



# INFORMATION PROCESSING

Instructor's Guide

FOURTH EDITION

Marilyn Bohl



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# INTRODUCTION

This *Instructor's Guide* suggests a general approach to teaching a course in which *Information Processing*, Fourth Edition, is used as a basic or major supplementary text. It shows how the text, *Study Guide*, and *Transparency Masters* can be coordinated to present an effective, integrated learning experience. As the instructor, you will, of course, want to develop a detailed teaching outline that is suited to your teaching style, available facilities, and student characteristics. This *Guide* will help you to do just that.

The paragraphs that follow contain a discussion of the text and the student audience for which it is intended, a description of additional course materials, a recommended course schedule, and a brief summary of the various elements in this *Instructor's Guide*.

## THE TEXT

*Information Processing* is designed primarily to serve as an introductory computer text for secondary school, community college, and four-year college students. It is also suitable for a variety of graduate courses and in business environments. Today, almost everyone is a user of computers. The fourth edition of *Information Processing* was created with the needs of students as users and as members of a computer-using society in mind.

The text emphasizes the basic principles of electronic data processing. It gives due attention to both hardware and software and shows how the two can be integrated to form a system—a unified whole. Data and data-recording media, input/output operations and devices, storage, and processors are surveyed. Both microcomputers and full-scale computer systems are discussed throughout. System analysis and design, program development, and programming languages are discussed. Database concepts and data-communication capabilities are discussed from a user-oriented point of view. The impact of computers on each of us as individuals, on our organizations, and on our computer-using society is pointed out. The depth to which these topics are explored in individual classrooms will depend on the course objectives, length of the course (the text is designed for a one-semester or one-quarter course), characteristics of the class, and study time available.

To meet the needs of its ever-expanding user base, the fourth edition of *Information Processing* is offered in two versions. The 17 chapters of text are alike in both versions. One version is language-free. The other version—with BASIC—is intended for instructors and students who want to pursue program-development concepts further. A special section on BASIC containing extensive teaching suggestions, simple answers to all problems given in the text appendix, additional exercises or test questions and programming problems, and sample answers to all of the additional exercises and programming problems is included in this *Instructor's Guide*.

A conventional lecture approach to the basic course content is recommended. Each chapter begins with a full-color photo essay and supporting prose to help



students see the influence of computers in the world around them. Each chapter is short enough to be assigned as a single reading assignment. Chapters are followed by a summary of key points and questions designed primarily to stimulate class discussion. You are free to determine how these aids can be used most effectively in your particular class situation. Specific suggestions for the use of aids when studying Chapters 1 and 2 are given in the corresponding Teaching Suggestions sections of this *Guide*. Similar methods can be followed with later chapters.

*Information Processing* also contains a glossary of computer-related terms and a comprehensive index. For ease of use, the two are combined to form a glossary/index. Make sure that students are aware of this glossary/index early in their course work. You're likely to find it useful when introducing new ideas or directing student review efforts.

#### **ADDITIONAL COURSE MATERIALS**

The *Study Guide to Information Processing* is divided into 17 chapters. Each chapter corresponds to a chapter in the text. All chapters are divided into the following sections:

- A brief statement of computer-literacy objectives
- An overview of the major concepts presented in the chapter
- A list of key terms and phrases
- Self-test questions
- Suggested individual and group activities (miniprojects)

Encourage students to study the computer-literacy objectives and read the Overview section of the *Study Guide* before reading the corresponding chapter of the text. After reading the chapter, the students should check their understanding of the material by giving a brief definition of each term or phrase listed in the Key Terms and Phrases section. The self-test questions can be used as a self-evaluation test. They can also be assigned as homework or used as in-class exercises. Answers to all of the questions are given at the end of the *Study Guide* and in this *Instructor's Guide*.

The Miniprojects section of the *Study Guide* provides suggestions for related activities. These activities can be assigned to individual students or to groups of students working together. Some of the miniprojects provide a basis for student presentations and a resultant sharing of learning experiences. Many are designed to increase the students' understanding and awareness of uses of computers in the world around them. "We learn by doing" is an often-quoted phrase and it also is an often-true one. The students are likely to gain much by participating in miniprojects throughout the course period.

The *Transparency Masters* contains a set of 185 paper masters for classroom transparencies. These masters are designed to help you present various computer-related concepts and techniques discussed in the fourth edition of *Information Processing*. Specific recommendations for their use are given within the Teaching Suggestions for the chapters in this *Instructor's Guide*.

You can make transparencies from the paper masters using any of the duplication methods commonly available. Colors or overlays can be added to emphasize important areas. Notes can be written directly on the transparencies using any of the implements designed for this purpose. Cardboard frames will help to keep the transparencies flat on the projector; the framed transparencies can be three-hole punched and stored in a loose-leaf binder when not in use.

The transparency masters are titled and numbered sequentially. The numbers, which are printed in the lower right-hand corners of the transparencies, are included primarily for reference purposes. You are free to resequence or supplement the transparencies to serve your particular course needs.



The classroom in which the course is taught should be equipped with a chalkboard, an overhead transparency projector, and a projection screen. Student access to microcomputer systems may be helpful but is *not* a requirement. Class demonstrations that you arrange or that arise out of miniprojects will also aid student learning. If some students want to share or demonstrate their programs or systems, you should arrange for them to do so if possible.

A test bank comprising more than 1000 test items designed especially for the fourth edition of *Information Processing* is available for your use. The test items are provided in printed form and in machine-readable form on a 5 1/4-inch diskette, together with a test generator (also on diskette) and brief documentation about how to use the test generator. To use the machine-readable form of the test items and the test generator, you'll need either an IBM PC (or PC-compatible) or an Apple IIe (or Apple-IIe-compatible) microcomputer system. The system requirements in either case are at least 64K of RAM, 80-character display screen, one or two disk drives, and a printer. You can use the test generator to delete, add, or modify items in the test bank and to select and format items for examinations.

If you've used earlier editions of *Information Processing*, you may notice that the number of items included in this test bank represents a three-fold increase over the number of test items provided with earlier editions. My thanks to those of you who shared your thoughts and experiences with me as input to the package that has become the fourth edition of *Information Processing*.

## **COURSE SCHEDULE**

Because of its emphasis on computer-system fundamentals, *Information Processing* is suitable for many courses. Some examples are:

- Course 1: Introduction to Computer-Based Systems
- Course 2: Introduction to Data Processing
- Course 3: Introduction to Computers with BASIC
- Course 4: Computer Literacy
- Course 5: Business Data Processing and Business Applications
- Course 6: Introduction to Data Processing with COBOL (or FORTRAN)
- Course 7: Introduction to Computing with Pascal

In Courses 1 and 2, *Information Processing* (language-free or *with BASIC*) serves as the basic text in a course of study like that outlined for Course CIS-1 of the Data Processing Management Association (DPMA) Education Foundation Model Curriculum for Undergraduate Computer Information Systems. The schedule at the end of this introduction shows the number of class sessions per chapter recommended for both semester and quarter courses. The semester schedule is based on a three-unit course with 45 sessions. The quarter schedule is based on a three-unit course with 33 sessions.

In Course 3, *Information Processing with BASIC* is the appropriate choice. The material in the BASIC appendix can be introduced when communicating with a computer is first discussed in detail in Chapter 2 of the text. Alternatively, the students' in-depth look at programming can begin when system analysis and design (Chapter 11) and program development (Chapter 12) are studied. These chapters can be discussed in the sequence in which they appear in the book or directly after Chapter 2 if desired.

In Course 4, emphasis is placed on the use of computer systems within the context of the user's over-all systems environment. Chapters 1, 2, 3, and 9 through 17 are of major importance. Students will gain much from the photo essays, the basic text of chapters, and the accompanying full-color photographs and artwork. Chapters 4 through 9 should be assigned as reading material, but



devoting only one class session to each is a reasonable tradeoff to allow more class time for topics in the other chapters.

In Course 5, emphasis is placed on computer-system fundamentals, management, and business applications. Special attention should be given to the examples of applications that occur in the photo essays and throughout the basic text material. Chapters 15 through 17 are particularly important.

In Course 6, the language-free version of *Information Processing* may be used with any of several COBOL (or FORTRAN) texts. In general, Chapters 1 and 2 of *Information Processing* should be studied first. Other chapters of the text can serve as modules that provide basic concepts in support of the COBOL-language (or FORTRAN-language) topics covered in the course.

If you desire to teach an introductory computing course in which Pascal serves as the programming language of reference, you should be aware that an alternate version of the third edition of *Information Processing*, known as *Information Processing with Pascal*, is available. This alternate version of the third edition contains a Pascal appendix that is similar in format and in its emphasis on problem solving to the BASIC appendix in *Information Processing with BASIC*. The comments made for Course 2 apply to this course (called Course 7 in our list) in a similar manner. An *Instructor's Guide Supplement* is available for instructors who use the Pascal appendix.

There is enough material in the text and *Study Guide* for a full semester's work. It will not be possible to do the same amount of work when *Information Processing* is used in a quarter course or in a semester course that places major emphasis on programming. In an introductory quarter course, it will be wiser in most cases to cover some topics less thoroughly than to omit complete chapters or topics within chapters. One approach is to assign all of the reading material but assign fewer exercises. In class sessions, you can omit details and present fewer examples. Where this text is used in connection with programming work, you may wish to place a greater emphasis initially on topics that are essential to programming or that students are likely to need in other courses. If students have ready access to microcomputer systems, you may wish to use Chapter 9 immediately following Chapters 1 and 2, then move to Chapters 11 and 12 as mentioned for Course 3.

## CONTENTS OF THE INSTRUCTOR'S GUIDE

The chapters in the *Instructor's Guide* correspond to the chapters in the text. Each chapter is divided into five sections: Computer-Literacy Objectives, Additional Materials Required, Suggested Approach, Teaching Suggestions, and Responses to *Study Guide* Self-Test. Where appropriate, a Guest Speakers section follows the Additional Materials Required section. It suggests resource persons who may be available in your local area to discuss selected topics.

The Computer-Literacy Objectives are designed to help you keep specific goals in mind as you introduce, explain, amplify, and reinforce the text material.

The Additional Materials Required section lists supplementary teaching tools that are either necessary or desirable when using the approach outlined in the Teaching Suggestions. If you want additional reference materials, you may find them at nearby computer stores or business centers. Computer and other equipment manufacturers, developers of software, and firms offering computer services frequently make reference materials available. A wealth of publications are issued weekly, semimonthly, and monthly. See Transparencies 184 and 185 in the *Transparency Masters* for well-known examples. You can take advantage of seminars and conferences in your area to keep abreast of current technologies and products.

The Guest Speakers section suggests resource persons who may be available in your vicinity.



The Suggested Approach presents the material to be covered in each chapter in the sequence recommended to accomplish the Objectives. It also provides a brief overview of the Teaching Suggestions.

The Teaching Suggestions are more specific, detailed guidelines to follow in teaching each chapter. Suggestions for the use of classroom transparencies are given where appropriate. In some cases, background information is included to provide additional facts that may be helpful in presenting the material. Sometimes demonstrations are suggested as the best ways to present certain topics. If demonstrations are used, they should be checked out thoroughly beforehand; at least one complete rehearsal is recommended.

The Responses to *Study Guide* Self-Test section contains solutions to all the problems that appear in the corresponding chapter of the *Study Guide*.

Following these chapter guidelines are similar guidelines for users of the BASIC appendix in *Information Processing with BASIC*. Many additional questions and programming problems, and sample answers for all of the questions and problems, are included.

Following the chapters and BASIC guidelines is a series of supplementary lecture notes. These notes provide additional information about subjects covered in the text or about related subject areas. For convenience, a point after which each lecture can be used is suggested. Their use is, of course, optional.

MARILYN BOHL



## COURSE 1: INTRODUCTION TO COMPUTER-BASED SYSTEMS

(*Information Processing* is used as a basic text, presenting an up-to-date survey of computer hardware and software systems.)

<i>Information Processing</i>		Number of Class Sessions per Chapter	
Chapter		Semester	Quarter
1	Computers and Their Uses	3	2
2	The Computer as a System	2	1
3	Data Representation	2	2
4	Entering Data	2	2
5	Obtaining Information	2	2
6	Storing Data	3	2
7	Processing Data	2	2
8	Computer Operations	3	2
9	Microcomputers in Use	2	2
10	Minis, Mainframes, and Monsters	2	2
11	System Analysis and Design	3	2
12	Developing Programs	3	2
13	Programming Languages	3	2
14	Operating Systems	3	2
15	Managing Data	2	2
16	Data Communications	4	2
17	Computing Issues and Impacts	4	2
Total		45	33



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<b>3</b> DATA REPRESENTATION	14
<b>4</b> ENTERING DATA	21
<b>5</b> OBTAINING INFORMATION	28
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(The titles of the lectures and a general guide to their use appear  
on the following page.)



## Supplementary Lecture Notes

Number	Title	Use with or any time after Chapter X, where X is the number below	Page
1	Computers in Use	1	162
2	Factory Automation	1	166
3	Linear Programming	2	169
4	DPMA	2	170
5	Code Checking	3	174
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18	Auditing	17	214
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# Instructor's Guide INFORMATION PROCESSING



# COMPUTERS AND THEIR USES

Approximate number of sessions: semester, 3; quarter, 2

## COMPUTER- LITERACY OBJECTIVES

Upon completion of this chapter, each student should be able to:

- discuss the importance of computer literacy in today's society, recognizing that the term itself is interpreted in a variety of ways.
- define data processing and give examples of data-processing systems.
- show how society's information needs have given impetus to technological innovation.
- point out, through a brief historical review and a discussion of current technology, the features of the computer that make it uniquely useful and different from other machines.
- identify specific uses of computers and computer-supported applications in the following areas: manufacturing, engineering and design, medicine and health care, law enforcement and criminal justice, education and training, and the home.
- discuss the variety of jobs directly or indirectly involved with computers.

## ADDITIONAL MATERIALS REQUIRED

- Transparencies 1 through 8
- Punched cards, a magnetic-tape reel, and a removable disk pack from any mainframe computer installation
- If possible, a circuit board such as found in the laboratories or production facilities of a computer manufacturer; mockups may also be available
- Processor chips (microprocessors) and memory chips being used in today's microcomputers and other devices
- A complete microcomputer system, 8-inch and 5¼-inch floppy disks, tape cassettes, and cartridges used in such systems
- Samples of computer output related to any user applications you discuss
- A current copy of the *Occupational Outlook Handbook*, updated at two-year intervals by the U.S. Department of Labor, Bureau of Labor Statistics

## SUGGESTED APPROACH

Open the class period with a few simple examples of how computers are being used in the students' everyday environments. Discuss the phrase *computer literacy* and various definitions that have been suggested for it. Explain the scope and objectives of this course. Then introduce *Information Processing, Fourth Edition*.



After completing this discussion, direct the student's attention to the concept of *paperwork*. Help them to see that paperwork is a necessary part of our environment. Develop a definition of data processing by pointing out that data can be processed in various ways. Trace the development of technology, showing how new techniques were devised to meet existing needs. Emphasize that the development of technology is still occurring.

If many students in the class are business-oriented, pay particular attention to the requirements for business data processing. Expand this discussion to survey many diverse, important tasks being done with the help of computers. Encourage students who have direct experience with computers to share their experiences.

Finally, mention employment opportunities in the computing field and in other fields that involve working with computers. Help students understand the wide range of interests, aptitudes, and skills of persons who work with computers. Whether or not a student chooses a career directly involving computers, a knowledge of computers—and of what they can and can't do—is sure to be helpful.

## TEACHING SUGGESTIONS

1. Begin this opening session with a few simple observations of how computers are being used in the students' everyday environments. Discuss uses at your school or workplace, e.g., student registration, class scheduling, grade reporting, administrative accounting, and the like, as appropriate. Admit that much attention is being directed to "computer literacy," though the phrase itself has many meanings. Help students to understand clearly the scope and objectives of this course. Doing so is your way of checking that each student's expectations of what he or she will gain from the class match with the intended scope and objectives. If that is not the case, the student should be encouraged to talk with you later.
2. Then introduce *Information Processing, Fourth Edition*. Point out the key features of this text that are designed to make learning easier for the students. For each chapter these include a detailed table of contents, a brief narrative introduction to the chapter contents, the full-color photographs and other artwork with full sentence captions, the summary of key points, and the discussion questions. Point out that each chapter begins with a photographic prelude that is supported by free-flowing paragraphs of text that clarify how the photographs relate to the general theme being portrayed.
3. Having completed these introductory steps, you and the students are ready to begin investigating more directly the exciting, computer-filled world in which we live. Everywhere we see a need for paperwork. Refer again to your earlier examples. Extend that discussion to the paperwork required in a large business organization such as a furniture-manufacturing company, a telephone company, an airline, a supermarket, or a department store. Point out that similar needs have existed for years; yet, we haven't always had computers to help us.
4. Use Transparency 1 to introduce the idea that data comes in many forms and can be processed in many ways. Point out that a data-processing system consists of the equipment and procedures required to collect, process, and distribute data. Distinguish between data and information.
5. Use Transparencies 2 through 4 to discuss technological developments that have made today's computers possible. Emphasize the data-processing needs that stimulated these developments. An item shown on Transparency 2 but not discussed in the text is Babbage's Analytical Engine, which



introduced new ideas of data storage, sequential control through programming, and automatic readout of the results of processing. Point out that the Atanasoff-Berry Computer (ABC) could be added to the time line of Transparency 3. Though the ABC is dismissed by some historians as simply a prototype never put to practical use, others argue that the work of Atanasoff and Berry has not received the recognition it merits, that the ABC should be given more attention as the first electronic digital computer. Emphasize that it is through technologies providing for ever-increasing miniaturization of computer components that the desktop computers, portable computers, and even pocket computers of the late 1970s and 1980s are possible.

6. Give particular attention to business data-processing needs. In doing so, teach the concepts of batch and transaction processing. Point out that the students will learn more about the technological developments that made these possible. If possible show students the actual equipment and data-recording media. Stress the minute size of transistors, integrated circuits, and silicon chips. (It will help students realize the minuteness and complexity of computer circuitry if suggested additional materials are available.)
7. Use Transparency 5 to insure that all students have at least a basic impression of what the major components of a 'typical' computer system look like and are. Discuss any components that have not been mentioned. Use Transparency 6 to lead a similar discussion of the components of a microcomputer system. Encourage students to discuss computer systems with which they are familiar.
8. Now direct the students' attention to the many diverse, important tasks being done with the help of computers. Help them to see computers as tools especially well-suited to handling our nation's information resource. Discuss computerized applications in manufacturing, engineering and design, medicine, law enforcement, education, and the home. Encourage the students to discuss their experiences with computers. Those who have personal computers should be encouraged to tell about them: what they are like; how they were obtained; and what they are good at, or good for. You may wish to refer to Supplementary Lectures 1 and 2 for additional application information.
9. Pose the following question: Why study computing? Alternatively, ask: Why are you studying computing? Give the students time to think and to respond. (See also Figure 1-16 of *Information Processing*.)
10. To help answer the question posed in 9 above, explain that there are many employment opportunities in the computing field. Mention first the firms that manufacture and/or market computers and related equipment or media; that design and write and/or market programs to run on the computers; that service installed equipment and programs; and so on. Point out that some large EDP-system users establish data-processing or information system departments of their own to do system analysis and design, programming, and operations work. Use Transparency 7 as you discuss these tasks. Tell the students they will learn more about all of them in this course. Be sure the students understand that Transparency 7 shows just one way of organizing an information system staff. There are others. For example, organization on a project or application basis is increasingly common.
11. Next mention job opportunities in other career fields that involve working with computers. Use Transparency 8 as a basis for this discussion.



Refer to the above discussion of computer applications and note how that topic relates to this one. Be sure to mention word-processing systems involving computers that are now appearing in ordinary office environments. In doing so, you may capture the attention and interest of students pursuing administration or secretarial careers who have not expected to use computers directly on their jobs. If any students are using such word-processing systems now, encourage them to discuss their work.

12. Refer to Figure 1-18 of *Information Processing* at this time. Be sure the students understand both how to read the graphs and how to interpret the information they present. If students are not familiar with the *Occupational Outlook Handbook* published every two years by the U.S. Department of Labor, Bureau of Labor Statistics, take the time to introduce it to them. In clear language, the *Handbook* describes what workers do in about 250 different types of jobs, the training and education they need, their earnings, and the expected job prospects for those who prepare themselves for the jobs. (The 1982-83 edition of the *Handbook* was available for \$9 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)
13. The discussion questions at the end of Chapter 1 should be assigned after the first session. At least parts 1 through 6 of the Teaching Suggestions will have been covered in class, so individual student volunteers or groups of students can be asked to prepare presentations in response to Question 7 as a basis for class discussion. Remind the students that the end-of-chapter summary is a convenient means by which they can verify their understanding of the key ideas presented in the chapter. If any point is not clear to a student, he or she should reread the corresponding portion of text material.
14. Direct the students' attention to the combined glossary/index in the text. Note especially the definitions for vocabulary terms listed in the *Study Guide*. Discuss how the glossary/index can be used throughout the course for review and reference purposes. Be sure students are aware of the *See* and *See also* references and understand how to use them effectively.
15. Use Chapter 1 of the *Study Guide* as a supplement to text and class discussion. The "Miniprojects" section offers many suggestions for both individual and group projects related to the topics discussed. Students will learn much by doing. They will also learn much from each other if you provide time for them to share the results of their project activities.

**RESPONSES TO**    **Part I**  
**STUDY GUIDE**  
**SELF TEST**

- |      |      |      |      |       |
|------|------|------|------|-------|
| 1. F | 3. T | 5. F | 7. T | 9. T  |
| 2. T | 4. F | 6. T | 8. F | 10. F |

**Part II**

- |              |         |         |         |         |
|--------------|---------|---------|---------|---------|
| 11. (c)      | 13. (d) | 15. (b) | 17. (b) | 19. (c) |
| 12. (a), (b) | 14. (c) | 16. (e) | 18. (c) | 20. (a) |



### Part III

- |   |                          |
|---|--------------------------|
| 21. Gottfried Leibnitz                    | 26. Howard Aiken         |
| 22. Blaise Pascal                         | 27. Dr. Herman Hollerith |
| 23. Ted Hoff                              | 28. Dr. John Mauchly,    |
| 24. Dr. Herman Hollerith                  | J. Presper Eckert        |
| 25. Dr. John Atanasoff,<br>Clifford Berry |                          |

### Part IV

29. *Productivity* can be defined as the rate of finished output per unit of labor input.
30. In the late 1950s computer-generated numerical control (NC) tapes were used to guide production machines. Coded instructions on the tapes controlled the selection of machine tools, feed rate, spindle speed, coolant setting, direction and distance of movements, and so on. High-speed precision drilling machines were often controlled by NC tapes.
31. spray painting; spot welding; lifting; assembling; packaging
32. automotive; aerospace; heavy-equipment manufacturers
33. Proposed characteristics of spacecraft—shape, length, width, and so on—are provided as input to a computer. The effects of gravity, thrust angles, weight loss with fuel burnup, and other environmental influences on the proposed aircraft are studied through simulation. If the spacecraft does not respond as desired, the characteristics can be changed.
34. A small computer inside an electrocardiograph system can read and interpret an electrocardiogram, or graph of pulses that cause a patient's heart to beat. In doing so, it helps a doctor quickly locate any damaged or diseased heart areas. Often the graph is displayed continuously on a screen for visual examination by the attending doctors and nurses.
35. A small computer inside a blood cell separator can separate the pints of blood into major components such as red cells, white cells, plasma, and platelets. Concentrates of each component can be given to patients who need that component. One patient may need only white blood cells; another may need only blood plasma.
36. (a) NCIC is the Federal Bureau of Investigation's National Crime Information Center, a computer system and database containing millions of records about individuals who have been officially accused of crimes.  
(b) Federal, state, and local law enforcement agencies can query the system.  
(c) If a person with whom they are dealing has been officially accused of a crime previously, the agencies will be able to find out more about the person and his or her activities from the database. If there is no data about a person in the database, they can assume that he or she has no prior record.
37. Computers are used to schedule courtrooms, judges, juries, and cases and to keep track of them. Computers are also used to organize, store, and retrieve vast amounts of congressional laws, legal precedents, and other case-related data.