to the nonelite in American society, such as literacy itself.

COMPUTERS SKILLS

With any subject, there is a skill level and an interpretive level. Just as a student must learn to read in order to be literate, so we must learn the terminology and primary skills of computers before we can become computer literate.

While we will discuss computer literacy, the primary purpose of this book is to teach a skill, namely, computer usage and, specifically, the computer language BASIC.

TYPES OF COMPUTERS

Although many people use the term "computer" to mean only digital computers, there actually are two main types of computers in use today: analog and digital.

ANALOG COMPUTERS

A simplified example of an analog computer is a house thermostat. The thermostat does not give the temperature in the house nor does it calculate any further information on the basis of the temperature. It merely converts the temperature into a reading on a gauge. That reading, in turn, causes some action to be taken, that is, the house heating system goes on or off or stays in the condition it is in. Some thermostats allow a partial condition such as turning the heat on part way through the use of valves and flowage controls, for example, a small amount of fuel is used and the burner has a small flame rather than a large amount of fuel resulting in a large flame. In this way, we say that an analog machine may have bi-stable (on-off) or proportional outputs. Most household thermostats are of the on-off or bi-stable types while more exotic proportional types often are found in larger public buildings.

The word "analog" is a good descriptor of the function of this type of computer since the computer deals with an analog of the real physical phenomenon, not the phenomenon itself. The analog computer is an electronic, mechanical, or hydraulic device that does not utilize numerical information for computing. Instead it uses voltage levels, hydraulic pressures, or the like to make a change in the machine over which it has control.

In a typical electronic analog computer, the inputs are converted into voltages that may be summed, multiplied, and integrated. Answers are continuously generated for display or for conversion to some other form desired by the user. Due to the continuous nature of the solution of problems in analog computers, they may be superior to digital computers when we want continuous readouts.

DIGITAL COMPUTERS

Digital computers do not work by dealing with analogs of some physical phenomenon. Rather, they usually use data in the form of digits or numbers converted into code. Calculations are performed after the data have been converted to numbers. These calculations most often do not result in immediate responses (such as turning the heat on or off) but only reports, that is, digital computers usually do not run machinery. When digital computers directly run machinery, the word "robot" is often used to describe one of them.

Up to the early 1900s, analog computers performed the technical and scientific computing of the world. Digital machines performed the relatively mundane tasks in the business world. During the twentieth century, work on the digital computer continued, finding its way out of accounting and inventory systems to scientific systems. Although very complex analog computing systems were used from the 1920s to the 1950s, they have now been replaced by more dependable and cheaper digital computers except in a few instances.

Task 3

1. List three uses for analog computers and three for digital computers.
2. Indicate the reason that you think it is an analog or digital computer.

CURRENT COMPUTER USAGE

The past three decades has shown an increase in computing power per dollar of about a factor of ten for each three years. That is, computer prices dropped so fast that for every three years that past, we could get ten times as much computer hardware and software for each dollar spent. If we take inflation into account, the number would be even greater.

Because the computer has become less and less expensive, a great many tasks that might otherwise require human effort have been turned over to the computer, such as keeping track of personal bank accounts, home word processing, making out tax returns. Other tasks that would have been impossible using human computational power, such as the space effort where real time computation demands (being able to compute reentry procedures and courses in split seconds) exceed human capabilities.

The trend has been to increase our dependence on the computer in all its forms: clerical tasks such as airline booking offices and banking; alterations in the credit economy typified by the "money machine"; changes in assembly line operations exemplified by the robot; and changes in office procedures involving word processing systems.

Task 4

1. List five tasks that would have been impossible or much more difficult before computers became relatively common, such as computerized checkout at the supermarket.
2. List five irritations you have had with a computerized process and indicate what you would like to have done about it. (Throwing the computer in the lake is not an acceptable, although perhaps emotionally satisfying, answer.)

THE COMPUTER AS AN INFORMATION PROCESSING MACHINE

One common way to look at a computer system is to draw the analogy with the human mental system. While the analogy fails in several spectacular ways, it is not surprising that there are also some striking similarities. The machines are, after all, designed by humans to think in patterns highly similar to our own.

In Figure 1.1, we see the five major parts of any information system and its interconnecting parts. The parts are common to both humans and computing machines.

THE LOGIC CENTER

In the top box marked "logic," the reasoning, or logic of the system is performed. In a human being, this might well be the rational centers, the cerebellum and cerebral cortex of the central nervous system. That is where we seem to do our logical processing although no one knows for sure where the "thinking center" of the human brain is. Actually, in people, there are probably many such locations within the brain.

Logic Center

The logic center of the computer is where it performs its computational functions. It is the CPU, the Control and Programming Unit. Some of the functions are hardwired into the logic center of the computer while others are placed there by software. In either case, the logic center of the computer is where its work is done.