

Instructor's Manual
and Test Bank
to accompany

Information Processing
Systems for Management
Second Edition

Hussain and Hussain

Prepared by Donna Hussain,
K. M. Hussain, and Pat Sims

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Information Processing Systems for Management

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**1985
Second Edition**



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PREFACE

Instructors are busy people. This manual offers suggestions for student assignments that require a minimum of instructor involvement but produce a maximum of student learning. It also supplies a wide range of actual student responses to those assignments.

Each chapter of the text concludes with a list of discussion questions that ask students to apply their own thinking, reading, and experience to the topic. Four possible uses for these questions, all of which have been tested in graduate or undergraduate classes, are:

1. oral discussion of selected questions in class as each chapter is completed,
2. assignment (written or oral) of selected questions to specific students who have a background or an interest in one phase of the topic,
3. long-term assignment (written or oral) of a specific question number to individual students (e.g., student "A" is assigned question Number 1 in all chapters), and
4. student creation of original questions related to the topic and student answers to them.

No attempt has been made to supply a student answer for every question in the text. Instead, student responses were chosen to show the range and quality an instructor may expect. Some were written by undergraduates who, as yet, have no personal experience in the field. Others are obviously from a broad, practical background of everyday work. No indication of quality is given, and all answers have been edited for grammatical correctness and clarity. Finally, the collected responses offer instructors a quick overview of the topics covered by the questions.

The editors wish to thank the following students for their contributions both to the class and to this manual: J. S. Champion, E. Delgado, A. E. Enniful, G. Fediw, H. Gausa, T. Hays, A. Houtman, J. Johnson, S. McFerron, D. Mackellar, S. Margrave, A. Martinez, J. Mayagoitia, J. Nakai, S. Plese, G. Quintana, L. Ray, and T. Turner.

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NOTE TO THE INSTRUCTOR:

Also available from Richard D. Irwin, Inc., is a book of transparency masters. The illustrations are designed to supplement and support your lectures.

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DISCUSSION QUESTIONS

1. Why should business students study computer processing and computerized information systems?

Answer

Being able to process data and use information effectively is vital to business organizations. Without the capability to process data about sales, inventories, income, taxes, and the like, it would be impossible for business to exist very long. Because data and information are so important to business, managers must understand what information systems can do and participate in the development of systems for their own needs. To do that, knowledge about computers and their capabilities is required.

2. Need a businessperson know about a computer? What understanding of a computer and a computer system is necessary? Why?

Answer

Because the computer is increasingly used for operations, control, and planning as well as to improve office efficiency, business people need to have a basic understanding of processing systems and computer applications. It is not necessary for them to understand technical details of how computers are constructed or how computers work.

When computers provide up-to-date information, managers are better able to answer questions, solve problems, and achieve corporate goals. Managers must understand how information systems can help them and should participate in the development of systems for their own special needs. They need to learn to define problems, objectives, and constraints in operational terms for systems designers.

3. Is the need for information systems for business increasing or decreasing? What is the future trend? How does it depend on the nature, size, and complexity of the business?

Answer

The demand for information systems for business is currently increasing and will continue to increase in the future. To make correct business decisions in increasingly complex situations, managers need quick and accurate information. Computers are used for communications, process control, accounting, and dozens of other applications. The tendency is for the computer to be used increasingly for planning business strategies and for improving office efficiency. But not all businesses should be computerized. In some cases, computerization could lead to increased complexity without substantial gains in efficiency. A small manual system may be better off left alone. Typically, the larger and more complex the system is, the more likely that a computer could increase its efficiency and provide more and better forms of information.

4. What is the difference between mechanization, automation, and computerization?

Answer

Mechanization is a working system using machinery. Automation is electronic control in manufacturing. Computerization is performing calculations and similar operations with electronics in any fashion. The difference between the three, then, is that computerization is a composite of mechanization and automation, while automation has only mechanization involved.

Example: Mechanization could be thought of as a hand driven ice cream maker. It is a working system to make ice cream. Automation would be the same thing but adding an electric motor to crank the machine. An example of computerization would be putting a microprocessor in charge of the ice cream maker and storing instructions (e.g., churning time or correct temperature) in its memory. Then the operator need only add ingredients, push a start button and await results.

Chapter 1

5. Give examples of users of computerized information in business and industry.

Answer

Examples of users in business and industry:
Sales clerks (point of sale terminals)
Secretaries
Typists (word processing)
Project directors
Payroll clerks
Managers
Auditors
Stock holders
Programmers
Data base administrators
Systems analysts
Bookkeepers
Industrial engineers (design and simulations)

6. Why might a business without a computer fail?

Answer

In this day of computers, businesses without them are forced to compete with the efficiency and speed of computerized information systems. These businesses could fail because of:

1. lack of speed in calculations
2. increase in data with no means of storage
3. destruction of data and information kept in paper form
4. wasted time from regenerating data
5. increased costs of data manipulation
6. cost for extra needed help for overload of incoming data.

7. What are the major trends in computers and computing in terms of speed, reliability, cost-effectiveness, and size? Are these trends expected to continue? If so, for how long and to what extent?

Answer

The major trend of computers is that of smaller, faster, more reliable and more cost effective systems. The size of computers has gone from huge number crunching monsters to hand-held, pocket-size, programmable calculators. This has increased their availability to almost anyone who has a need for one. As electronic designs have become more technologically advanced, the reliability of smaller computers has also increased. Smaller chips have the same, if not more, effectiveness as larger circuits. Electronic technology has also increased the speed with which computers are able to process information. These smaller, more reliable systems have made it possible for businesses and individuals to afford and maintain information systems.

These trends are expected to continue to a point. There comes a time when the development of smaller and faster computer systems does not justify their need. The added costs of developing and producing such systems far outweigh their benefits. A tiny, extremely fast computer is of no practical use if the user cannot see the display or easily enter his input.

8. Would you agree that persons who like computers tend to be technologists, scientists, and mathematicians, and those who dislike computers, humanists?

Answer

I might once have agreed that only technical people liked computers simply because only technical people had interaction with computers. With the advent of microelectronics, however, cheaper personal computers are now so available that as many humanistic as technical types utilize computers.

A computer seems to be liked if it can be used to satisfy one's needs. As more humanists meet their needs with computers, they will tend to like computers just as much as technical people. Another criterion for liking a computer is one's ability to communicate with the computer. Technical people are especially trained to communicate in a variety of higher and lower level languages. But through advanced technology, it is growing increasingly easier to communicate with computers via terminal interactive languages or computer prompted queries. Humanists tend to use these interactive languages to communicate with their computers.

Chapter 1

In communicating with computers via an interactive language, one tends to unconsciously perceive a computer in a human image. Computers have seductive powers over those who use them. Could we be seduced by an entity that we did not like? I don't think so. Once humanists have enough user experiences to perceive computers in a human, helpful light rather than a mechanistic one, they will be as comfortable with them as technologists are now.

9. What is the role of a manager in the development and maintenance of an information system?

Answer

The specification for the design of an information system is the responsibility of the manager. He/she must make organizational changes to implement the new system if required. Managers must cooperate with the system's analyst throughout the development. To do so fully, they should understand the basic tools, have a fundamental knowledge of the information system and its data structures, and comprehend the development process of the information system. Mid-level managers should also participate in developing the information system at their own functional levels. But top management's attitude is the key in creating a favorable atmosphere of cooperation and implementation.

DISCUSSION QUESTIONS

1. What are the economic considerations and conditions that can justify the use of computers?

Answer

To justify the use of computers it is necessary to consider initial investment, fixed costs, and variable costs for manual, machine, and computer processing. Managers must calculate the break-even point beyond which the processing volume justifies a bigger initial investment. As the volume of data processing increases, the switchover from manual to machine to computer processing becomes economically justified.

2. Distinguish between manual, machine, and computer processing in terms of:
 - a. Equipment used.
 - b. Economic justification.

Answer

Following a transaction, data on the event must be handled according to predetermined procedures and decision rules to generate desired information. This can be done by hand and is called manual processing. Machine processing is recommended when computations are complex and large in volume; in such cases, hand processing can be slow, monotonous, inaccurate, and costly. Machine processing was first used by Herman Hollerith in 1896 and proved its great accuracy. The machines used were electrical and performed primarily accounting operations, but as the amount of data to be processed increased, this equipment also became slow and expensive to use. It was replaced by the electronic computer for electronic data processing.

As the volume of data processing increases, electronic data processing is required because it can handle a large amount of data at a lower cost. If these costs are represented in a graph (see page 18 of the text), companies can find the break-even point and justify the cost of purchasing computers, possible external storage, and other necessary peripherals.

3. Distinguish between batch, time-sharing, interactive, online, and online-real-time processing. Give an example of each mode of processing in business.

Answer

There are several different modes of processing: batch, time sharing, interactive, online, and online real time.

Batch processing was the first mode available and is consequently the slowest. It involves the gathering together of jobs by the computer operator, or the system itself, to be processed in batches. This method is still used in many government installations because it is a relatively inexpensive mode of operation.

When a computer is shared between many users at separate terminals, the process is called time sharing. Usually these systems are online, that is, the users are directly connected to the system. The computer utilizes a round-robin approach for servicing each user, thus enabling a reasonable response time. And, of course, the online system responds much faster than the batch system. A factory parts inventory system may utilize an online system on a weekly basis.

The fastest mode of processing is online real time because the access time is not only quick but continuous; simultaneous updating of the data base occurs at the same time. A bank would use a real-time system to keep constant tabs on the status of a customer's account balance.

An interactive system is one in which the user can receive immediate feedback from the computer in a conversational style. Many businesses will use an interactive language like APL for writing and running programs right at the terminal.

4. List the main advantages of computer processing over:
 - a. Manual processing.
 - b. Machine processing.

Answer

Advantages of computer processing over manual processing:

1. lower cost per unit
2. performance of complex computations in large volume
3. speed
4. improved accuracy.

Advantages of computer processing over machine processing:

1. earlier break-even point
2. speed
3. economy for large volume
4. memory
5. flexibility
6. adaptability to different configurations.

5. Are computers capable of making logical choices? Explain.

Answer

Computers can make logical choices but these choices are extremely limited. For example, microprocessors have hardware designed to make adjustments when conditions are changed. However, only certain types of conditions are acceptable since only a certain format of input is acceptable.

Programs are also capable of making logical choices. With programs, the intelligence of the computer is based on the program's instructions to the CPU. These instructions can perform a number of logical choices; however, the choices are again limited to those specifically allowed by the human programmer.

6. Distinguish between:
- a. Business and scientific computer.
 - b. Analog and digital computer.
 - c. Discrete and continuous computations.
 - d. General-purpose and special-purpose computer.
 - e. Small and large computer.
 - f. Microcomputer and microprocessor.
 - g. Microcomputer and minicomputer.

Answer

(A) A few years ago there was a large difference between a computer for the business world and a computer for the scientific world. The business computer had to handle large sets of data records and files. And usually a data base or bases were associated with the business computer. The scientific computer was considered a number cruncher. It had to be fast and accurate. Accuracy of the scientific computer would be to ten or more decimal places, whereas the business computer would only need three to four decimal accuracy. The Cray is an example of a number crunching scientific computer. And an example of a small but typical business computer would be an IBM System 3. But the trend now is to construct computers suitable for both fields of work. The Univac 1100 Series is a good example. It can be partitioned in such a way that part of the machine will "number crunch" and the other part will work with large data sets.

(B) The difference between an analog and a digital computer starts with the type of data processed. An analog computer continuously monitors physical variables such as voltage, resistance, and rotation. Examples can be found in sensing devices to control temperature, pressure, gas flow, and altitude. The digital computer, on the other hand, handles discrete data on which it performs arithmetic and logical operations. Examples include scientific and business computers; the data arrives in blocks or is generated internally.

(C) Discrete computations are carried out by digital computers on separate, distinct units of data such as numeric characters in mathematical formulae. Continuous computations are handled by analog computers that can deal with an uninterrupted flow of data such as fluctuating temperatures or air pressures.

(D) A special-purpose computer is used to monitor and perhaps act upon one flow of data such as the air/fuel mixture of an automobile engine. General purpose computers, like today's minis and micros, may perform many functions from word-processing to price forecasting. A computer may also be "dedicated" to one special purpose such as stock reports even though it is capable of performing other functions.

(E) "Small" and "large" are no longer very descriptive terms since computers that are small in physical size may be huge in computing capacity. Because of this development, the division lines between small, medium, and large cannot be drawn with any great precision.

(F) A microprocessor performs just one specific function, such as measuring an aircraft's cabin pressure, since it has only small memory capacity and is strictly limited in the kind of input and output it can handle. When additional memory and input/output capabilities are added, the microprocessor becomes a microcomputer. Often, groups of microprocessors make up a microcomputer.

(G) Microcomputers are more limited in their possible applications than are minicomputers. In general, the mini is larger than the micro, but as minis become physically smaller, this distinction blurs, and the best distinguishing characteristic between the two is the number of applications each can perform. In a similar way, minis are merging with mainframes. The progression is microprocessor, microcomputer, minicomputer and mainframe.

7. What unique hardware features are required for a system operating in an OLRT environment rather than a batch environment?

Answer

By definition, real-time systems process both input and output data continuously and simultaneously. Such systems should therefore be online and have teleprocessing abilities in order to function. Certain hardware features should also be present. Equipment at the user's end consists of a terminal, a multiplexer or concentrator, and a modem. Equipment at the computer end consists of a modem and a front-end processor. The function of each piece of equipment is described as follows:

- A. terminal(s): connect user(s) on line to the computer main frame;
- B. multiplexer(s): combine multiple lines from terminals with slow transmission speeds into one fast broad beam transmission line;
- C. concentrator(s): concentrate slow terminal lines into faster channels for transmission;
- D. modem(s): convert digital to analog signals and vice versa;
- E. front-end processor(s): relieve the CPU of teleprocessing responsibilities.

8. What is meant by computer generations? How have computer generations affected the user in business?

Answer

The effects of the different generations of computers are probably more profound on commercial developers than on users. In the first generation, developers had to be as familiar with the actual structure of the machine as with the programming language. The emphasis at that time was on the optimization of time and computer resources since computers and time on them were both so expensive. Programming technique sacrificed clarity of program to hardware and time considerations. A side effect of this philosophy was that the programmer became nearly indispensable, for once he had written a piece of code, he was the only one who could maintain it properly.

With the second generation, the emphasis shifted somewhat from the physical aspects of the machine to "purer" programming. The main ideals were still time and computer resource efficiency, but ideals were turning toward clear programs and detailed algorithm design. Higher level languages were becoming better and more popular. Commercial developers could use a high level language for programming, but the programmer was still largely indispensable. The third generation was to change all that.

With the advent of the third generation of computers, developers had to change radically. Time and computer resources were no longer nearly as important as before, and the cost of a programmer's labor to maintain programs was more expensive in the long run than the computer and its use. Businesses demanded better programs at lower cost, and the best place to reduce costs was in maintenance. To achieve these goals, algorithm design for the programmer became extremely important. Individual programmers themselves became less important for a single piece of code than for the quality of code produced.

With the creation of more efficient high level languages to support algorithmic programming on third generation computers, commercial developers underwent a radical change in style. Fourth generation computers will provide equally important challenges and changes that are just beginning to emerge.

9. What will be the impact of fifth generation computers on:
- a. Foreign trade?
 - b. World leadership in computing?
 - c. Productivity?
 - d. Employment?

Answer

The answer to (a) of this question depends on who takes the lead in fifth generation computers: the Japanese or the Americans. If the Japanese meet their stated goal and develop fifth generation computers in the 1990s before the Americans do, in all likelihood U.S. exports (in computers) will suffer as our trading partners will turn to the Japanese for the latest in computer technology. Not only foreign trade, but U.S. world leadership in computing will suffer (b). As for productivity (c), there should not be much increase even if the United States develops a fifth generation computer first (at least not in the short run), since supercomputers would be used largely by governments and large firms (like Exxon and Bechtel) in research. However, if the artificial intelligence features of fifth generation computers are adopted by micros and main frames, then there will be an improvement in productivity. If Japanese fifth generation computers invade the U.S. market, employment will decrease (d).

DISCUSSION QUESTIONS

1. What is an operating system? Why is it sometimes called the "underwear" system to the hardware and software system?

Answer

The operating system is a group of programs that monitor and control all input/output and processing operations. Programs that make up the operating system are usually developed by computer manufacturers and supplied to organizations purchasing their systems. Operating programs are designed to make the best possible use of the components in any given computer system. Thus, an operating program that is effective for one type of system may be totally unusable on the equipment of another manufacturer.

The objectives of operating software are to maximize efficiency of operations, minimize human intervention, and facilitate the task of the programmer in accessing data and/or peripheral equipment. Because the operating system must be in the computer before any manipulation of data can occur, it could be said to "undergird" any computer process. Like human underwear, it is a hidden support system, unseen but effective and valuable.

2. What is the difference between a natural language, such as English, and a formal programming language? Under what circumstances would it be desirable for programming languages to approach natural languages?

Answer

It first seems appropriate to define a natural language. It is the set of signs and symbols, verbal or written, which make up the means of communication between humans. One example of this, of course, is the English language. A formal programming language, on the other hand, is a strictly defined set of written symbols which enable communication between man and machine. If machine language is considered the lowest possible man-machine interface, then the programming language which most closely approaches natural language would be the highest form.

Because most humans communicate best with each other in a natural language, it seems logical that this would also be true of the link between a person and a computer. For instance, a manager would not need to learn a highly structured programming language in order to enter and retrieve data. He/she would simply carry on a dialog with the computer to formulate a problem and request a solution or more information. This method would also eliminate the need for a trained programmer to interpret (and possibly misinterpret) the user's needs for translation into a machine compatible program. Another possible application for a natural language link is for use in teaching English or any other human language. The computer could guide the user and correct when necessary.

Although there are obvious advantages in programming languages that simulate natural language, there is also evidence which shows that the full range of English, with all its diverse grammatical and syntactical subtleties, is too flexible for practical use. A formal query type language, many of which are currently available, may help structure and clarify the user's requests. Natural language with all its generalities and ambiguities can give the user a false sense of security when actually the computer has not correctly interpreted the user's meaning. Obviously, much more research needs to be done in this area.

3. Name two compiler-based languages used in business. How are they different? When would each be used?

Answer

COBOL and SIMSCRIPT are two compiler languages that are used in business. These two languages differ in several ways: (1) COBOL is comparatively easy to learn while SIMSCRIPT is quite difficult; (2) COBOL is fairly easy to read while SIMSCRIPT is of medium readability; and (3) COBOL is a rather machine independent language, whereas SIMSCRIPT is available from consulting companies.

COBOL, a leading business language, is used in many business applications. It has a sort of verb, elegant data structures, and better computational capability than other business languages. COBOL is used in such applications as payroll systems and address listing of employees.

SIMSCRIPT is also used in business but specifically for problems that involve probabilities which cannot be solved by models like those in linear programming or by regression equations. To answer questions such as "What if this variable were to change X percent?" one would use SIMSCRIPT. In other words, SIMSCRIPT simulates probable situations.

4. Which programming languages are most suitable for business applications? Give examples.

Answer

COBOL is a good business language. COBOL is easy to read since it is very English-like. It is also self-documenting. COBOL would be good for bank programs because a manager can easily learn to understand the logic of the programs.

RPG is a report generation language. It is easily available. RPG would be a good choice for a company with a large inventory (e.g., a book store) and a need to keep track of all available units.

Query-by-example is another good business language. It can simulate such things as the optimum number of tellers in a bank at a certain time or the average waiting time of customers at a gas station.

Other good query languages for businesses are QUEL and SEQUEL II. These come very close to natural languages. Of the interactive languages, GPSS is probably the best for queuing problems in simulation: it is easy to learn and easy to read.

5. What factors must be considered when selecting a programming language for a given specific business problem?

Answer

A programming language for any problem depends on availability, storage requirements, readability, documentation, and time to learn, write, validate, and execute. The type of problem can also affect the choice of language used. The most common language used for business applications is COBOL. However, if a scientific problem were encountered, FORTRAN, APL, ALGOL, APT, or ADAPT might be chosen. Simulation problems may be solved by using FORTRAN as well, but they are generally solved using languages such as GPSS and SIMSCRIPT.

6. Would software packages be more appropriate for small rather than large businesses? Why? What are the limitations of such software packages? What are some advantages?

Answer

Small businesses are likely to respond in a generalized manner to the reports that are demanded by management for decision making; furthermore, the volume of data processing that they do is small. Large businesses, on the other hand, are likely to process a large volume of data; and management requires specialized reports in different formats and varying levels of detail. Software packages are designed to offer a certain number of generalized reports for generalized application. Consequently, software packages would be more appropriate for small businesses.

One limitation is that most software is designed for specific hardware. The main advantages of these software packages are (1) lower expense than individual development; (2) fewer developing and debugging worries; and (3) less time stolen from other assignments.

7. What are the limitations of translator or compiler-based languages?

Answer

First, let us define translator languages and their functions. A translator is generally termed as any language processor that accepts programs in some source language (high level or low level) as input and produces functionally equivalent programs in another object language (high level or low level) as output. Examples of translators are compilers, assemblers, and loaders.

A limitation or disadvantage of translator language is connected with storage. Usually a single source statement expands during translation into many machine language instructions. Another limitation of translators is that some are unique to their environment.

8. When would it be appropriate for a businessperson to use:
- Spreadsheet?
 - SQL?
 - High level language?
 - Low level language?
 - Windows?

Answer

- A spreadsheet is designed for financial planning. But it can be used for all calculations that involve a matrix where one of the variables changes. This could well be in marketing, production, accounting, and even personnel management (e.g., to determine

changes over the next five years in salary structure should certain variables, like health benefits or taxes, rise).

- b. SQL is a high level language designed by IBM for use in a DBMS environment. It is supposed to be easy to use but it still requires the learning of user commands. Management at middle and top levels might find SQL useful for browsing a data base and quick retrieval of information though use requires matching and some Boolean calculations.
- c. High level languages, such as COBOL and RPG, are used in batch. APL is useful in an interactive mode by mathematically-oriented users. Pascal use is fashionable. BASIC is commonly used on micros.
- d. Low level languages are for systems programmers, not businesspersons.
- e. Windows enable a user to review the contents of two or more files on a CRT screen simultaneously. Changes can also be made to the files displayed.

DISCUSSION QUESTIONS

1. What is the difference between online and offline devices? Give three examples of each. What circumstances favor each?

Answer

Offline devices are not directly connected to the computer; the interface is part of the computer. Examples of offline devices are the card reader, card punch, and optical character recognition reader. Examples of online devices are the teletype, cathode ray tube, and POS terminals. If an immediate response is needed, online devices are appropriate. If 24 hour turnaround is sufficient, offline is adequate. If a job requires the generation of long, very detailed reports, an offline device may be appropriate. However, if output is only a line or two for each inquiry, an online device is convenient. Large input volume usually works best with offline devices whereas random access to small parts of records or files is better done online.

2. Compare OCR with MICR. Cite examples in business where each has a comparative advantage.

Answer

Magnetic Ink Character Recognition (MICR) involves the use of a machine that scans a pre-printed document for input to a computer. Typically the characters are nonalphabetic and are specifically shaped for reliable detection by the scanner. Optical character recognition (OCR) on the other hand does not require preprinted forms or abnormally shaped characters. It has the advantage of permitting direct input to the computer from OCR type documents. OCR is generally not as fast as MICR nor as reliable. However, it has the distinct advantage of recognizing regular type fonts and is therefore much more versatile for general business use.

MICR has potential applications in business for handling special documents such as checks. It is used to advantage in banks where a standard for the characters has been agreed upon. OCR has been slow to develop because there is no accepted standard for character fonts. So many different character fonts and different character sets exist that it is very difficult for businesses to commit to using OCR. However, its uses in business are potentially so many that its future is promising. It is particularly useful for business correspondence and document input to the computer.

3. Compare printers, CRTs, and COMs as computer output devices. Cite business examples where each has the comparative advantage. Explain.

Answer

Printer:

- Media-hard copy
- Function-printed output
- Advantages-speed, low cost
- Disadvantages-bulk of output
- Example-business reports

CRT:

- Media-soft display
- Function-keyboard input/output
- Advantages-convenience
- Disadvantages-limited display, no hard copy
- Example-bank balance reference

COM:

- Media-microfilm/fiche
- Function-archival output
- Advantages-storage size
- Disadvantages-special equipment
- Example-library reference

Each of these three has specific comparative advantages and all three are useful. To explain, I shall use the example of a system in a savings and loan firm which has all three means of output devices. The advantage of printer hard copy is that it can provide a statement of account to the customer which he or she can easily read and understand. The CRT can be used as a quick reference to tell someone his current balance. And COM can be easily stored to verify the fact that a certain account earned a specific amount of interest during the previous year.

4. Compare typewriter terminals and CRTs as I/O devices. Under what conditions would one be more desirable than the other?

Answer

Typewriter terminals are much slower than CRTs. They are limited to the operator's typing speed and teletype speed. Typewriter terminals don't have a cursor to move around in text as CRTs do. However, CRTs need extra hardware to operate and thus cost more. CRTs can eliminate the use of paper, but if a printer is wanted, an extra cost is again incurred. CRTs can display tables, charts, and designs while maintaining more control over image manipulation than typewriter terminals. Instead of being limited to a keyboard, the CRT operator can use joysticks, bit maps, blinking characters, reverse video characters, zooming, scaling, and multiple windows.

One big advantage of the typewriter terminal over the CRT is simply that people are accustomed to its keyboard and unwilling to change to another mode for input. Users also feel limited by the CRT's display capability.

5. When would voice input and voice output be appropriate? Why is voice recognition equipment limited in use at the present time?

Answer

Voice input and output would be extremely useful in situations where a third hand is needed (e.g., mail sorting when both hands are busy). Voice input and output would be advantageous in an emergency situation like an accident where a paramedic needs both hands to work on an injured victim. Handicapped persons could benefit greatly from the use of voice input and output. Another use might be as a language translator; one language could be used as input, and another voice could give the translation and pronunciation as output. Voice recognition may be used for security access in some cases.

The major difficulty with voice input and output is the problem of pattern recognition. A person's voice may change because of mood, time, or health conditions. For obvious reasons the equipment is rather expensive.

6. How are checks processed in a modern bank using computers? What special equipment and input characteristics are required?

Answer

Modern banks using computers process checks via a Magnetic Ink Character Reader (MICR). The checks are preprinted and specify the bank customer account number and other vital information. The character set is a universal one and is used by all banks which process checks in this manner. This type of check processing requires a special reader for the character set and standard print styles.

7. What peripherals would you use for an OLRT system in a large firm with a diversified set of sources for raw materials, many products, and a variety of production processes?

Answer

Since the system is OLRT and diversified, a network of CRT terminals would be chosen. Each terminal would be on a full duplex channel to permit simultaneous transmission in both directions. All the channels would be hooked to a multiplexer in order to combine multiple lines from the terminals and to accommodate each of the terminals on its own channel. Modems are obviously necessary for conversion of analog/digital signals.

To reduce the effect of breakdown, I would establish an interconnected network processing system which utilized a front-end processor primarily to alleviate the CPU of its teleprocessing responsibilities. Some other benefits of the front-end processor would be message switching between terminals, acceptance of messages from local lines, mixed communication modes of transmission, and performance of stand-alone data processing when the teleprocessing load is low or absent. I would also have a COM device for large reports used infrequently and a printer for short permanent display forms. Finally, I would install a colorgraphic plotter to display analytical or statistical data as a management tool for decision making.

8. Are peripherals essential to the operation of a computer? Do they contribute to the performance of a computer? What is the proportion of peripheral cost to the total cost of hardware?

Answer

The peripherals are one of the most important parts of a computer. They provide the main access for input, output, and storage. Peripherals also account for major portions of the total cost. In fact, their share may be as much as 90% of the total.

9. What developments in the peripheral industry are expected in the next few years? What is the main obstacle to peripheral technological advance?

Answer

Peripherals are one of the main causes of bottlenecks in computer time. However, peripheral speed will be greatly increased in the future. Storage peripherals will be enhanced to be able to store more information in a smaller space. CRTs are going to become more versatile in use. Even though the CRT will be able to do more, its cost will drop. Overall the main advancement in peripheral development will be in speed.

The lack of standards seems to be the main obstacle to peripheral advance. Without set standards, peripherals like OCRs, which could speed up office work, cannot be implemented. A standard is needed for character design. We can see what standards can do for development when we look at the advances in software. By standardizing COBOL and FORTRAN, we have portable software and efficient design. We need to "speak" the same language, and that is what standards provide.

10. How can a manager benefit from the following features?

- (a) Paging.
- (b) Zooming.
- (c) Refreshing.
- (d) Scaling.

Answer

- (a) Paging is a desirable feature when large amounts of memory need to be accessed from internal storage (e.g., a manager who is referring repeatedly to many pages of a large manual).
- (b) Zooming is a graphic capability. It lets a user focus on a part of a screen and enlarges that part. It is useful for designers using CAD.
- (c) Refreshing is important to a manager who wishes to keep images on the screen for long reference periods.
- (d) Scaling is another useful graphic capability used in CAD. It enables designers to enlarge or make smaller any part of an image on the screen.