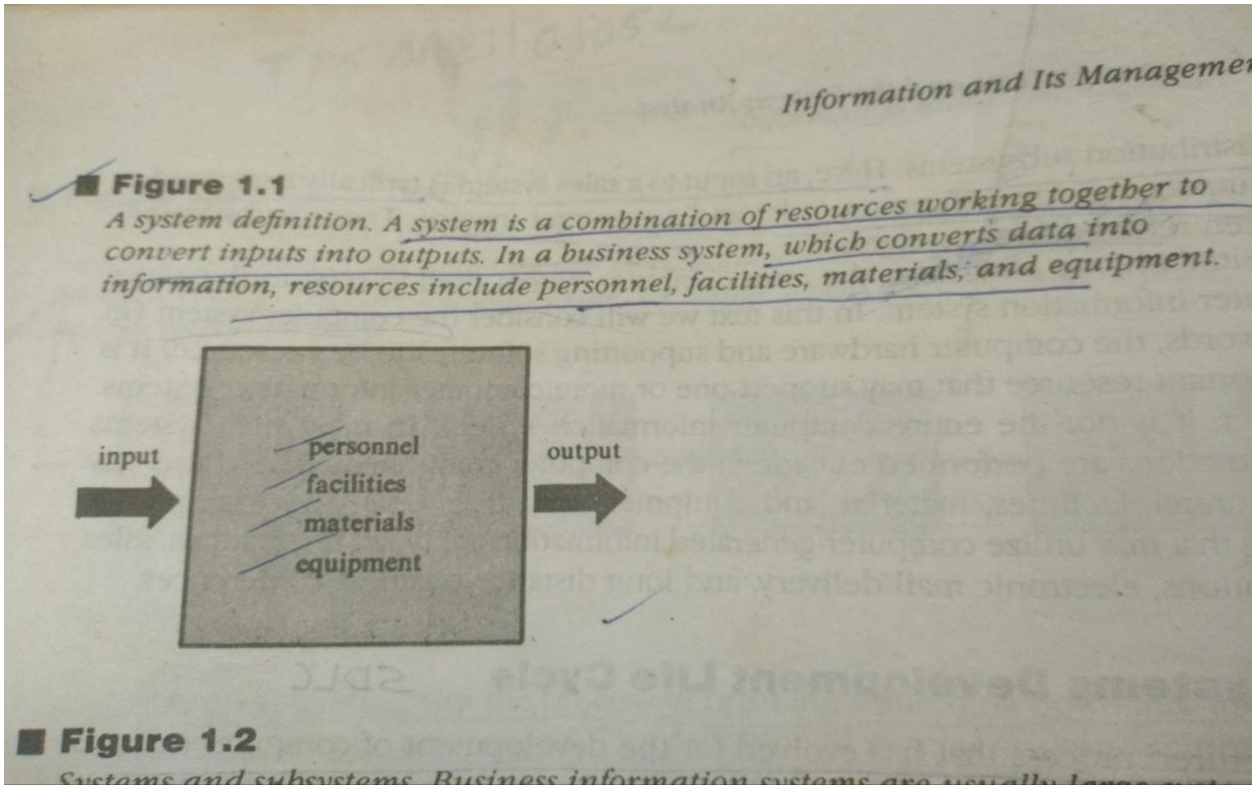
MODULE 1

SYSTEM

System is a combination of resources working together to convert input in to out put

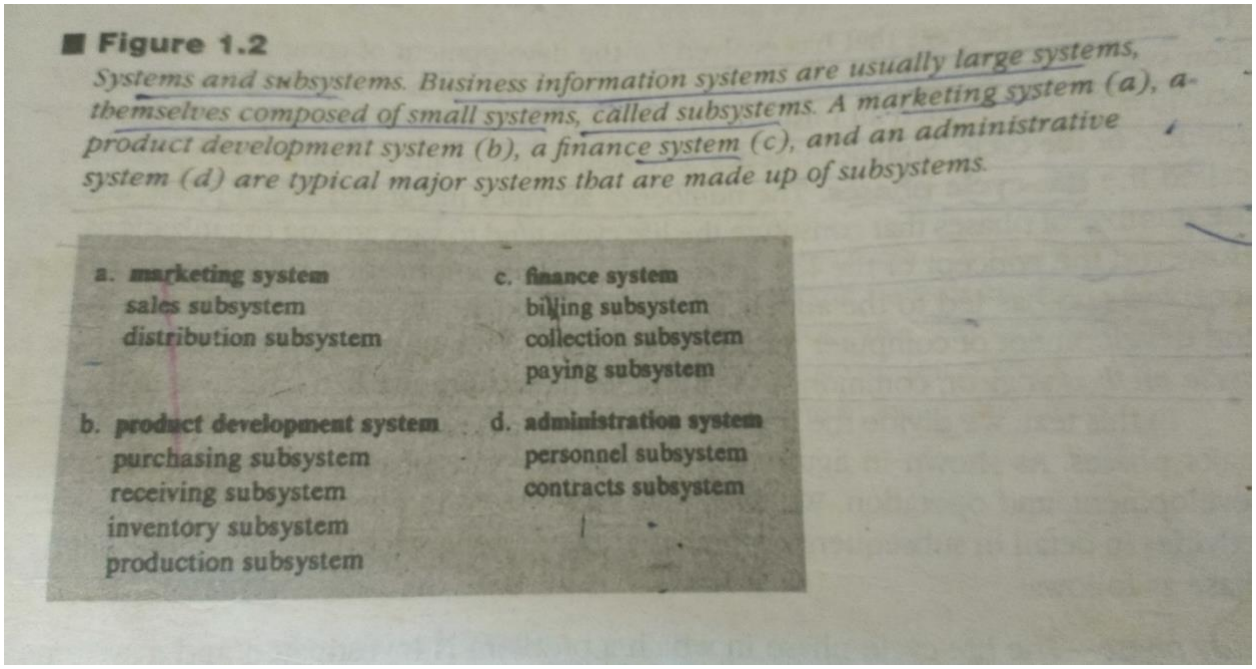
eg:marketing system



Sub system

Large systems are composed of small systems called sub system

eg:Marketing system consists of small subsystems like sales subsystem and distribution sub system



BUSINESS INFORMATION SYSTEM(BIS)

It is a system that uses resources to convert data into the information needed to accomplish the purpose of the business.

Eg: Retail store system that convert sales transaction data in to information needed to prepare customer billing, manage inventory, and calculate profit and loss.

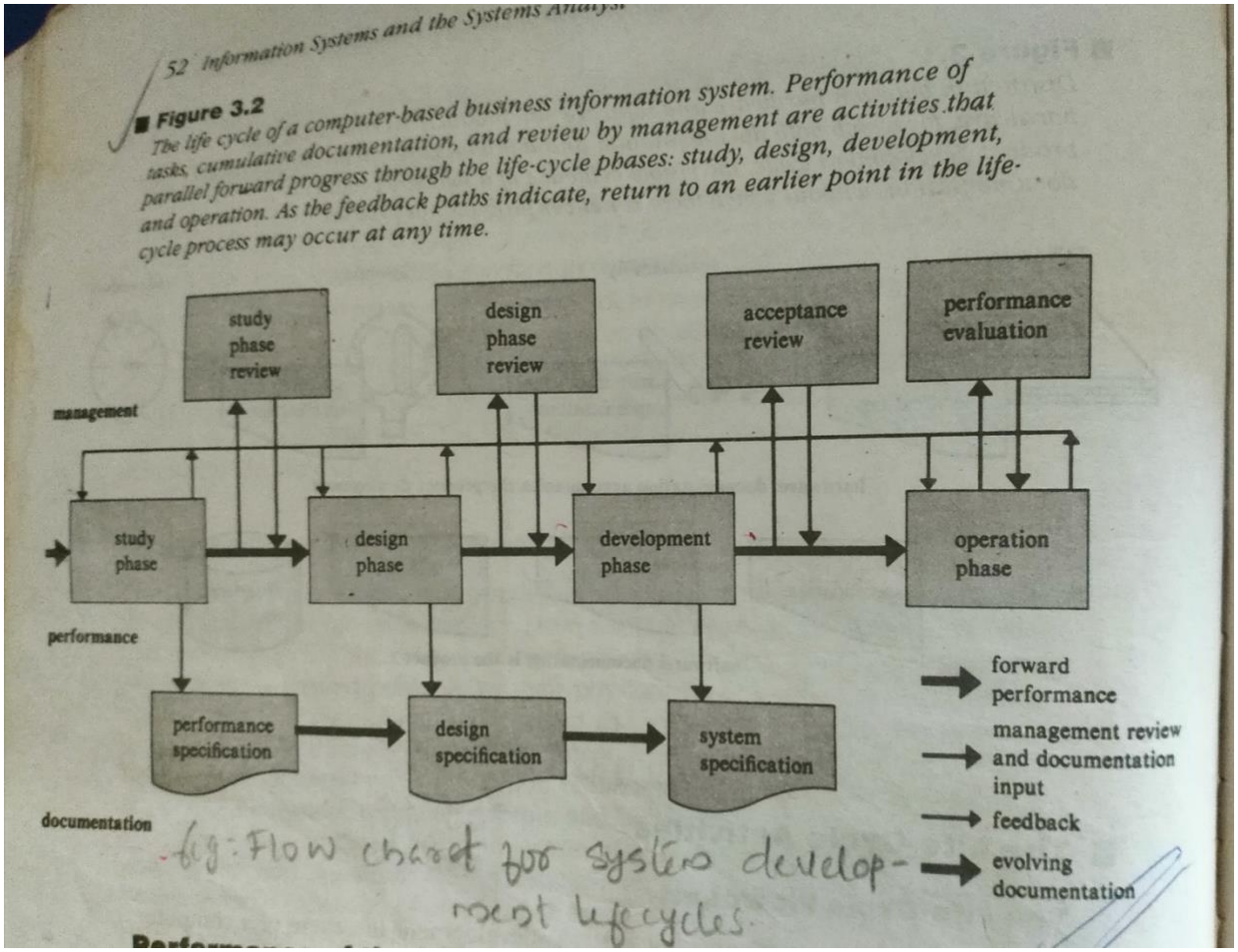
COMPUTER INFORMATION SYSTEM(CIS)

Computer based business information system is called CIS.

THE SYSTEM DEVELOPMENT LIFE CYCLE

Significant sequence of necessary and important activities through which all business information system must pass during their existence or lifecycle. The number of activities integrated into a phases called the lifecycle phases.

A project oriented lifecycle based approach to the design and development of computer information systems is called System development life cycle.



The different phases are

- Study phase
  This is the phase in which a problem is identified and analysed,alternate solutions studied,and a system recommendation made at general design level.
- The design phase
  In this phase in which detailed design of the system selected in the study phase is accomplished. In the case of a computer based business system, design phase activities include the allocation of resources to equipment tasks, personnel tasks, and computer program tasks. In the design phase ,the technical specifications are prepared for the performance of allocated resources.
- The development phase
  This is the phase in which the computer based system is constructed from the specifications prepared in the design phase. Equipment is acquired and installed during the development phase. Computer programs are written. All necessary procedures ,manuals, software

specifications and other documentation are completed. The staff is trained, and the complete system is tested for operational readiness.

- The operation phase

  In this phase ,the new system is installed or there is a changeover from the old system to the new system. The new system is operated and maintained. Its performance reviewed, and changes in it are managed.

Management review of the lifecycle activities

Management review of the lifecycle activities may occur at any time. The conclusion of each phase is natural time for a major management review. They are essential to a structured interaction between the system analyst and the user, ensuring user involvement at critical decision points. Three types of decision forth coming at each review

- Proceed to next phase
- Cancel the project
- Redo certain parts of previous phase

Documenting the computer based business information system

Base line specifications

It is a reference document for system maintenance and change. The principal baseline specifications are

- Performance specification
- Design specification
- System specification

Performance specification

Completed at the conclusion of the study phase, and describing in the language of the user exactly what the system is to do.

Design specification

Completed at the conclusion of the design phase, and describing in the language of the programmer how to develop the system.

System specification

Completed at the conclusion of the development phase and containing all of the critical system documentation. It is the basis for all manuals and procedures.

System analysis

System analysis is a general term that refers to a structured process for identifying and solving problems

System analyst

A system analyst is an individual who performs systems analysis during any,or all of the lifecycle phases of a business information system.

BUSINESS SYSTEM CHARACTERISTICS

A business information system is a system that uses resources to convert data into information in order to accomplish the purpose of a business. We classified these resources are personnel,facilities,materials,and equipment

The purpose of business can be defined interns of goals and objectives

- Goal

  A goal is a broadly stated purpose.

  Examples are the goal of making profit and the goal of educating students.

- Objectives

  Objectives are concrete and specific accomplishments necessary to the achievement of goals.

  Examples

  1)An automobile manufacturer must have as an objective the production of a competitive product in order to achieve a profit goal

  2)A college must have an objective relevant curriculum in order to achieve its educational goal.

DESCRIBING BUSINESS ORGANIZATION

Organization chart

- A flow chart that identifies organizational elements of a business and displays areas of responsibility and lines of authority

- It structured as a series of superior subordinate relationships

USES OF ORGANIZATION CHART

- Reviewing functions performed by major elements of the company
- Aligning corporate structure with business opportunities
- Comparing salaries, authority and organizational size at equivalent and subordinate levels

The standard means for presenting an organization chart is a flow chart that uses lines to connect rectangles identifying individuals and functions. As indicated in figure authority can be delegated downward, but responsibility must flow upward. It also displays characteristic aspect of this type of organization-the expansion into successively subordinate levels, using the connecting elements as link pins. In this example the vice presidents, the directors, and the managers are link pins.

Figure 2.5

Basic superior-subordinate relationship. Most business organization charts are structured as a series of superior-subordinate relationships. Rectangles identify positions and functions; lines and arrowheads indicate the downward flow of authority and the upward flow of responsibility.

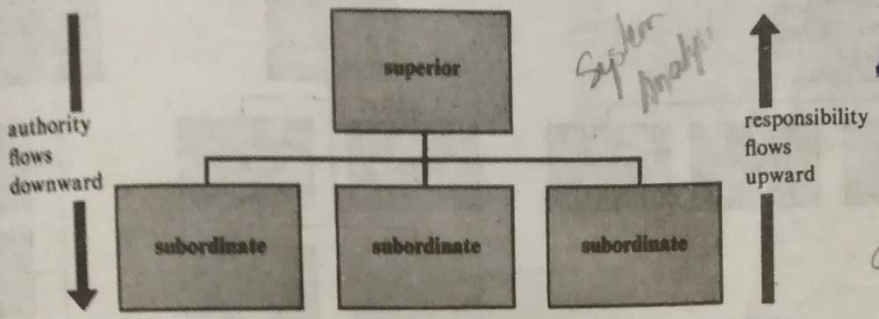
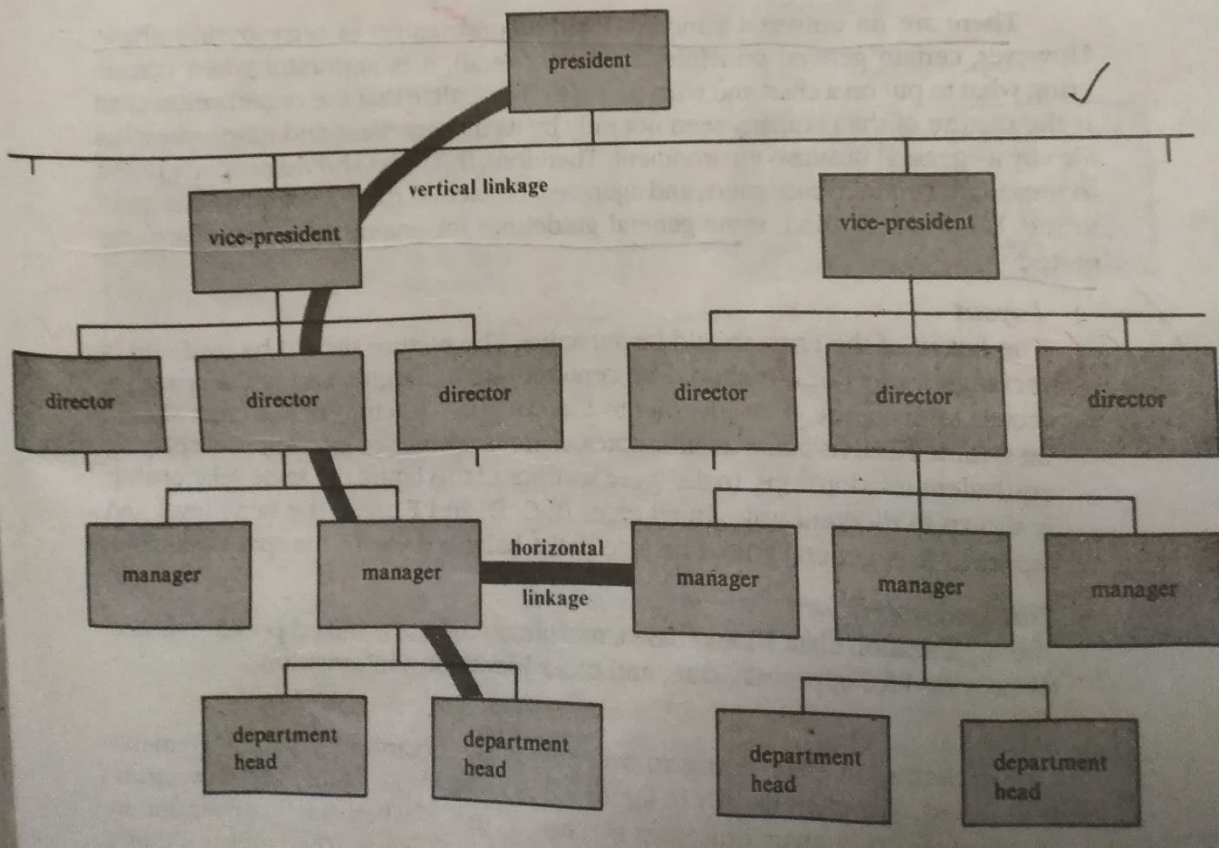


Figure 2.6

Organization chart. Organization charts can be expanded to display linkages between successive levels. Positions for which both a superior and subordinate reporting relationship are shown are called link pins. On this chart, the link pin positions are president, director, and management.



The general guidelines for organization chart

Some general guidelines for drawing organization chart are

1.layout

- The layout of the chart should be attractive. The picture should be made up of lines and rectangles.

2.Title and approvals

- The organization chart should have a meaningful title. A standard position should have a meaningful title. A standard position should be provided for approvals,date,and other identifying information.

3 Scope

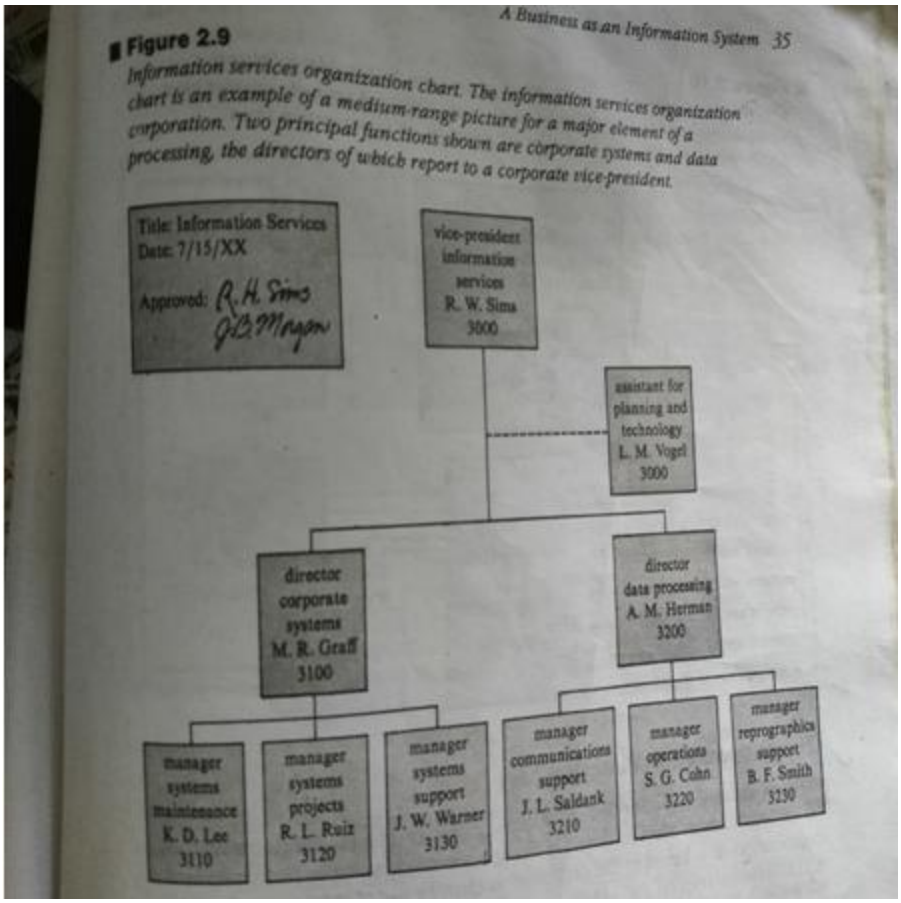
One organization chart giving an overview of the organization's main elements is required..

4 Organization chart distribution

- The overview organization chart should be distributed to top management and to all operating officers of the business . it should be available to customers and to employees who express an interest in the general organization of the company.

5 information provided

- Each organizational rectangle on the chart should contain a title with functional significance, the name of the individual in that position, and an identifying organization number.



ORGANIZATION FUNCTION LIST

- Organization function list is a document prepared for each organization shown on an organization chart to describe the specific major activities performed by that organization

■ Figure 2.10

Organization function list. An organization function list provides information about the major activities performed by an organization. A separate organization function list is prepared for each element shown on an organization chart.

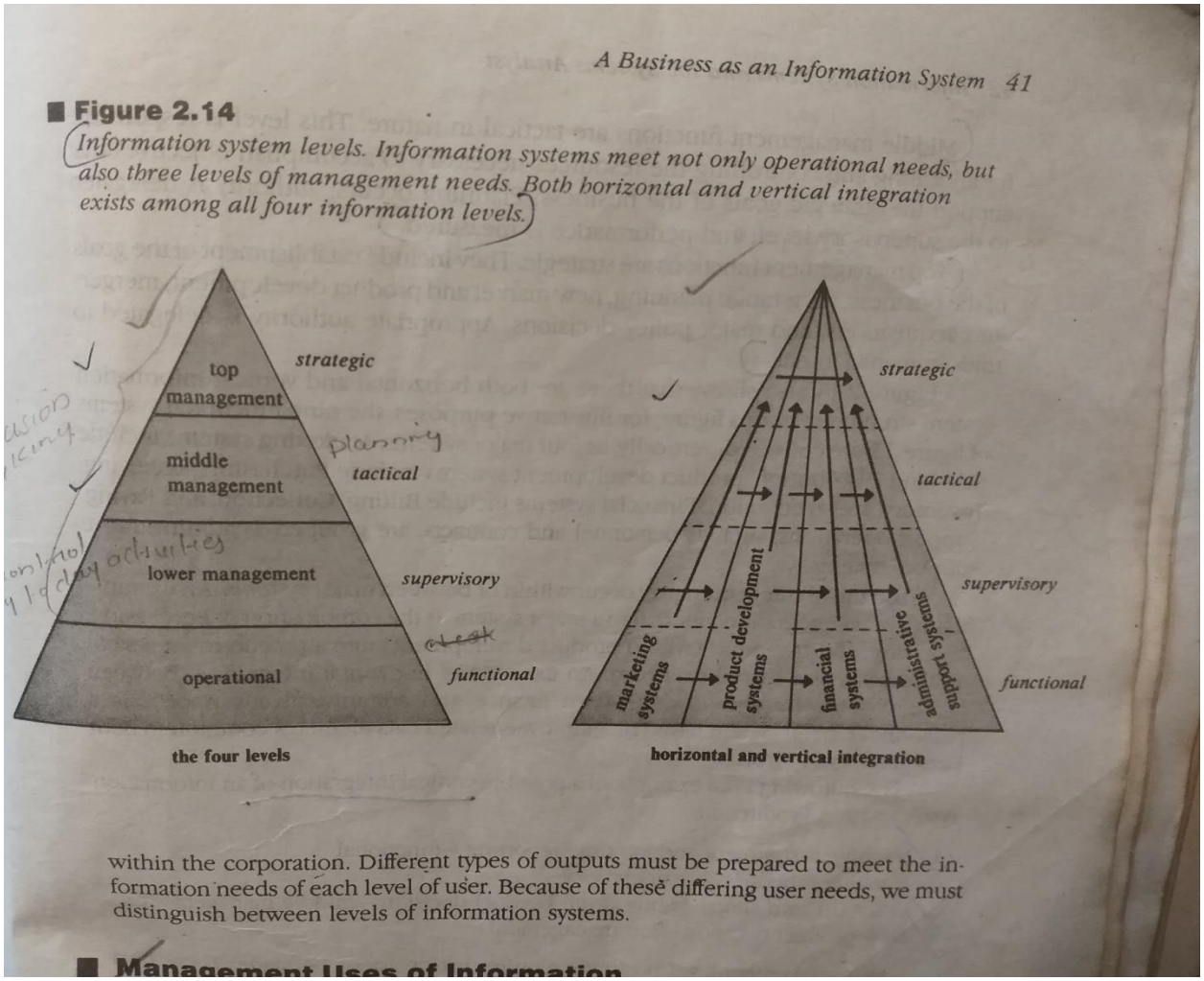
Organization Function List
Systems Support Department
Department Number: 3130
Date: 6/15/XX
Approved:

J. W. Warner

M. R. Graff

1. designs and controls forms
2. manages and retains records
3. performs work measurement studies
4. prepares and maintains organization charts
5. analyzes reports
6. writes policies and procedures

Information system levels



A Business as an Information System 41

■ **Figure 2.14**

Information system levels. Information systems meet not only operational needs, but also three levels of management needs. Both horizontal and vertical integration exists among all four information levels.

within the corporation. Different types of outputs must be prepared to meet the information needs of each level of user. Because of these differing user needs, we must distinguish between levels of information systems.

■ **Management Uses of Information**

There are 4 levels of information systems that exist in typical business

- **Operational**

- Llower management
- Middle management
- Top management

- **Operational level**

- At the operational level ,routine production or clerical operations are performed
- Operational systems provide little feed back directly to employee

- **Lower management**

- Lower management performs supervisory functions that are short term relative to higher levels of management.
- They deals with day today job scheduling, checking results of operation and taking corrective actions.

- **Middle management**

- Its functions are tactical in nature
- This level is responsible for allocating and controlling the resources necessary to accomplish objectives that support strategic goals of business

- **Top management**

- Top management functions are strategic. They include establishment of goals of the business, long range planning, new market and development, mergers and acquisitions and major policy decisions

Example of vertical integration of information system

- Machine assignment and job time reporting-functional
- Machine scheduling-supervisory
- Make(in shop) or buy(from vendor)decision-middle management
- New product decision-top management

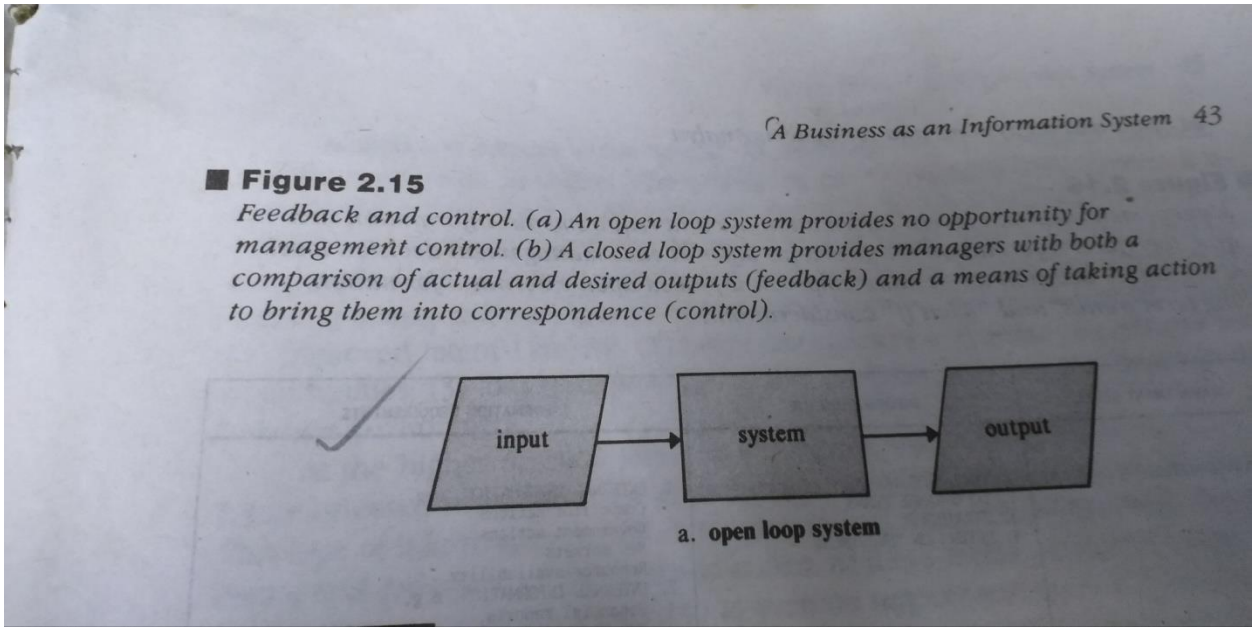
FEEDBACK AND CONTROL

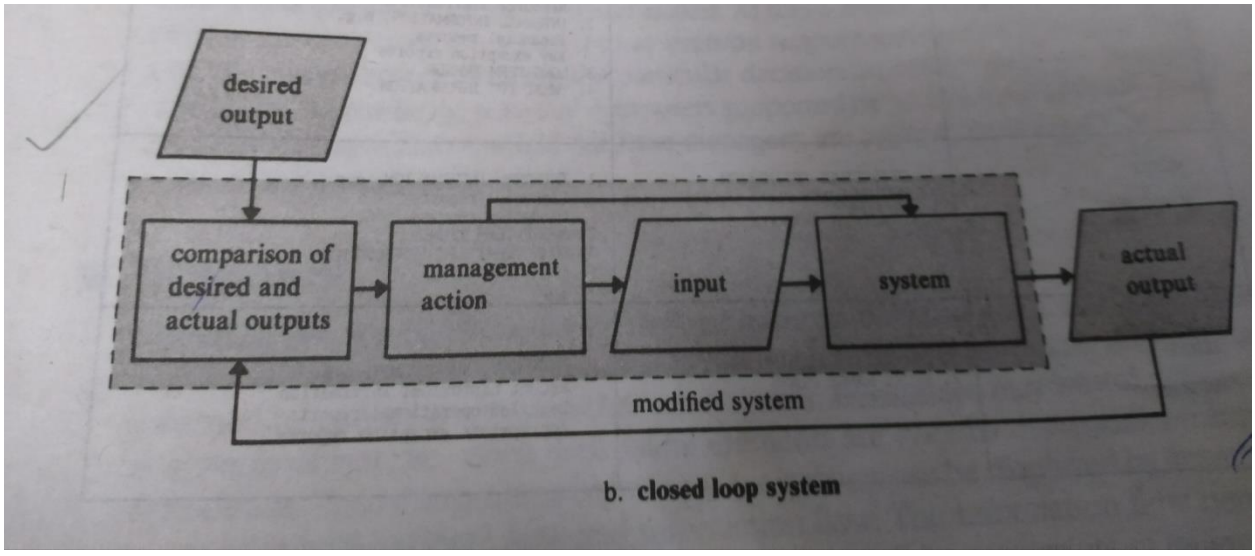
- Feedback

It is the process of comparing an actual output with a desired output for the purpose o f improving the performance of a system

- Control

It is the action taken to bring the difference between an actual output and a desired output within an acceptable range





Open loop system

- ❖ Open loop system does not have feedback and control.
- ❖ This system does transform an input into an output
- ❖ If the output is not satisfactory ,there is no provision for modifying either the system or input

Closed loop System

- A closed loop system provides managers with both a comparison of actual and desired outputs(feedback) and a means of taking action to bring them into correspondence(control)
- All true management system are closed loop system

CHARACTERISTICS OF COMPUTER INFORMATION SYSTEM

ACCURACY

- ▶ There is a greater potential for accuracy. Once the data are entered correctly in to the system in a machine readable format, it is not necessary to renter them. This reduces the chance of error by reducing the number of times humans are involved.

Data collection and communication

- ▶ Methods for collecting and communicating data are faster and more efficient. Modern computers allow data communication network to be established to collect data and to respond to inquiries.

Data storage

- ▶ In computer oriented system ,data are kept in masterfiles,usually magnetic, in a machine readable format. A collection of related files for a database.

Databases allow for the centralized storage of data, thereby eliminating the need for multiplicity of redundant files.

Speed of response

- Speed of response-the time required for information to become available-can be greatly improved by the use of computers.

ROLE OF SYSTEM ANALYST / FUNCTIONS OF SYSTEM ANALYSIS

- To analyse business system with problems and to design new or modified system to solve those problems
- To develop business system to meet new information or operational needs
- To prepare and maintain manuals to communicate company policies and procedures
- To design various business forms used to collect data and to distribute information
- To perform record management, including the distribution and use of reports
- To participate in the selection of information processing equipment and to establish standards for equipment selection
- To prepare and maintain business organization charts

Important questions

1. Define BIS
2. Define CIS
3. What are the characteristics of business organisation
4. Define system,subsystem,example

5. Explain SystemDevelopmentLifeCycle with figure
6. What are the characteristics of computer information system?
7. Define system analysis
8. Define system analyst.
9. What are the functions of system analyst?
10. What are the functions of system analysis?
11. What is organization chart? What are the uses of organization chart? Give example. What are the guidelines of organization chart
12. What is organization function list?
13. Explain information system levels
14. Explain feedback and control
15. Differentiate open loop system and closed loop system

MODULE 2

BASIC TOOLS FOR SYSTEM ANALYSIS

Basic tools for system analysis are

A. Identification code

B. Forms

A)Identification code

Identification code is a group of characters Used to identify a record of data

Eg:pincode,bank account numbers

While identification is the main function of a code, codes are also used to show relationship between similar records of data.

As an example ,a code might not only identify a particular employee but also indicate the department to which the employee assigned.

Code plan

The code plan identifies the particular characteristics that need to be contained within a code. After preparing a code plan ,the analyst recommends an appropriate coding method. The method selected must be

- Expandable

  The code must provide for reasonable growth in the number of assigned codes.
- Precise

  The code must identify the specific record
- Concise

  The code should be as brief as possible and still conform to the code plan
- Convenient

  The code must be easy to encode and decode
- Meaningful

  The code must be useful to the people dealing with it.
- operable

The code should be compatible with present and anticipated methods of data processing-manual or machine.

Code dictionary

To allow people to work easily with a code, it is often necessary to develop a code dictionary. A code dictionary is a listing of codes and their corresponding data item or the determination of the code for a particular data item

COMMON TYPES OF CODE

The different types of codes are

- Sequence code

  Simple sequence code

  Block sequence code

- Group classification code
- Significant digit code
- Alphanumeric code

  mnemonic code

  alphabetic derivation codes

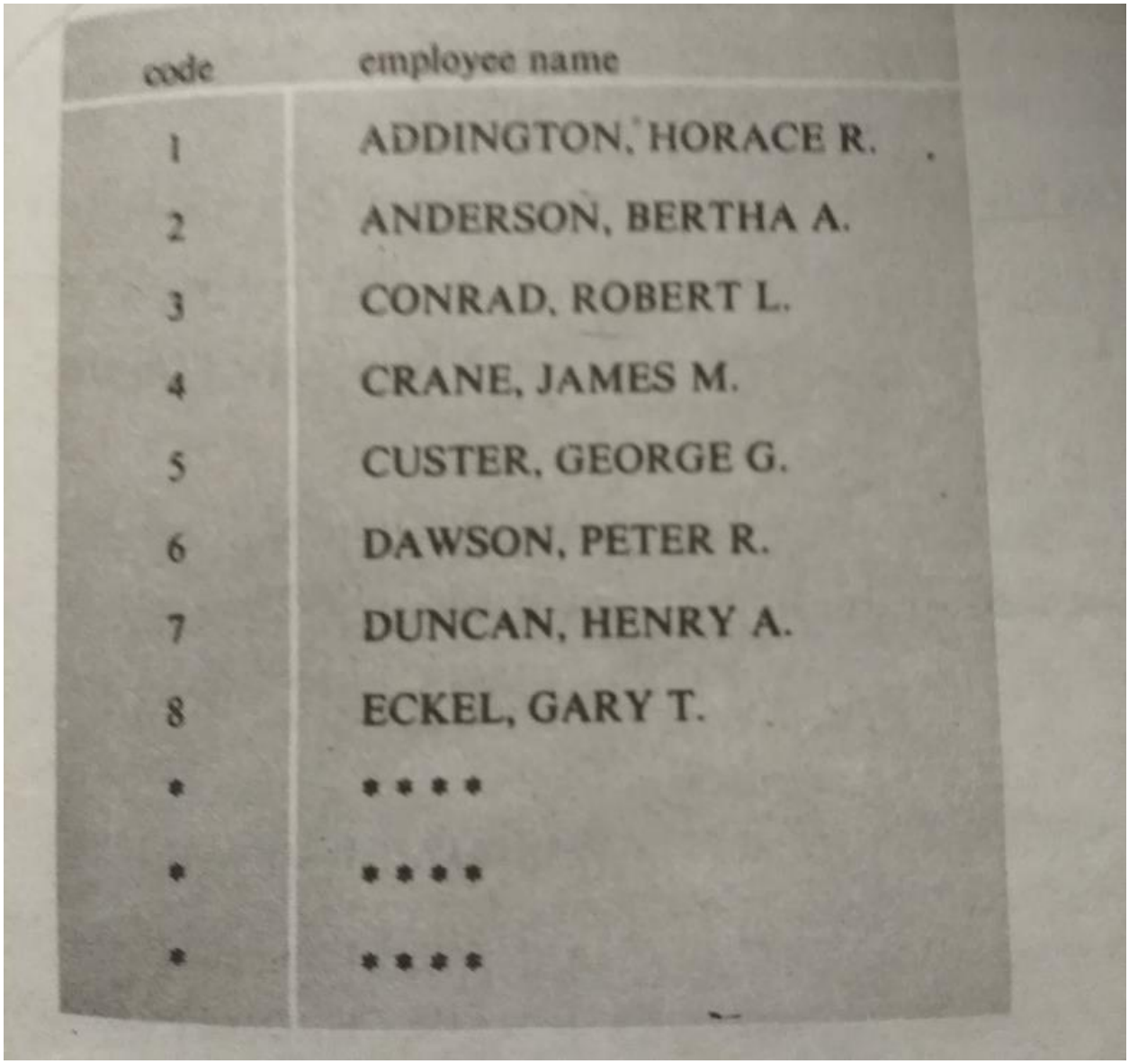
- Self checking code

1 Sequence code

- Simple sequence code

A sequence code has no relation to the characteristics of an item. The assignment of consecutive numbers ,for example 1,2,3……to a list of items as they occur is called a simple sequence code

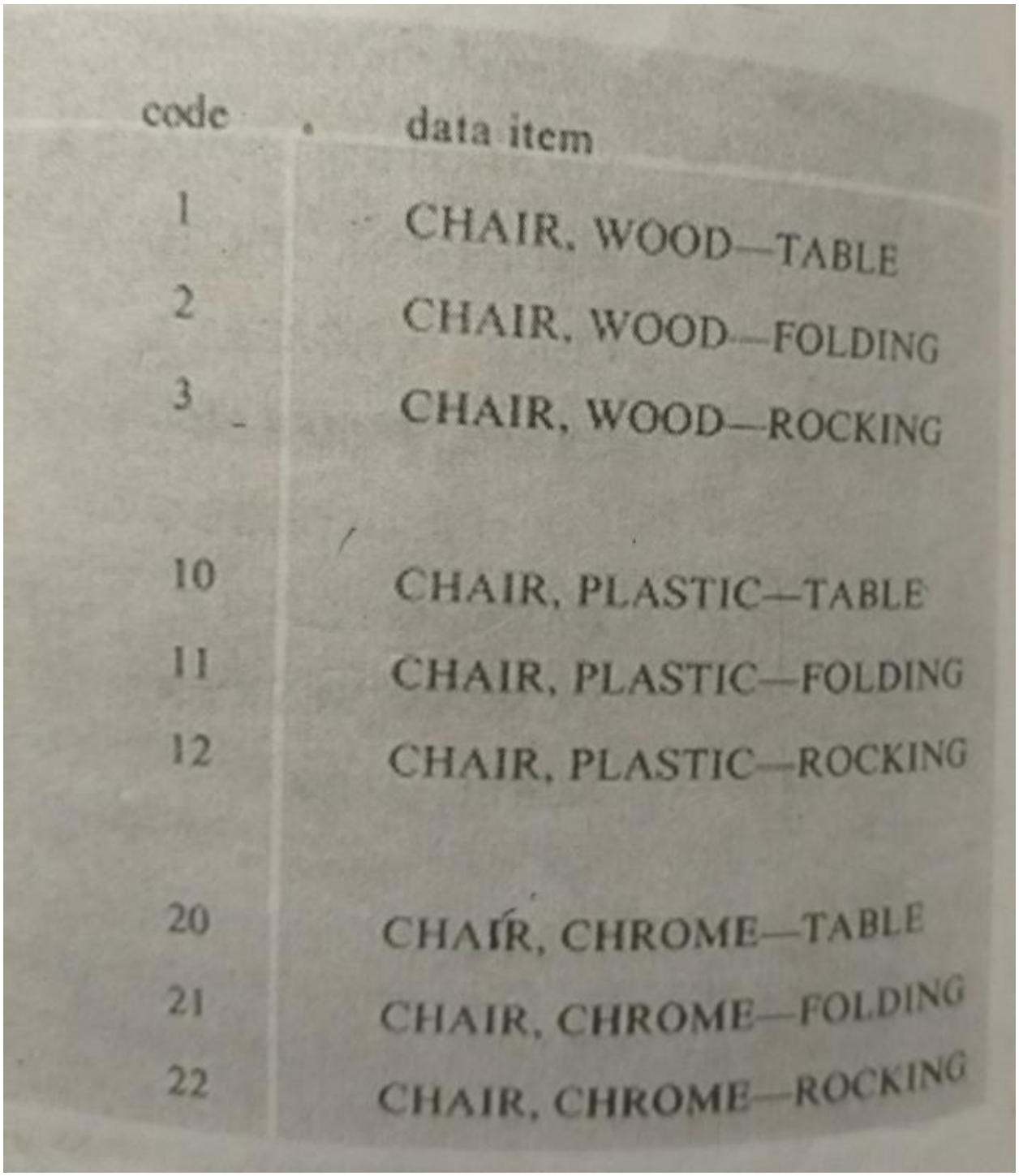
- Advantage-ability to code large number of items with the least number of code digits
- Disadvantage-limited amount of information it can convey



code	employee name
1	ADDINGTON, HORACE R.
2	ANDERSON, BERTHA A.
3	CONRAD, ROBERT L.
4	CRANE, JAMES M.
5	CUSTER, GEORGE G.
6	DAWSON, PETER R.
7	DUNCAN, HENRY A.
8	ECKEL, GARY T.
*	* * * *
*	* * * *
*	* * * *

Block sequence of code

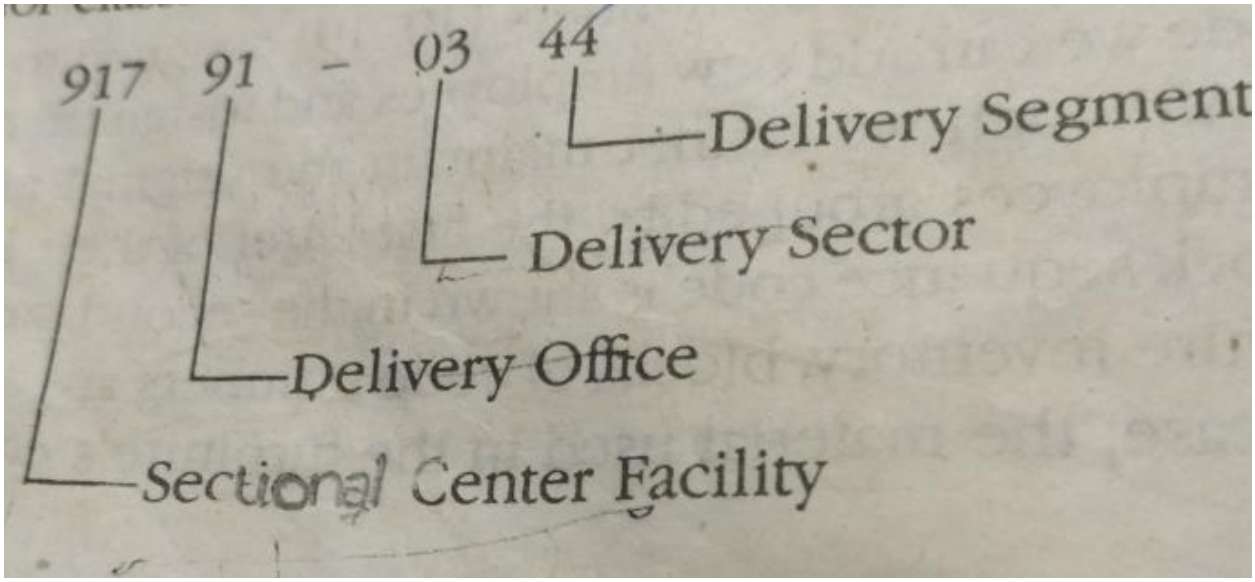
- This code is a modification of the sequence code that makes possible a more homogeneous collection of related items. In a block sequence code ,a series of consecutive numbers and/or letters is divided into blocks,each one reserved for identifying a group of items with a common characteristic



code	data item
1	CHAIR, WOOD—TABLE
2	CHAIR, WOOD—FOLDING
3	CHAIR, WOOD—ROCKING
10	CHAIR, PLASTIC—TABLE
11	CHAIR, PLASTIC—FOLDING
12	CHAIR, PLASTIC—ROCKING
20	CHAIR, CHROME—TABLE
21	CHAIR, CHROME—FOLDING
22	CHAIR, CHROME—ROCKING

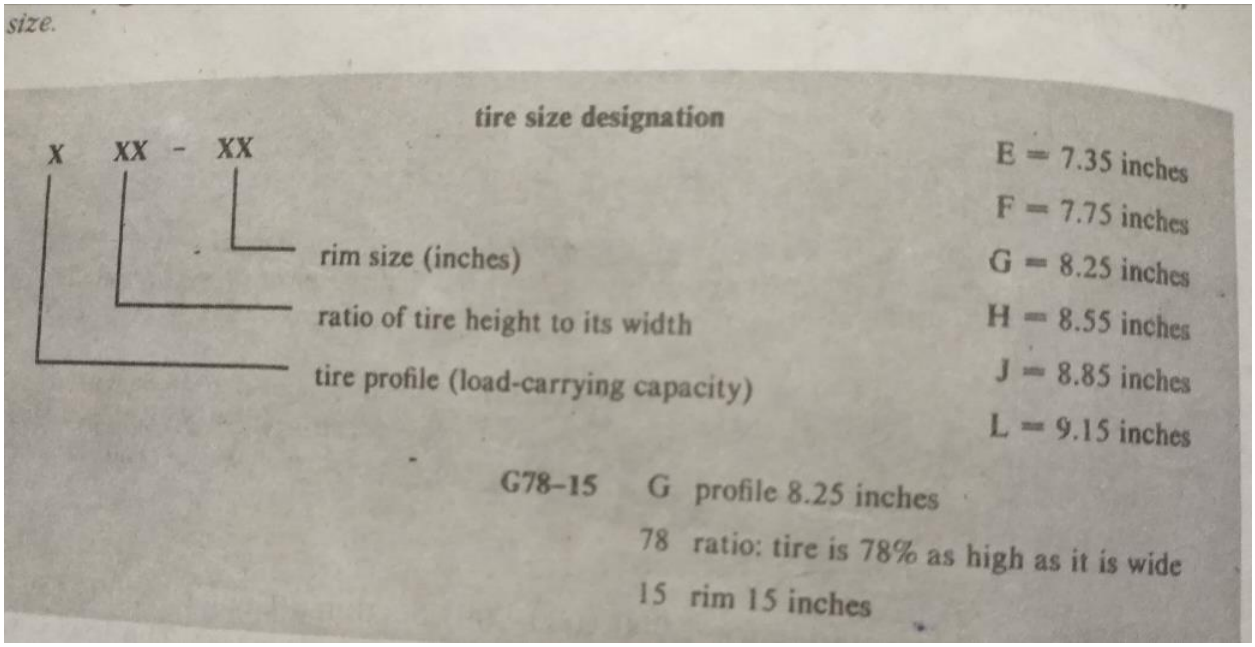
2 Group classification code

- The group classification code designates major,intermediate,and minor data classification by successively lower order of digits. This code type is useful when the item or information to be coded can be Brocken down in to sub classifications or sub divisions



3 Significant digit code

- A numeric code in which the numbers describe a measurable physical characteristic of an item. The characteristic may be weight,size,length,capacity,time or any other physically measurable attribute that is a part of code plan

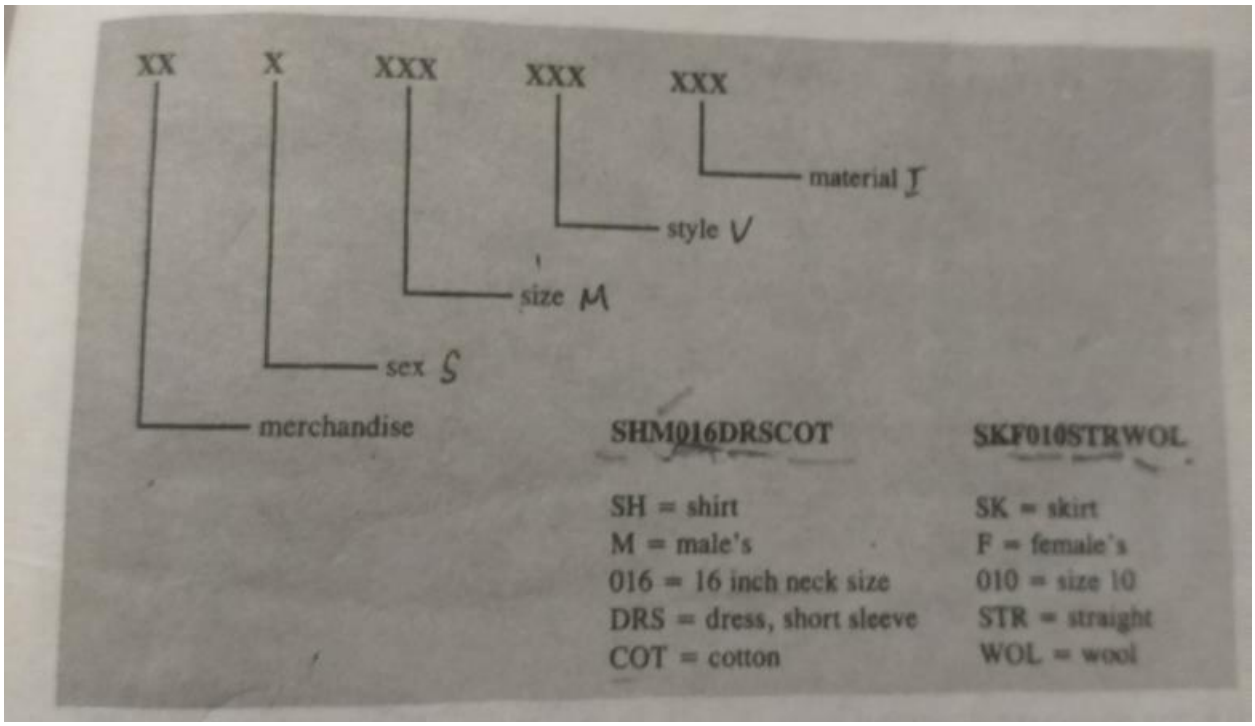


4 Alphanumeric code

- Alphanumeric code describes item by the use of letter and number combinations. There are two categories of alphanumeric codes: mnemonic code and alphabetic derivation codes

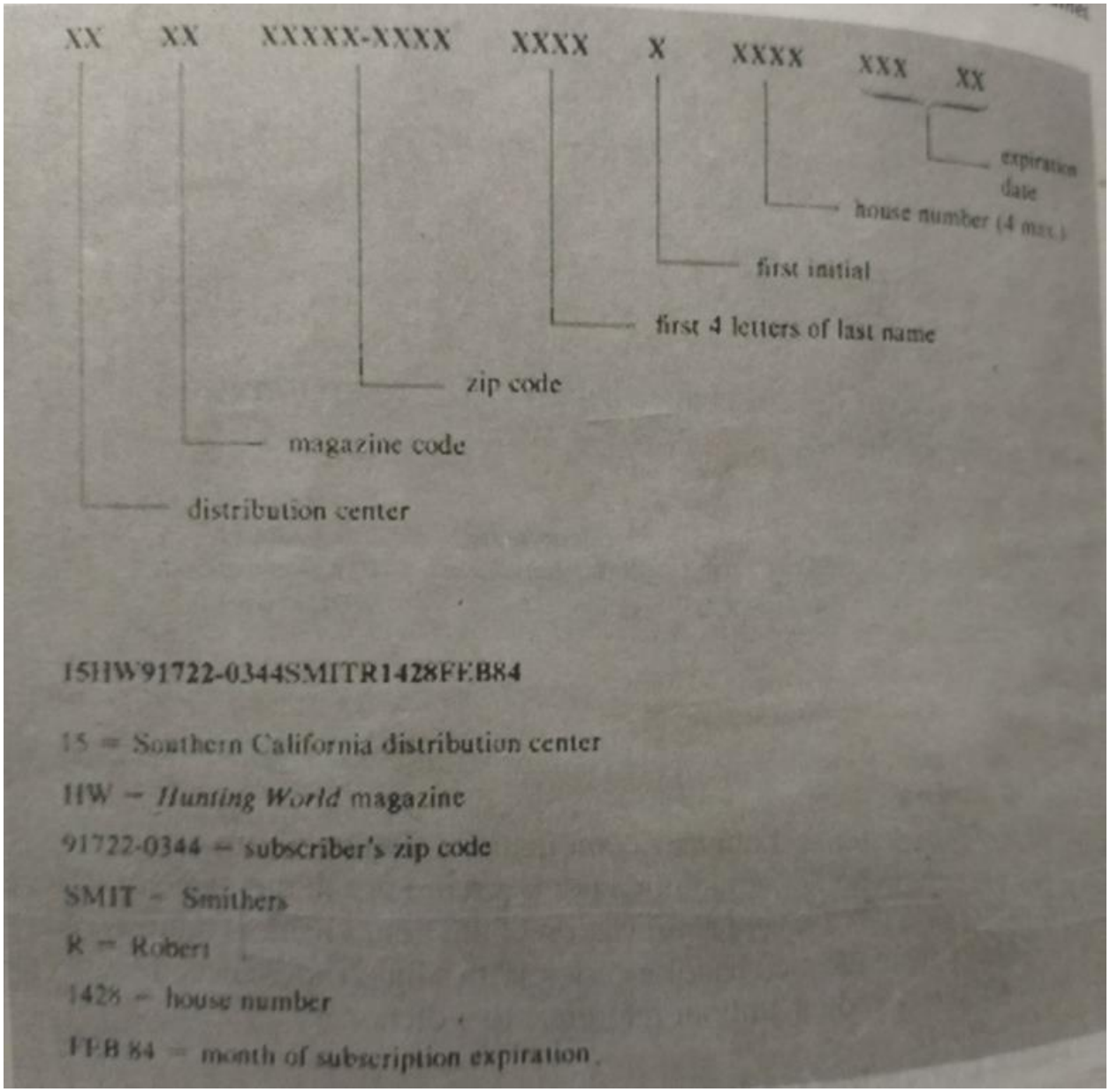
Mnemonic code

- Mnemonic codes are letter and number combinations obtained from descriptions of coded item. A mnemonic, or memory aid is a reminder of the name or description of an item



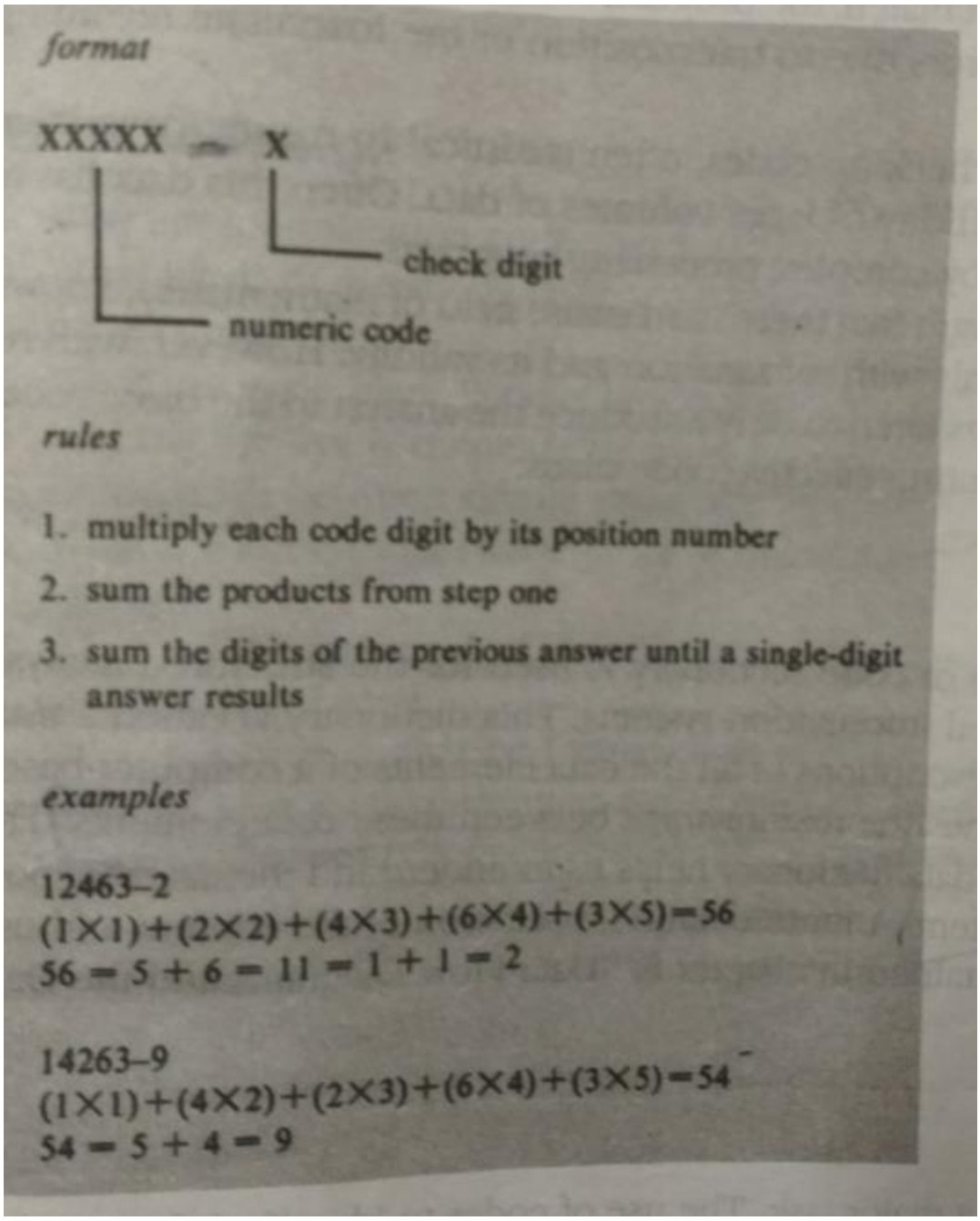
Alphabetic derivation codes

These codes are characters taken or derived from the name or description of coded item according to a set of rules. Alphabetic derivation codes are used to handle large volume lists that must be maintained and processed in sequence



5 Self checking code

- It uses a check digit to check the validity of the code. This type of code is an important means of controlling the validity of data that is being processed



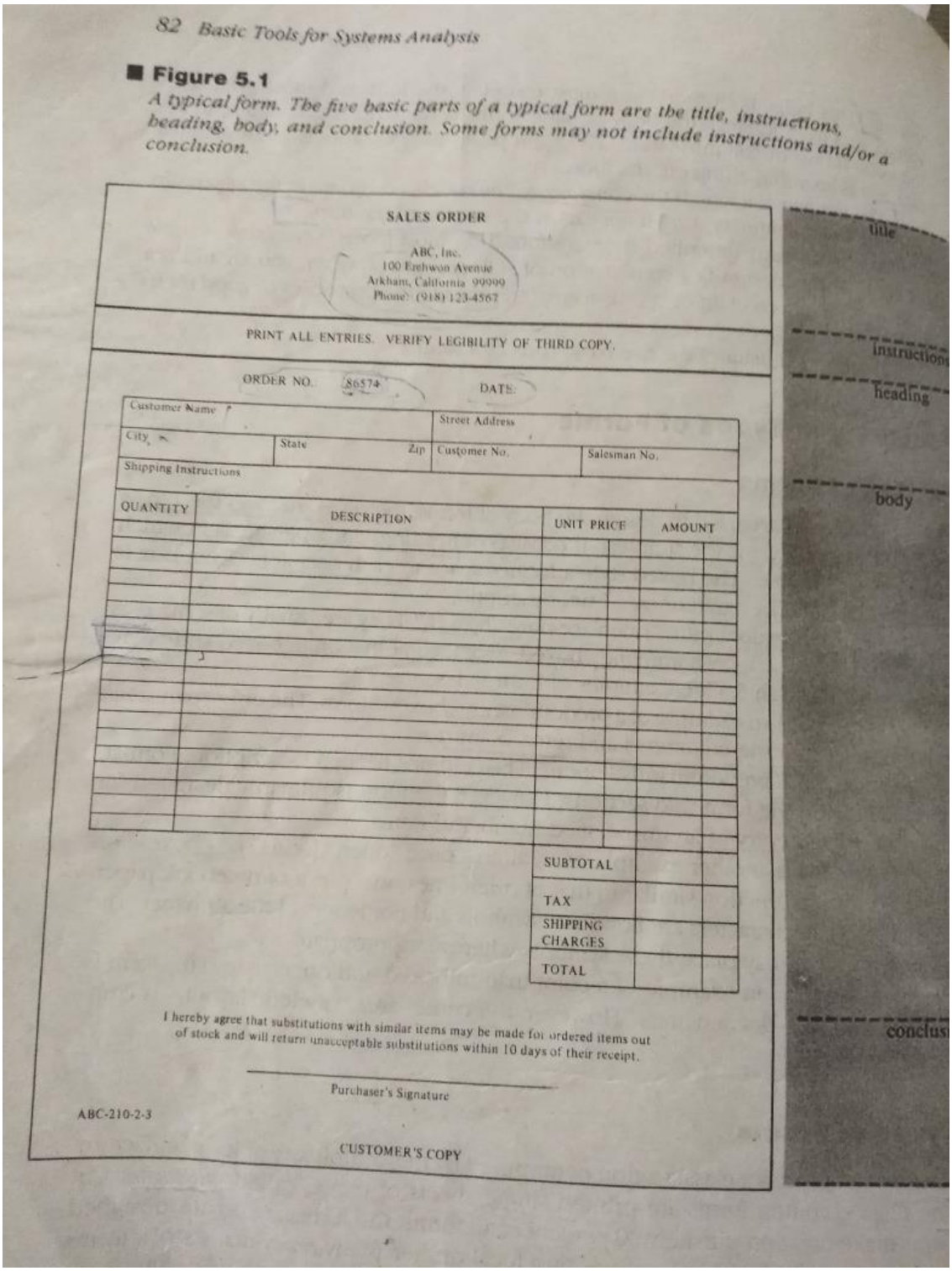
C) FORMS

The cost of collecting raw data and the cost of distributing processed information are two of the major cost of a system. Since much of the data that enters and leaves a system is recorded on forms ,forms design can greatly affect the cost effectiveness of system.

Basic parts of form

■ **Figure 5.1**

A typical form. The five basic parts of a typical form are the title, instructions, heading, body, and conclusion. Some forms may not include instructions and/or a conclusion.



SALES ORDER

ABC, Inc.
100 Erehwon Avenue
Arkham, California 99999
Phone: (918) 123-4567

PRINT ALL ENTRIES. VERIFY LEGIBILITY OF THIRD COPY.

ORDER NO. 86574 DATE:

Customer Name		Street Address	
City	State Zip	Customer No.	Salesman No.
Shipping Instructions			

QUANTITY	DESCRIPTION	UNIT PRICE	AMOUNT
		SUBTOTAL	
		TAX	
		SHIPPING CHARGES	
		TOTAL	

I hereby agree that substitutions with similar items may be made for ordered items out of stock and will return unacceptable substitutions within 10 days of their receipt.

Purchaser's Signature

ABC-210-2-3

CUSTOMER'S COPY

title

instructions

heading

body

conclusi

- **Title**

✓ Title idea identifies the form

✓ . It should be as descriptive and as brief as possible.

✓ The title usually is cenred at the top of the form

✓ Eamples are "Purchase Order." "Memo," and "Sales Order."

- **Instructions**

✓ Instructions tell how to complete or use the form

✓ general institutions should be at the beginning of the form, instructions should be placed so that they are seen before the form is completed

- **heading**

✓ Contains all the general identification data, For example, it might include the date, form sequence number, name, and address. The heading data is necessary to record identification purposes. All data used for reference filing is contained in the heading. The heading often is separated from the remainder of the form by ruled lines or by a box drawn around it

- **Body**

✓ The specific data the form was designed to collect is called the body of the form.

- **Conclusions**

✓ The conclusion contains the approvals, signatures, and summary data

Styles and Types of Forms

Styles of form

Two basic styles are used to design body of the system

- ## Open style

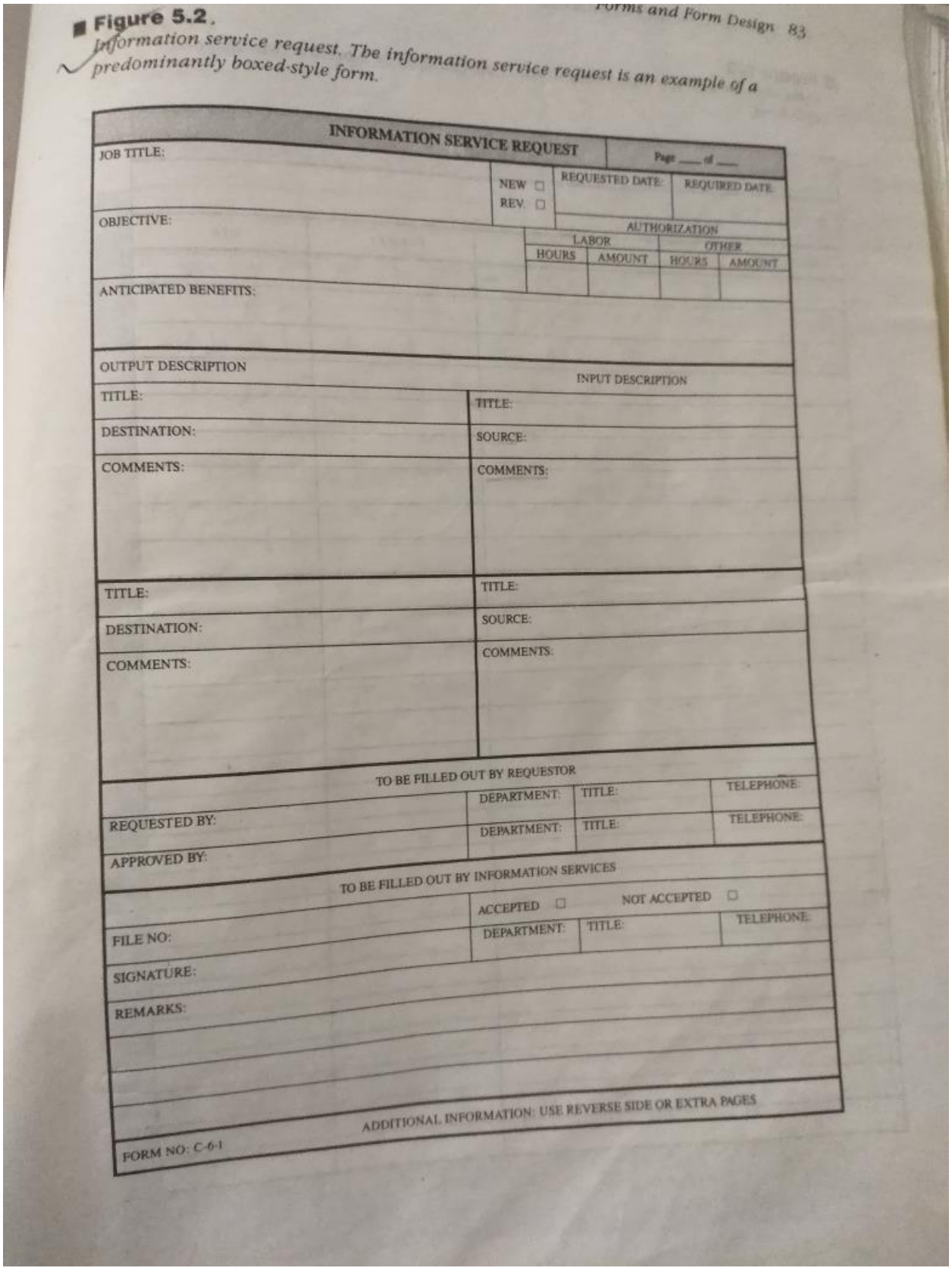
The open style is the and the simplest. It consist of heading and open as which data can be entered.

- ## Box style

The box style allocates space to each data item. Each box is clearly identified by name or by a

brief description.

Figure 5.2.
Information service request. The information service request is an example of a predominantly boxed-style form.



INFORMATION SERVICE REQUEST Page ___ of ___

JOB TITLE: | NEW ☐ REV. ☐ | REQUESTED DATE: | REQUIRED DATE:

OBJECTIVE: | AUTHORIZATION: LABOR HOURS | LABOR AMOUNT | OTHER HOURS | OTHER AMOUNT

ANTICIPATED BENEFITS:

OUTPUT DESCRIPTION	INPUT DESCRIPTION
TITLE:	TITLE:
DESTINATION:	SOURCE:
COMMENTS:	COMMENTS:
TITLE:	TITLE:
DESTINATION:	SOURCE:
COMMENTS:	COMMENTS:

TO BE FILLED OUT BY REQUESTOR

REQUESTED BY:	DEPARTMENT:	TITLE:	TELEPHONE:
APPROVED BY:	DEPARTMENT:	TITLE:	TELEPHONE:

TO BE FILLED OUT BY INFORMATION SERVICES

ACCEPTED ☐ NOT ACCEPTED ☐

FILE NO:	DEPARTMENT:	TITLE:	TELEPHONE:
SIGNATURE:			

REMARKS:

FORM NO: C-6-1 ADDITIONAL INFORMATION: USE REVERSE SIDE OR EXTRA PAGES

Form are seldom pure "open or pure "boxed." They are usually described predominantly open, predominantly boxed, or as a combination of boxed and open

DIFFERENT TYPES OF FORM

The type of form is a classification determined by the complexity of its manufacture

The different types of form are

- Cut forms
- Specialty form

  forms bound into books

  continues forms

  detachable stub sets

  mailers

CUT FORMS

Cut forms are printed single sheet of paper.

Cut forms are usually designed by the user and printed in house or by a local printer.

Several copies may be made in one writing by the use of carbon paper.

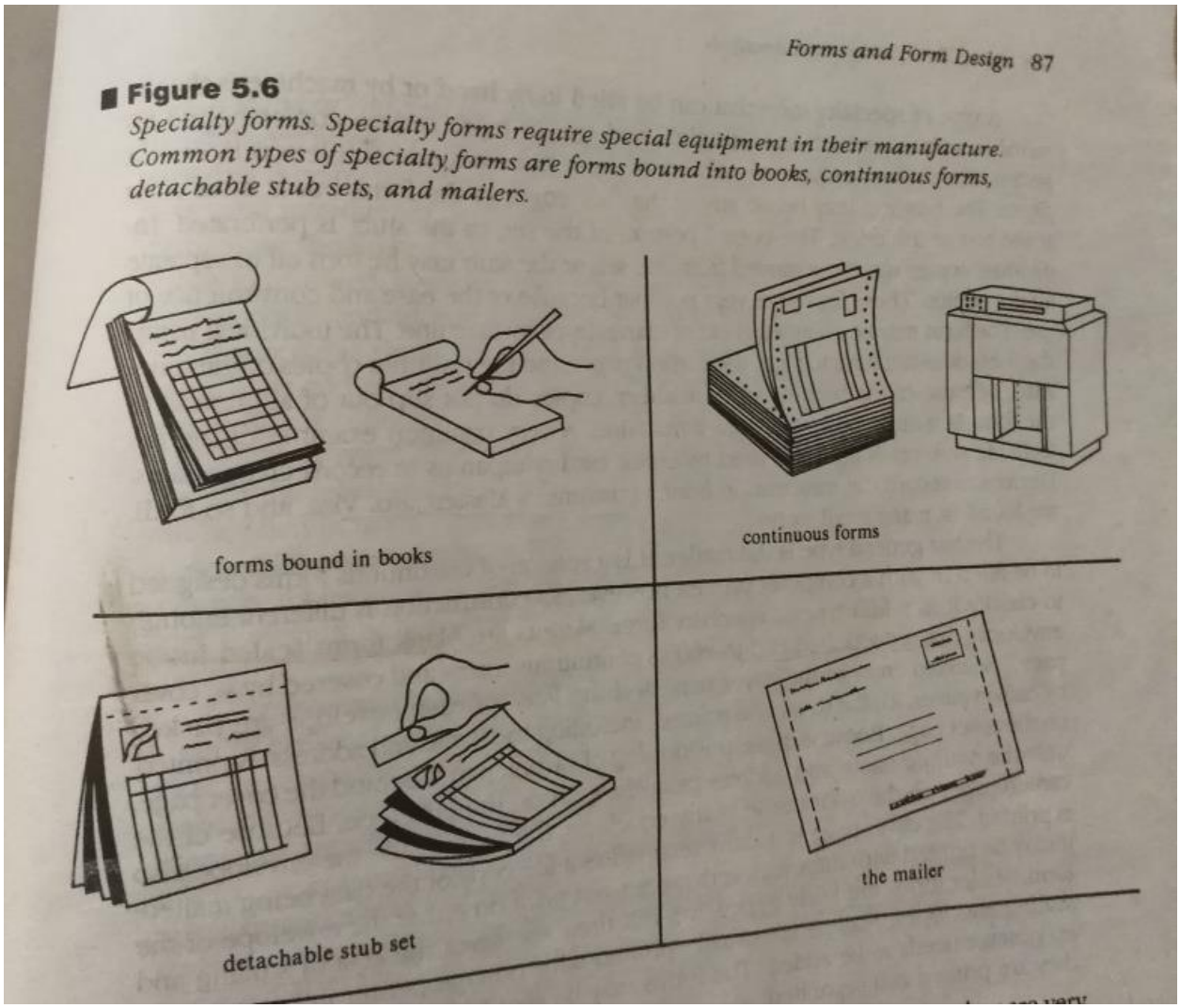
SPECIALTY FORMS

- Specialty forms are more complex.
- Examples are multiple copy forms, forms with special binding, and

  forms with special binding and forms designed to be completed with the use of a machine .
- Specialty forms are complex enough in their construction to require special equipment for their manufacture or use.

The types of specialty forms:

1. forms bound into books:
2. continuous forms
3. detachable stub set
4. mailers



Forms bound in to books

- The simplest specialty forms are those that are bound into books, they are very similar to padded cut forms except for a stronger binding. They are designed to be completed manually. Examples are sales books and receipt books.

Continuous forms

- Continuous forms are forms that are a series of pages attached end to end in a long continuous string. The most common examples of continuous forms are the forms used on computer printers. These forms may be single part (no carbon copies),or multiple part(with carbon copies)forms.

Detachable stub set

- A type of specialty form that can be filled in by hand or by machine is the detachable stub set, which is an original and one or more carbon copies bound together.
- The binding may be any of the four edges of the form, but is most often at the top or left edge
- The bound portion of the set, or the stub is perforated.
- A very common example detachable stub set is the form used by the credit card companies to record charge sales.

Mailers

- It is a version of continuous forms designed to be filled in with a computer printer.
- Mailers are blank forms sealed inside envelopes that are attached end to end as continuous forms and covered by a “cover page”.
- Mailer forms are fairly expensive, bur their use saves the cost of stuffing and sealing envelopes Mailers are usually printed with postage permit Information no postage needs to be added. The forms may be sent to the post office as soon as they are printed and separated.

Principles of Forms Design

Well designed business firms can increase clerical efficiency, improve work flow, and lower system. To evaluate a form's effectiveness, the analyst should keep four principles in mind

1. The form must be easy to fill out
2. The completed form must be easy to use in the system
3. The form should not collect data that will not be used in the system.
4. The form should not be unnecessarily expensive

Ease of Data Recording

Business for should be designed so that they can be filled out quickly and accurately. It is important that the analyst avoid errors induced by the form design.

Data items should be grouped in a logical pattern. Grouping requires fewer instructions and result in fewer errors.

Ease of Use

Sequence the data on the form in the order in which it is to be used.

The analyst should be aware of the ink and paper color combinations on the legibility and readability of the forms. Colored paper can be used to distinguish the various form and to aid in form distribution

Many businesses input source data into computerized systems with optical scanner. If optical scanning of forms is to be used, the analyst must consider character size and vertical spacing requirements. It is the analyst's responsibility to verify that the form layout is compatible with the scanner hardware

Required Data

The analysis should verify that all the data items requested on a form are required and actually used in the system. Many times data is collected on a form simply because it was collected on previous versions of the form. Data items not actually required waste the time of the person completing the form and clutter the form for those who use the data. Wasting clerical time adds unnecessary expense to the system.

Cost Considerations

- The cost of using a form are far greater than the costs of producing it .
- Design forms in a standard size.
- Print forms in standard quantities.

DATA DICTIONARY

- Data Dictionary- A particularly important type of code dictionary is used for the structured analysis and design of computer based information systems. This dictionary is called a data dictionary. It contains the descriptions of all the data elements of a computer-based information system and defines the relationships between these data elements.

System Flowcharts

Definition and Uses of Flowcharts

Definition of a Flowchart

Flowcharting is a graphic technique specifically developed for use in data processing. A **flowchart** is a pictorial representation that uses predefined symbols to describe data flow in a business system or the logic of a computer program.

Figure 9.1 is an example of a simple system flowchart. The symbols shown in this figure are "predefined"; their shapes identify data and communicate what is happening to it. In this example the top and bottom symbols represent input or output data. The middle symbol on the left is the process symbol; it represents the operation performed on input data to convert it into meaningful output. The symbol to the right of the process symbol depicts on-line storage that is available to the computer program. The words within each symbol provide additional information about each step. There are other important symbols that the systems analyst must know in order to make effective use of flowcharts. We will present these after introducing the principal uses of flowcharts.

Uses of Flowcharts

Flowcharts help the analyst to describe and communicate complex sets of data in three principal ways. These are: (1) analyze existing systems; (2) synthesize new systems; and (3) communicate with others.

The flowchart of an existing system enables the analyst to visualize the parts of the system and to record their functions. A *system flowchart* can compress many pages of written description into one informative picture.

Flowcharts help the analyst synthesize new systems. Each "candidate" system can be described quickly and effectively by an appropriate flowchart. Throughout the life cycle the analyst must be able to communicate effectively with users, with programmers (if computer programs are required), and with other analysts. Flowcharts are a powerful method for efficient internal communication since all persons involved can grasp their meaning quickly.

Flowcharts also are an effective method for communication with groups outside the company. External communication is most often accomplished through professional journals, seminars, or meetings with user groups. The user groups may be composed of companies in the same or related industries, or of companies with problems of a similar nature. Knowledge of what other companies have done to solve similar problems often is of great aid to the analyst in solving the company's problems.

Flowcharting Symbols

Standardization of Symbols

For communication to be improved by the use of symbols, the meaning of the symbols must be understood by all their users. Several groups have contributed to the standardization of flowchart symbols. National and international efforts to develop standard flowcharting symbols began in the early 1960s. The effort in the United States

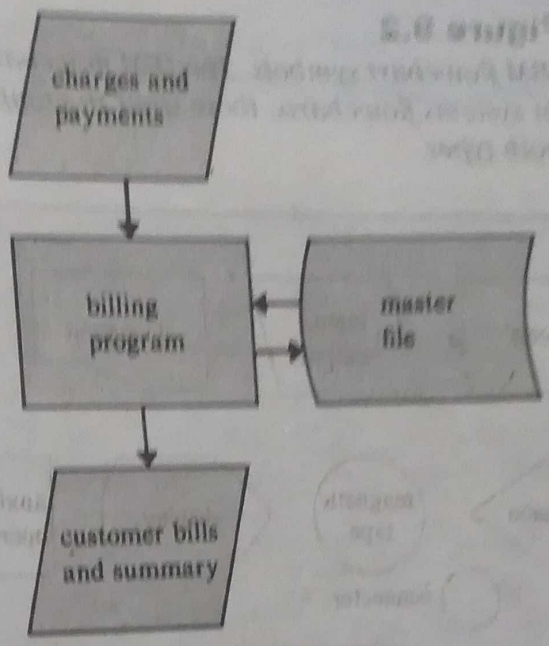


Figure 9.1
System flowchart. This system flowchart uses predefined symbol shapes to identify data and communicate what is happening to that data.

resulted in the set of symbols adopted by the American National Standards Institute (ANSI). The ANSI standard was developed through the combined efforts of professional associations, including the Association for Computing Machinery (ACM) and the Data Processing Management Association (DPMA). These symbols are a subset of those adopted as a result of the parallel efforts of an international group. This more extensive set of symbols is called the International Organization for Standardization (ISO) flowchart symbols.

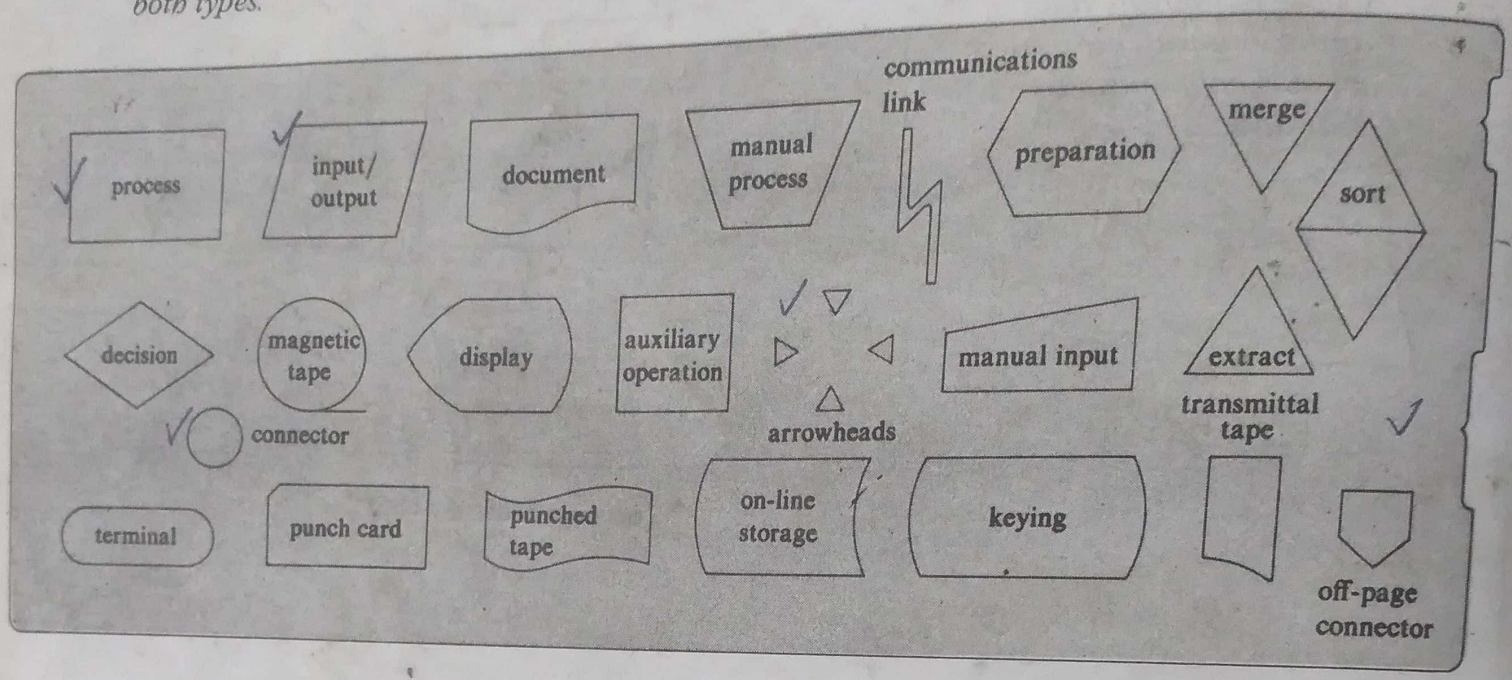
The ANSI-ISO standards are conformed to widely by the systems and programming professions. However, they have been augmented in areas in which additional symbols could improve clarity. In particular, the IBM Corporation has developed some additional symbols. Through the production and distribution of a useful plastic "template," IBM has achieved widespread acceptance of its set of symbols.[1] Hence, we use the IBM set of flowcharting symbols in this text.

IBM Flowcharting Symbols

Symbol Groups Figure 9.2 illustrates the outlines of the flowcharting symbols as they appear on the IBM template. Some of these symbols are used only in systems flowcharts; some are used only in computer program flowcharts; and some are used in both types. We will describe each group, with particular stress on those symbols used to prepare system flowcharts.

1. *Flowcharting Template*, Form GX20-8020 (White Plains, New York: IBM Corporation).

Figure 9.2
IBM flowchart symbols. The IBM flowcharting template includes symbols used only in systems flowcharts, those used in computer program flowcharts, and those used in both types.



Basic Symbols Figure 9.3 sh

Figure 9.3

Basic flowcharting symbols. Basic flowcharting symbols are used to draw both systems and programming flowcharts. The off-page connector is an IBM extension to the ANSI standard.

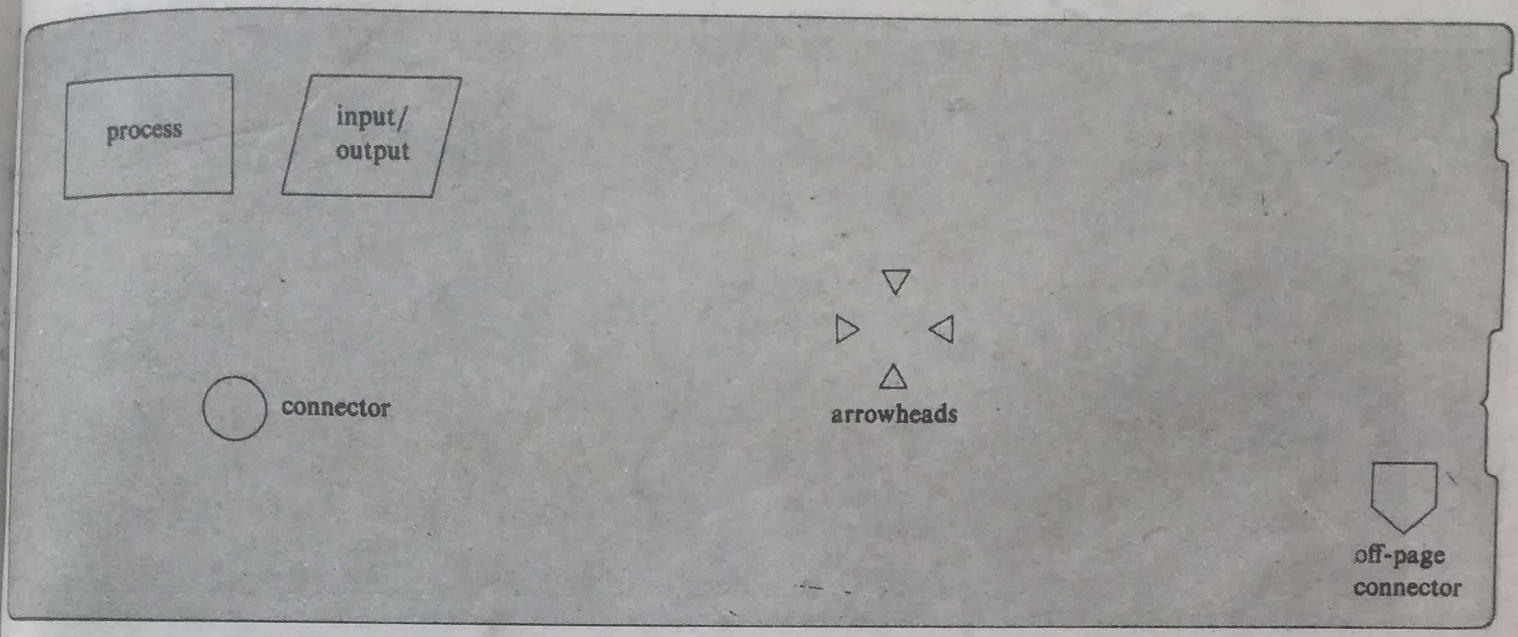
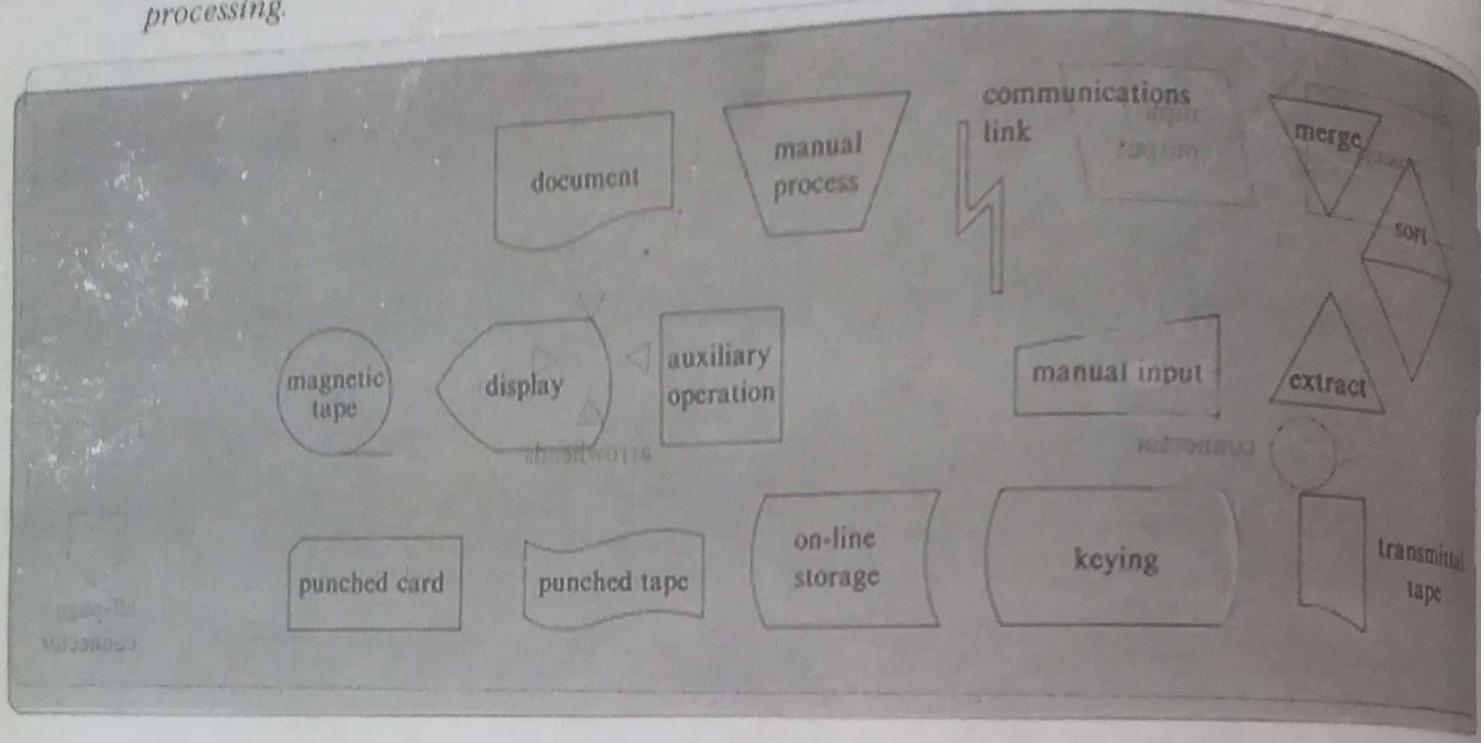


Figure 9.4

■ **Figure 9.5**
System flowcharting symbols. Systems flowcharting symbols, plus the basic symbols, are used to construct systems flowcharts. The system symbols consist of symbols for equipment, symbols for specialized input/output, and symbols to show specialized processing.



Symbols Related to Systems Fifteen symbol outlines are shown in figure 9.5. Additional symbols can be formed by combining or modifying the symbols shown in this figure. For ease of discussion, we will split the symbols into three groups, shown in separate figures:

1. Symbols for equipment (figure 9.6)
2. Specialized input/output symbols (figure 9.7)
3. Specialized processing symbols (figure 9.8)

Since each of these symbols represents a particular piece of equipment or implies some sort of physical description of the system, they are used to develop physical models rather than logical models of a system.

Figure 9.6 illustrates three symbols used to show specific types of equipment.

1. The communications link is used in place of a normal flowline to indicate that remotely located equipment is tied into the system through telephone lines, microwave transmitters, or other media. The communications link is commonly used in the description of modern distributed data processing (DDP) systems.
2. Off-line storage is used to show storage that is not accessible to the computer. For example, it is the symbol used to show the manual filing of data in a storage or file cabinet. It can also be used to indicate off-line computer storage, such as magnetic tape. It is a modification of the merge symbol.
3. On-line storage is storage that is accessible by a computer program as data are being processed. An example of on-line storage is the magnetic disk. This symbol is a generalized symbol and does not identify specific media.

Figure 9.6
Symbols for equipment. Symbols for equipment reflect particular hardware types to be used within the system. These types include communication link, off-line storage, and on-line storage.

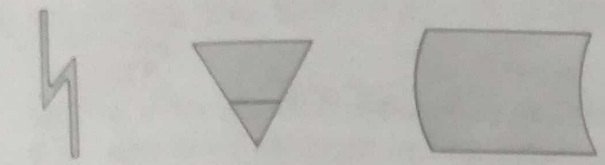
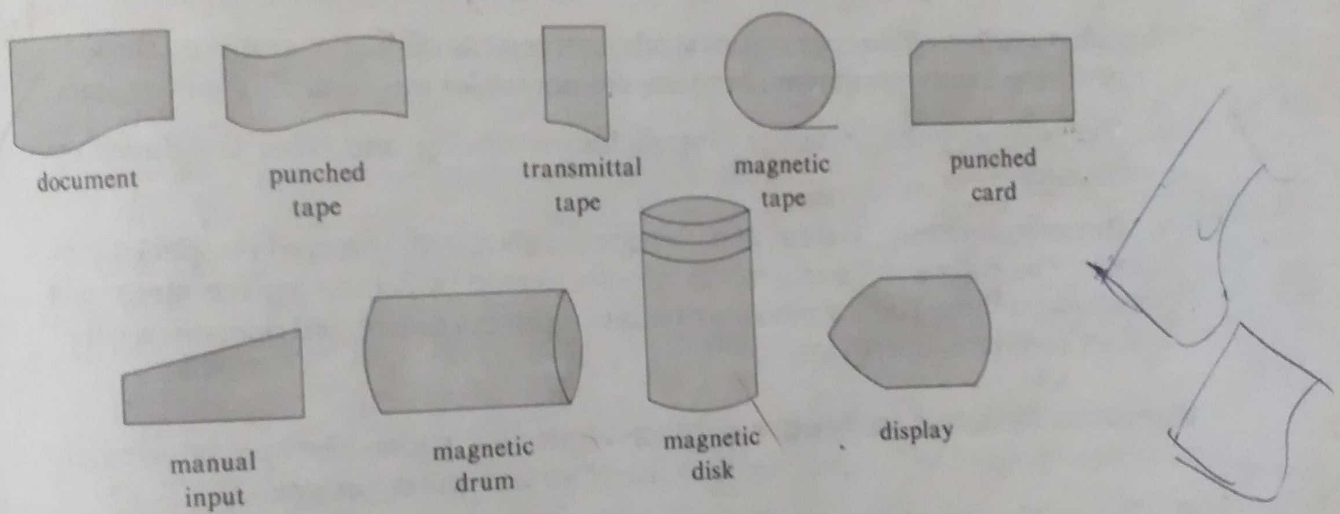


Figure 9.7
Specialized input/output symbols. Specialized input/output symbols are used to indicate a specific input or output device or media.



When a specific input or output device or media is known, it usually is helpful to indicate what it is. Figure 9.7 contains nine specialized symbols that may be used in place of the basic input/output symbol (parallelogram).

1. The *document symbol* is used to describe any input or output that is a paper document. It includes source documents and printed reports.
2. *Punched tape* often is produced by attachments to cash registers and book-keeping machines.
3. A *transmittal tape* is a proof or other control total produced by a device such as an adding machine.
4. The *magnetic tape* symbol represents the use of magnetic tape as an input, output, or auxiliary storage device.
5. *Punched cards* may be used as input, output, or storage media. Some punched cards also serve as source document.

6. The *manual input* symbol indicates inputs to computer systems by means of on-line data entry terminals, switches, or buttons. It is not used to indicate keying processes such as keypunching or verifying.
7. *Magnetic drum* and *magnetic disk* are specific replacements for the general on-line storage symbol. Both of these symbols are constructed from the on-line storage outline.
8. The *display* symbol shows visual outputs from on-line devices, such as CRT (cathode ray tube) terminals, console printers, and plotters. As contrasted with hard-copy data carriers represented by the document symbol, the display symbol represents softcopy data carriers.

Symbols used to replace the basic process symbol (rectangle) are illustrated in figure 9.8.

1. *Manual off-line* operations are operations that are performed by humans without the aid of equipment. An example is filling in a source document.
2. The *auxiliary off-line* operations symbol represents off-line operations. These are performed with equipment, but they are not under the control of a computer.
3. The *keying* symbol indicates keypunching, verifying, and other key-driven operations.
4. The *merge, extract, collate,* and *sort* operations are represented by special symbols. The collate and sort symbols are constructed by combining the merge and extract outlines. These symbols are used to represent unit record operations rather than computer operations.

Symbols Related to Programming Figure 9.9 shows the special symbols most commonly used to prepare flowcharts for computer programs:

1. The *preparation* symbol shows the setting of a program switch or the use of a subroutine within a computer program.
2. The *decision* symbol is used for operations that determine which of two or more alternative paths will be followed in the program.
3. The *terminal* symbol indicates a start, stop, halt, pause, or interrupt in a computer program.

In addition to these three unique *programming symbols*, a fourth symbol called the predefined process is commonly used. The predefined process symbol is a composite symbol drawn by combining the basic process symbol with two vertical lines drawn near the left and right edges. Figure 9.10 illustrates this symbol. It is used to show the execution of a function that is defined elsewhere in the flowchart or on a separate flowchart. Examples are title-column heading routines, data movement routines, calculation routines, and total routines.

Figure 9.8
Specialized processing symbols. The specialized processing symbols may be used instead of the process symbol.

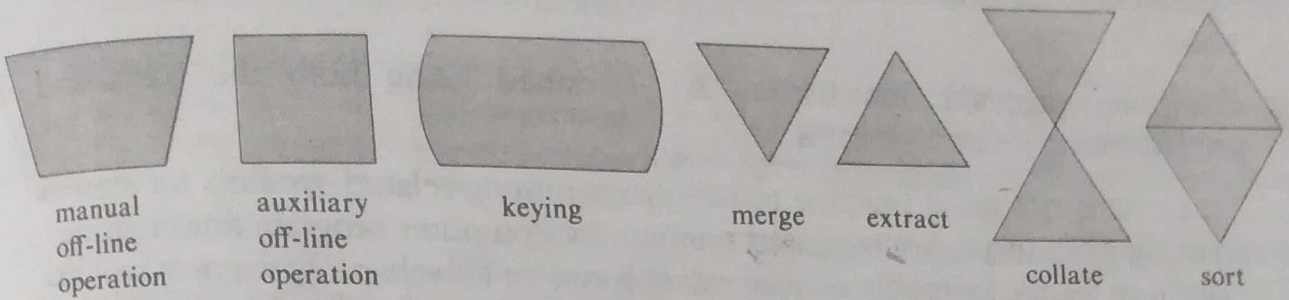
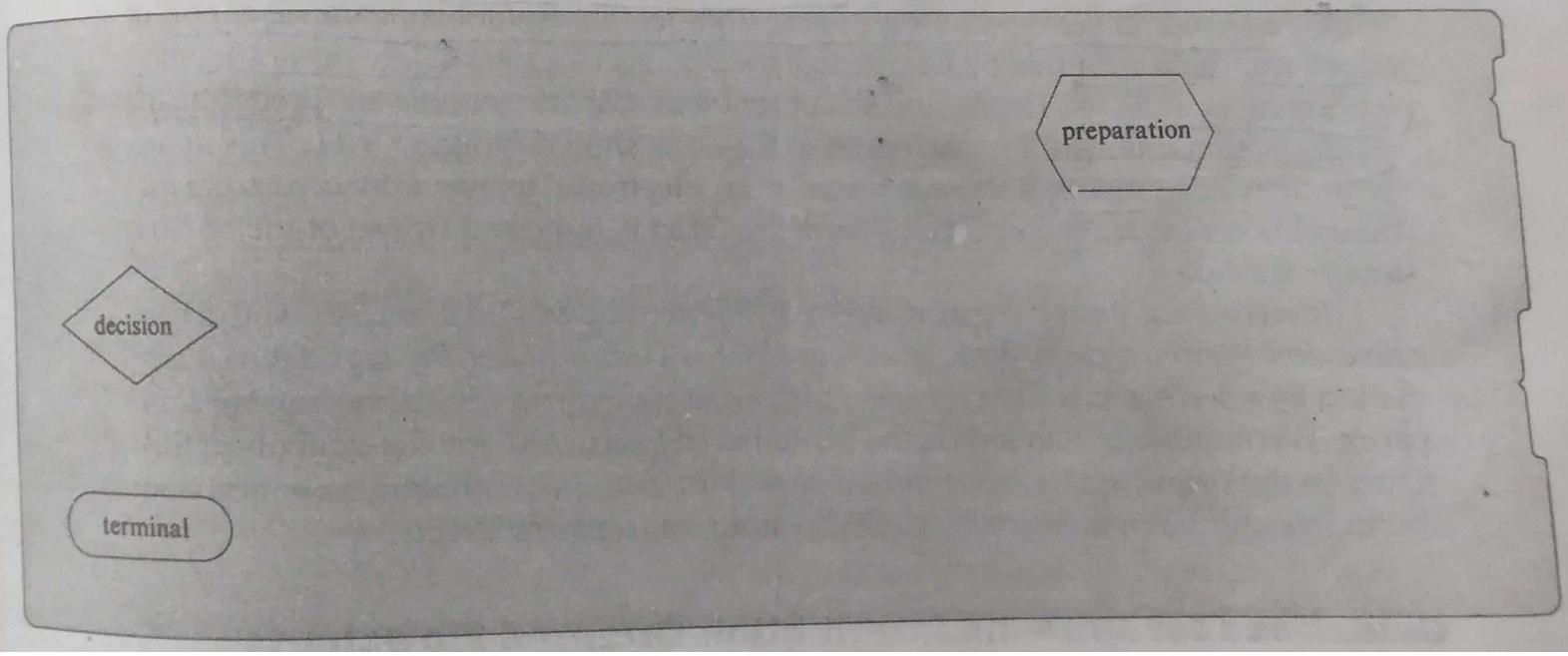


Figure 9.9
Program flowcharting symbols. Program flowcharting symbols consist of the preparation, decision, and terminal symbols. These three symbols plus the basic symbols make up the programming symbol set.



Symbol Sets

The basic symbols, the symbols related to systems, and the symbols related to programming are combined in two ways:

1. System flowcharting is performed using both the basic and systems-related symbols.
2. Computer program flowcharting is performed using both the basic and programming-related symbols.

Note: It is not good practice to use programming-related symbols for system flowcharting or to use systems-related symbols for computer program flowcharting.

Because we are primarily concerned with system flowcharting, we next will examine the principal system flowcharts: information-oriented system flowcharts and process-oriented system flowcharts.

Information-Oriented System Flowcharts

Information-oriented flowcharts use a grid structure to trace the flow of data. They identify input data and follow its flow until its subsequent appearance as output information. They do this by identifying specific data carriers. They do not identify processing operations. Hence, the document and display symbols are predominant in information-oriented flowcharts. An example is shown in figure 9.11. This figure shows how data, that is, filled-out forms or an electronic image, flow across organizational boundaries. The storage of hard-copy data is indicated by use of the off-line storage symbol.

It is customary to accompany information-oriented system flowcharts with a narrative description. One technique for doing this is to number the significant information flow steps and to describe them by a narrative on an accompanying sheet of paper. The numbers encircled on the flowchart in figure 9.11 key the symbols in this figure to the narrative shown below the flowchart. Another technique is to describe the inputs and outputs for each labeled column on separate sheets.

Guidelines for Drawing Information-Oriented Flowcharts

There are a few simple steps in drawing information-oriented flowcharts that can make the task much easier. The following steps assume that the analyst has already collected information about an existing system by studying documentation of the system and from interviewing members of the user departments, or that the analyst understands the system requirements of a new system.

The first step is to identify all groups or departments that are involved with the system. The names of these groups/departments become the headings across the top of the chart.

Figure 9.11
Information-oriented flowchart and narrative. Information-oriented flowcharts use a grid structure to trace the flow of data. They identify input data and follow its flow until its subsequent appearance as output information. The narrative is keyed to the flowchart through circled numbers.

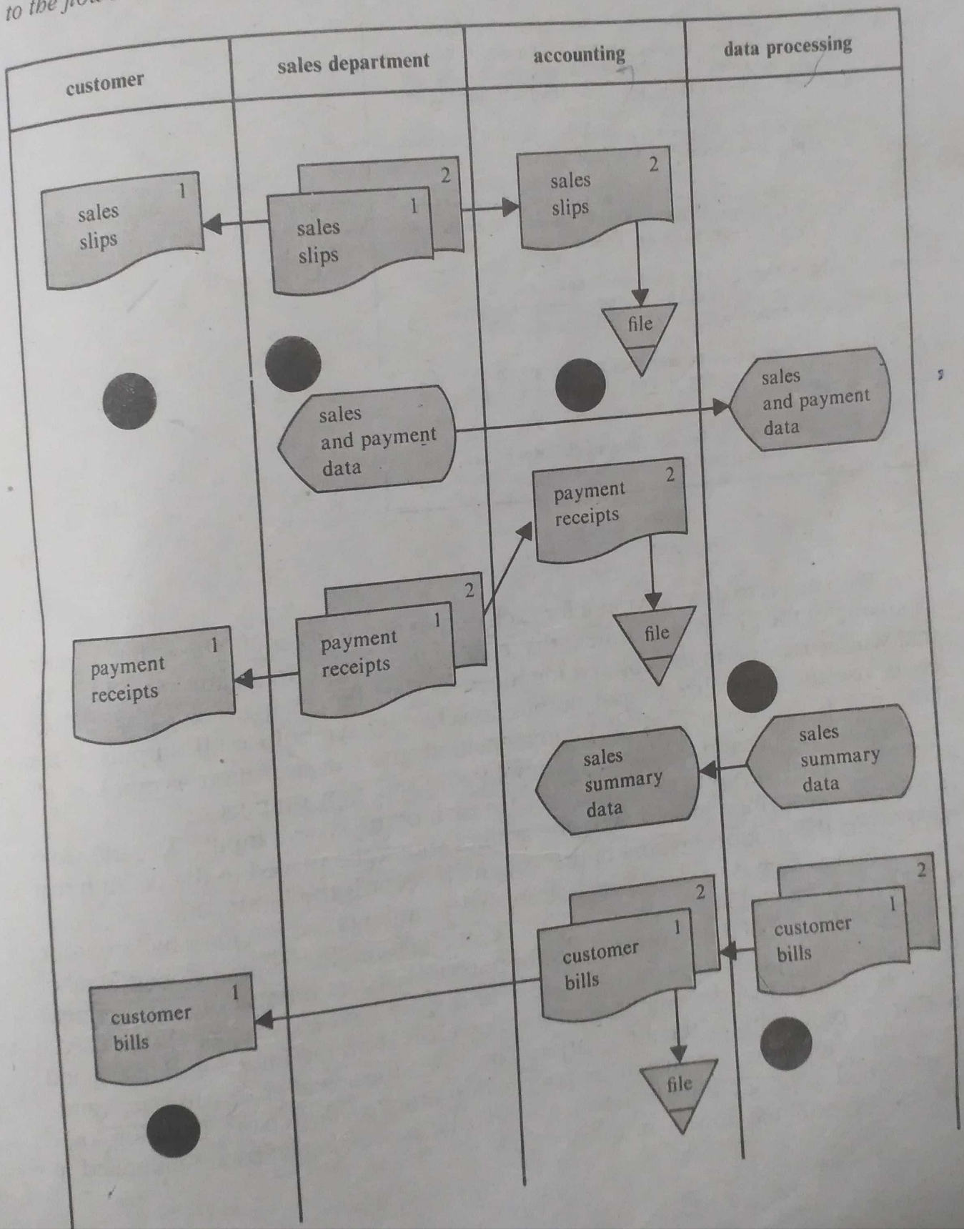


Figure 9.11
continued

CUSTOMER BILLING SYSTEM

1. A point-of-sale terminal is used to capture sales and payment data that is transmitted to data processing. In addition, sales slips and payment receipts are produced in duplicate.

2. The original copies of sales slips and payment receipts are given to the customers.

3. The second copies of sales slips and receipts are sent to accounting where they are retained for future reference in files.

4. Sales summary data is formatted and is available for display in the accounting department.

5. Two copies of customer bills are produced and sent to accounting where the second copies are filed.

6. The original copies of the customer bills are mailed to the customer.

Step two is to draw a symbol for each output of the system in the column under the name of the group/department that creates the output. In an automated system, that will usually be in the column identified as Data Processing. For a logical flowchart, use the generalized input/output flowcharting symbol for all outputs. If the flowchart is to show a physical implementation, use the document symbol for all hard copy outputs and the display symbol for all soft-copy outputs.

The third step is to draw a symbol for each of the system inputs. Use the same symbols as described in step two. The symbol should be placed in the column that represents the group/department that originally records the input data.

The last step is to show where groups/departments use the information. If the use of the information is merely to file a copy of a form, the off-line storage symbol is used. If the use of the information is for purposes of data verification, management decisions, etc., the document (hard copy) or display (soft copy) symbols are used.

Remember that the emphasis of this flowchart is on the information itself, and not on the processing of the information. Therefore, the actual processing steps and/or decision logic are not shown on information oriented flowcharts. Decision logic is described in program logic flowcharts, and the processing steps are identified in the process oriented flowchart.

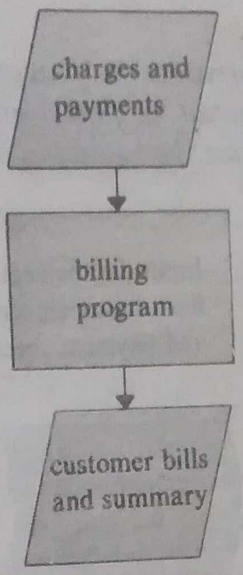


Figure 9.12
High-level process-oriented system flowchart—basic symbols. High-level system flowcharts use basic symbols to give an overview of the system.

Process-Oriented System Flowcharts

Levels of System Flowcharts

Process-oriented flowcharts commonly are referred to as "system flowcharts." They show which data processing operations are converting inputs into outputs. These flowcharts can be drawn to any appropriate level of detail. The highest level and least detailed flowchart is called a high-level system flowchart. Lower levels of detail are represented by expanded flowcharts, which are referred to by names such as "intermediate level" and "detailed level." They can be used to provide a logical description of the system by using only the basic symbols, or a physical description by using the system-related symbols.

Figure 9.12 is an example of the highest level of a process-oriented system flowchart. It uses the basic symbols to give an overview of the logical system.

Structure of System Flowcharts

System flowcharts have a characteristic "sandwich" structure, so called because the chart is made up of alternating layers of input/output identifiers and process identifiers. Figure 9.12 exhibits the basic sandwich structure. Charges and payments are the "bread" of the input data; the billing program is the "filling" of the processing operation; and customer bills and summary is the "bread" of the output data. Note that this chart does not explain how processing is performed; it only identifies what processing is done. Also, note that the output of one step may become the input of a successive step.

Process-oriented flowcharts should also be accompanied by a narrative. The flowchart of figure 9.13 is the same as figure 9.1; it also illustrates the use of an accompanying narrative.

Many flowcharts are too complex and too detailed to accommodate the narrative on the same page. Either there is not enough room or the flowchart would appear confusing. Figure 9.14 illustrates the use of a separate page for the narrative.

Figure 9.13
Flowchart and narrative. All flowcharts should be accompanied by a narrative to explain in words what the flowchart has described with symbols. If room permits, the narrative may be on the same page as the flowchart.

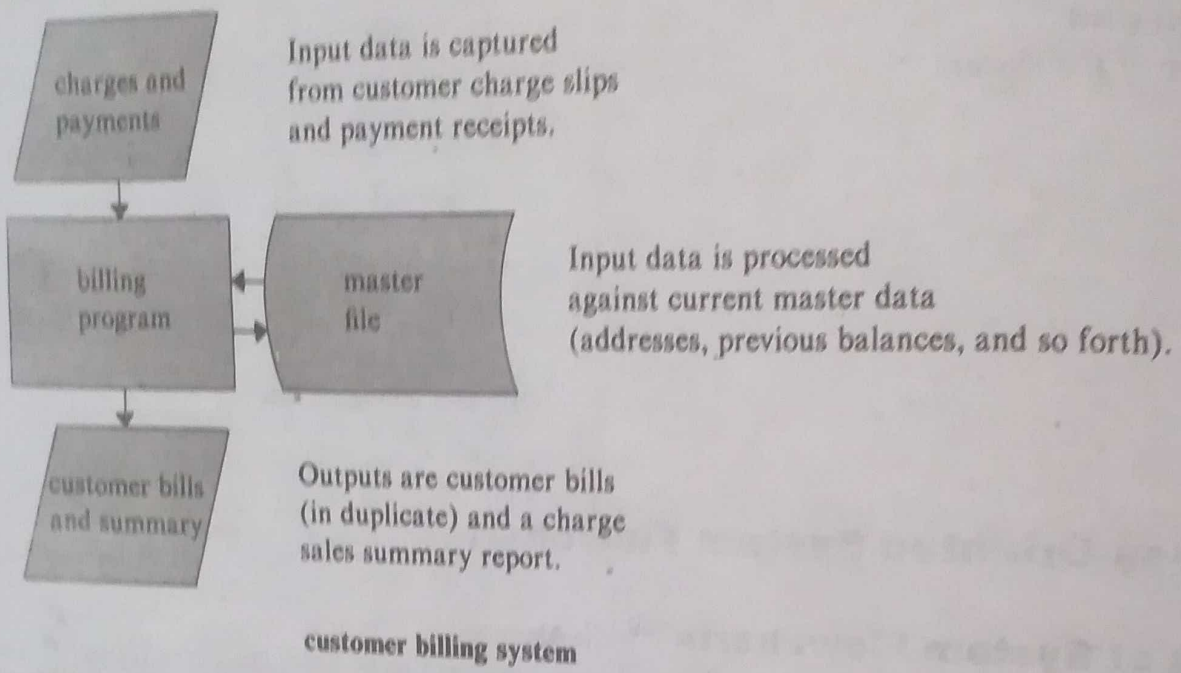


Figure 9.14
Flowchart and separate narrative. Many flowcharts are too complex and too detailed to accommodate the narrative on the same page. In these cases the narrative is presented on a separate page but is still keyed to the flowchart.

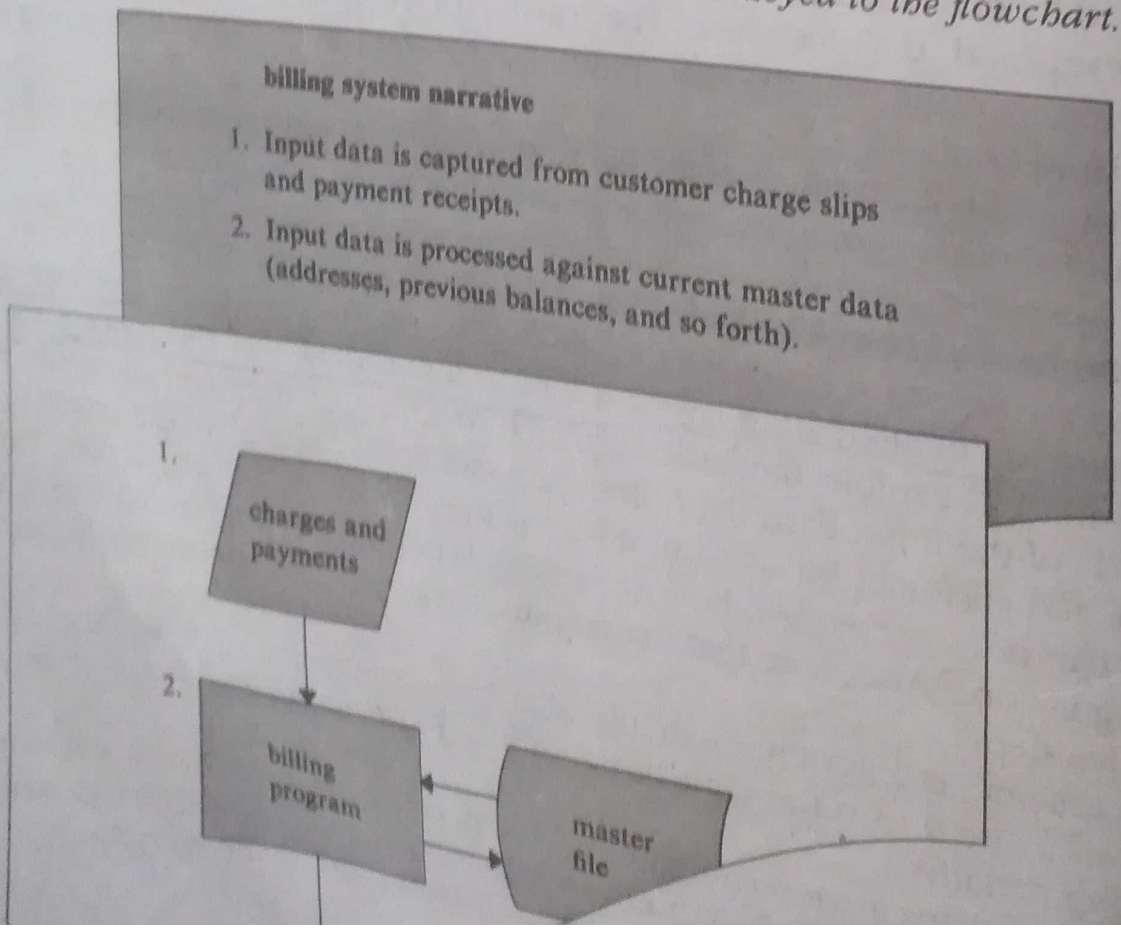
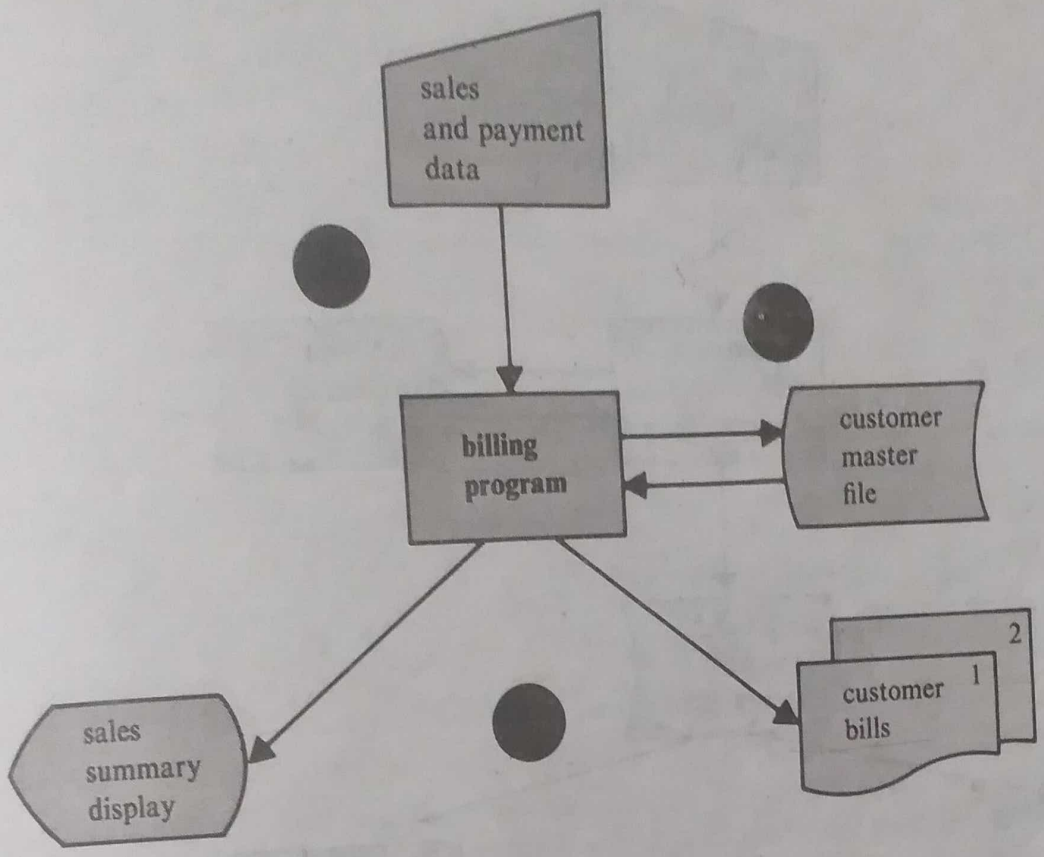


Figure 9.15
High-level process-oriented flowchart. High-level flowcharts provide an overview of the system by eliminating confusing detail. These flowcharts are very valuable at study phase reviews to highlight the user-oriented characteristics of the system.

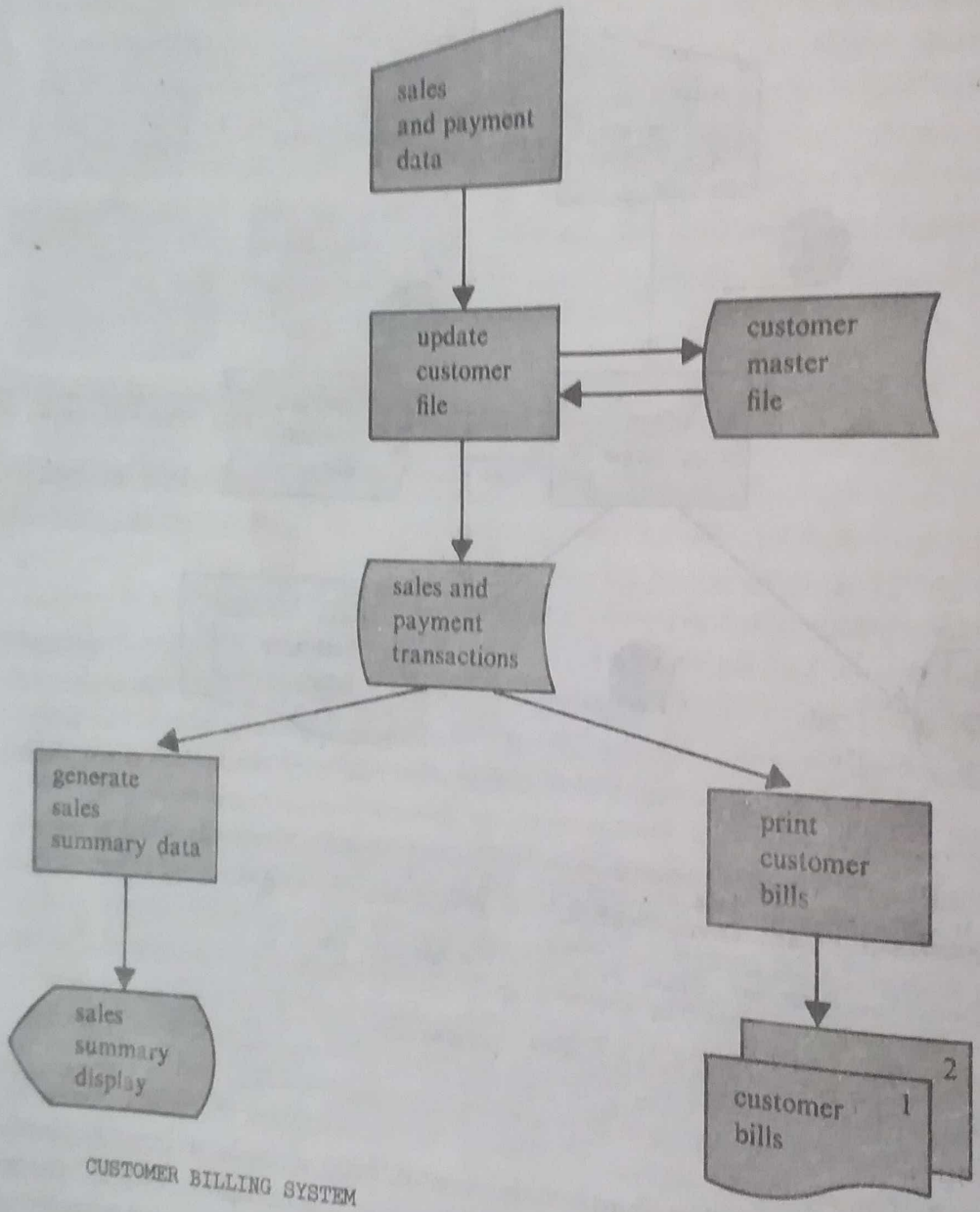



```
CUSTOMER BILLING SYSTEM

1.  Sales and payment data are captured on a point-of-
    sale terminal and transmitted to data processing.

2.  An on-line customer master file supplies data to the
    program and is updated by the program.

3.  Program outputs are a sales summary display and two copies
    of each customer bill.
```

The process-oriented flowcharts we have examined so far have been high-level flowcharts. These flowcharts are expanded in detail as the computer-based business system proceeds through its life cycle. The flowchart levels are associated with certain life-cycle phases:

1. High-level process-oriented flowcharts: study phase. These flowcharts are very valuable at study phase reviews. The participants in these reviews usually are not data processing professionals. Elimination of confusing detail in the flowchart helps to highlight the user-oriented characteristics of the system. If we present management with systems flowcharts that are too detailed, we become "confusers" instead of "simplifiers." Figure 9.15 illustrates a system flowchart suitable for a management presentation. Note that even though this flowchart is high-level, it does show the physical implementation proposed for the system.

Figure 9.16
Intermediate-level process-oriented flowchart and narrative. Intermediate-level system flowcharts identify the specific inputs, outputs, and processes in considerable detail. This level of flowchart is frequently used during the design phase.



CUSTOMER BILLING SYSTEM

1. Sales and payment data are captured on a point-of-sale terminal and transmitted to a processing.
2. An on-line customer master file is updated by the customer master file update program.
3. Current sales and payment transactions are the inputs to a program that prints two copies of customer bills.
4. Current sales transactions are the inputs to a program that provides for a sales summary display.

2. Intermediate-level process-oriented flowcharts: design phase. These flowcharts identify the specific inputs, outputs, and processes in considerable detail. Figure 9.16 is an example of this type. The accompanying narrative is shown below the flowchart.

   As we will discuss in chapter 14, "System Design," major input, processing, and output controls can also be indicated on intermediate-level flowcharts.

3. Detailed-level system flowcharts: development phase. These flowcharts precede the construction of computer program flowcharts by programmers. They identify the inputs, outputs, and processing operations for each of the computer program components. Detailed control operations are also shown. The use of this type of flowchart is described in chapter 20, "Computer Program Development."

Structure Charts

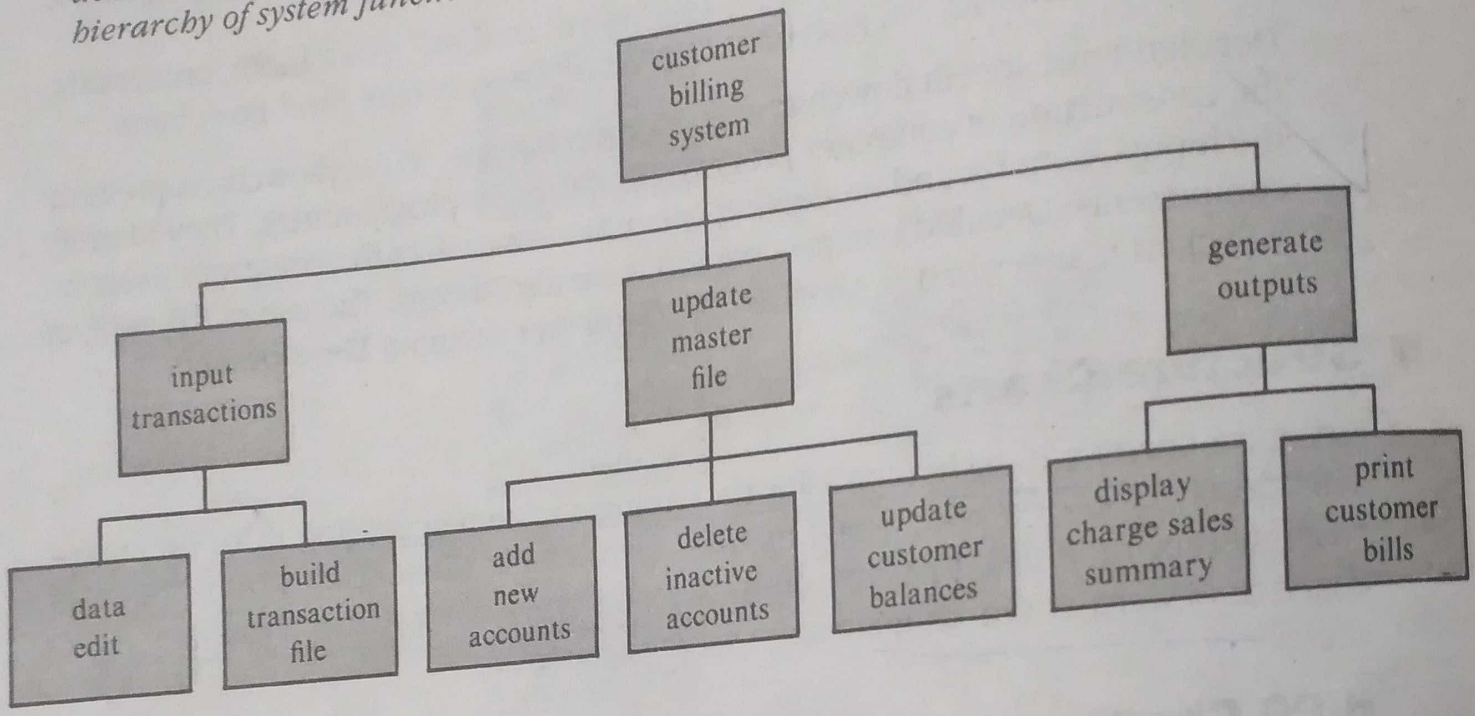
Structure charts are design tools for describing a system according to its functions. This description of a system by functions leads to the identification and design of basic system modules. The two most common types of structure charts are HIPO charts and Warnier-Orr diagrams.

HIPO Charts

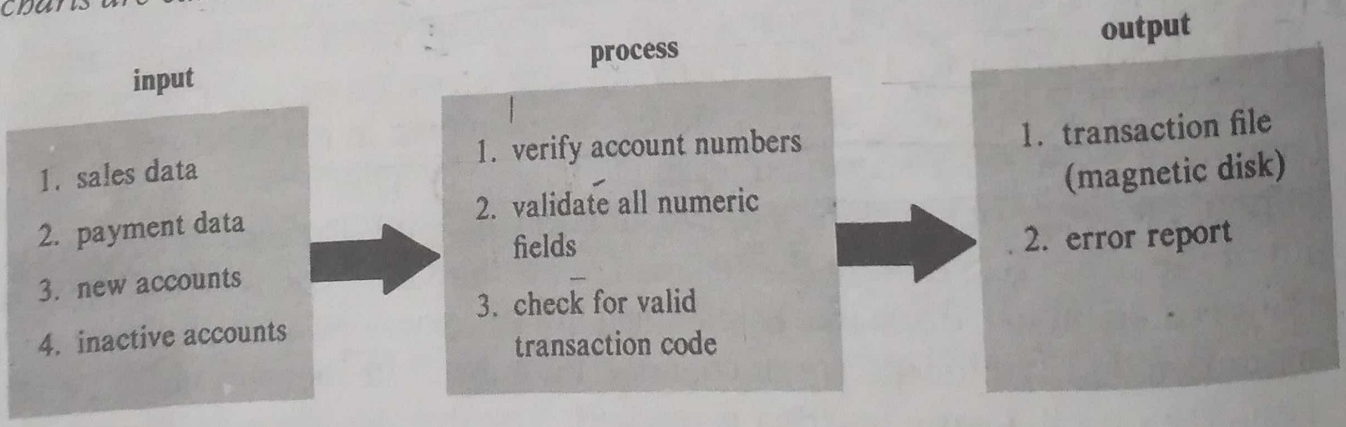
The most popular type of structure chart is the **HIPO chart.** HIPO stands for Hierarchy plus Input Processing Output. Actually, two types of charts make up a HIPO package. One shows the hierarchy, the other depicts the input, processing, and output. The first presents the functional modules of a system (or computer program) as a hierarchy of functions. Levels of hierarchy were shown on an organization chart in chapter 2. The hierarchy of functions can be presented in the same way as the hierarchy of positions is shown on organization charts. Figure 9.17 illustrates the concept of hierarchy of functions. The system is the top level. The second level is made up of the major functions of the system. For the third level, each of the major functions is then broken down into its subfunctions. Decomposing functions into smaller, more detailed, subfunctions can continue until the chart shows as much detail as desired or until a basic function is reached. Note that the *hierarchy chart* is more detailed than the high-level system flowchart of figure 9.15. The hierarchy chart is a design phase tool with a detail level about equal to intermediate-level system flowcharts.

The second of the HIPO package charts is a detail-level chart listing the inputs, processing steps, and outputs of each functional module of the hierarchy chart. These charts are commonly referred to as *IPO charts*. One IPO chart is normally prepared for each function shown on the hierarchy chart. IPO charts do not show hierarchy. Figure 9.18 is an example.

■ **Figure 9.17**
Customer billing system hierarchy. Hierarchy charts are a design phase tool with a detail level about equal to intermediate-level system flowcharts. They describe the hierarchy of system functions.



■ **Figure 9.18**
IPO detail chart for data edit function. Each function shown on the hierarchy chart may be described in detail by listing its inputs, processing steps, and outputs. These charts are called IPO charts and are the second part of the HIPO package.



are

It should be noted that HIPO charts may be used for the top-down planning of programs as well as the planning of systems. The hierarchy of functions charted would be the functions of the program. The program HIPO chart is a common plan-

TOOLS FOR STRUCTURED SYSTEM ANALYSIS AND DESIGN

The different tools for structured system analysis and design are

1 CHART

2 DECISION TABLES

3 DECISION TREES

4 STRUCTURED ENGLISH

5 DFD

6 DATADICTIONARY

7 FLOW CHART

1 CHART

A chart is a Graphical or pictorial expression of relationships or movements

The different types of chart are

- Bar chart
- Line chart
- Piechart
- Step chart

BAR CHARTS

- Bar chart depict relationships among elements better than any other type of chart
- They are easily understood
- They are used for management display
- When the bars are separated the chart displays relatioships
- When the bars are spaced closely together, the chart create an impression of pattern of movement
- Individual bars may be shaded to enhance visual impact

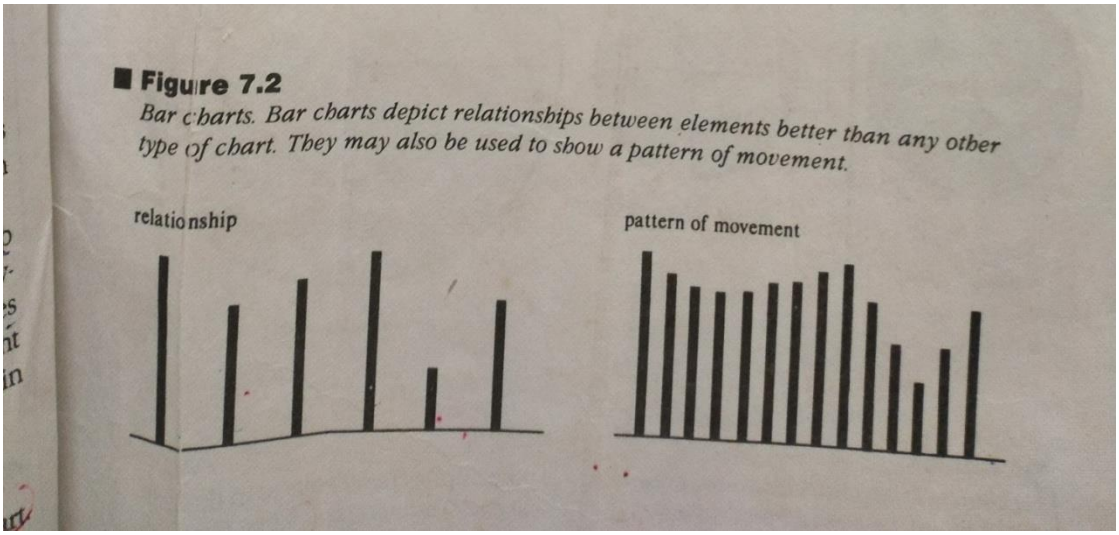


Figure 7.2
Bar charts. Bar charts depict relationships between elements better than any other type of chart. They may also be used to show a pattern of movement.

LINE CHART

- Line charts are often called graphs
- They are consructed by connecting a set of previously plotted points
- They communicate movements
- Multiple plots on a single chart can show relationships

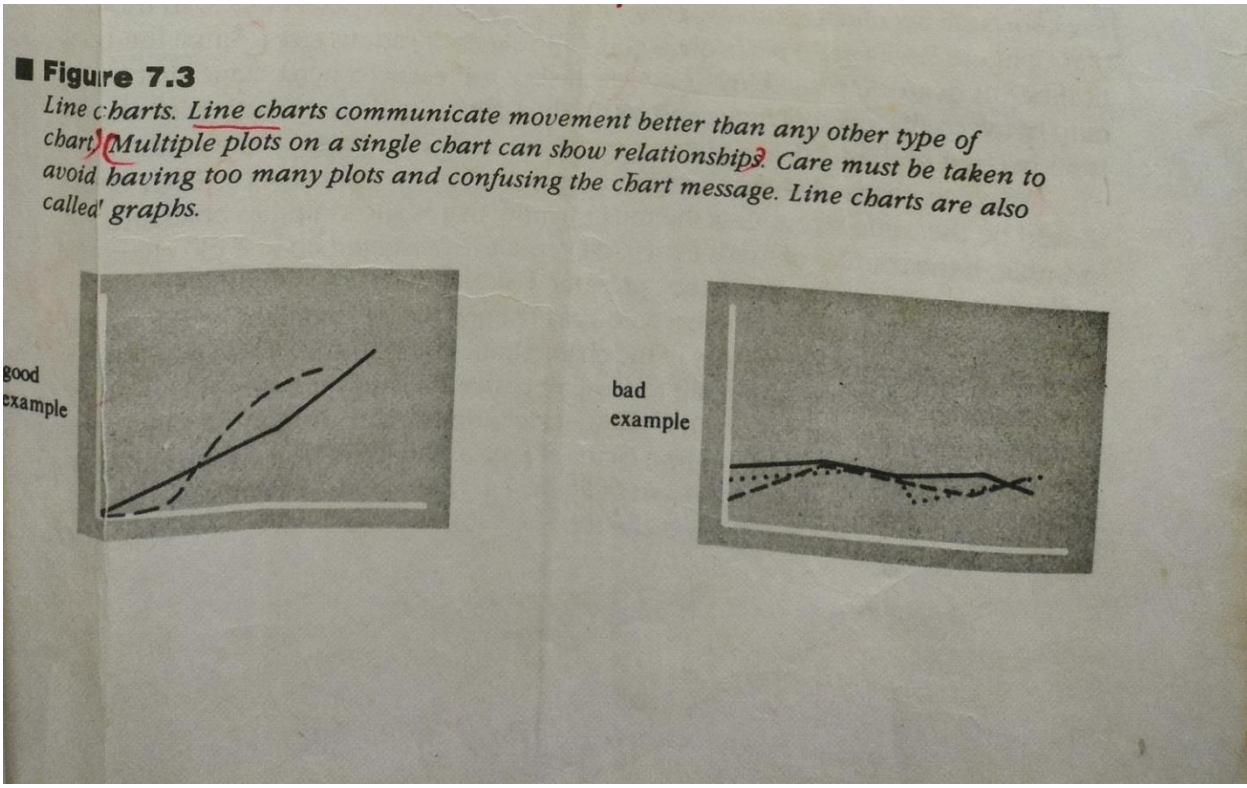
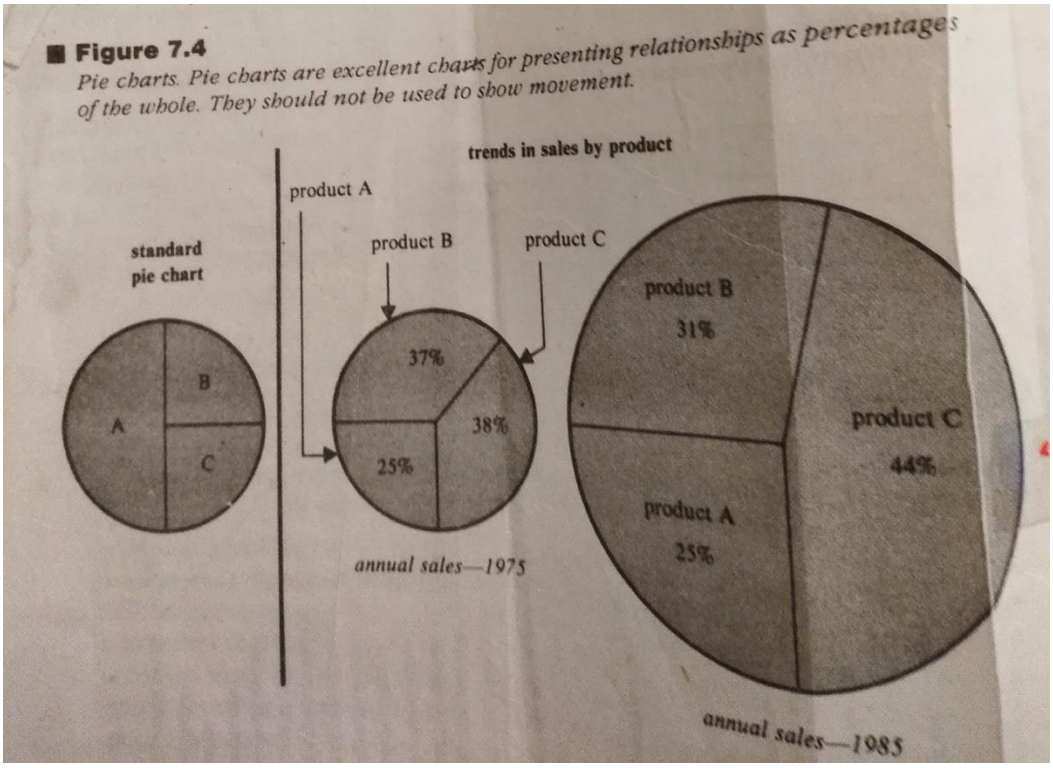


Figure 7.3
Line charts. Line charts communicate movement better than any other type of chart. Multiple plots on a single chart can show relationships. Care must be taken to avoid having too many plots and confusing the chart message. Line charts are also called graphs.

Pie chart

- They are used for presenting relationship as percentages
- Since the total number of degrees in a circle is 360 degree, each slice represent a percentage that is the ratio between the angle of its arc and 360 degree

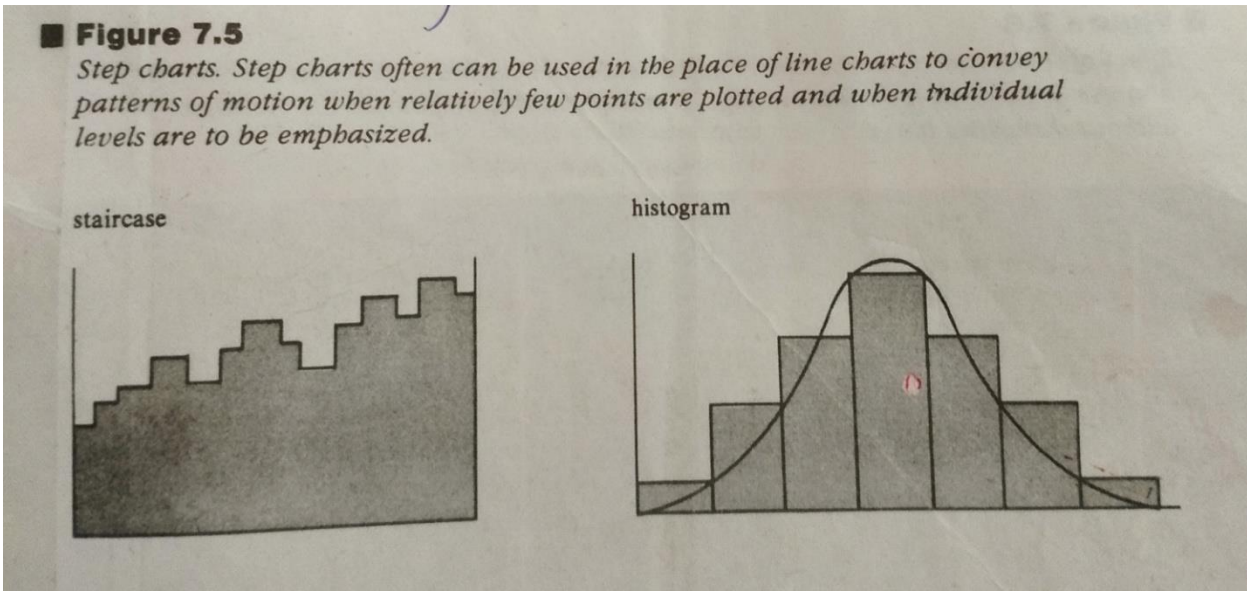


STEP CHART

- Step charts often can be used in the place of lines charts to convey pattern of motion
- It also possesses some of the characteristics of bar chart
- Combination of Line chart and steps chart brings Histogram. This histogram can be used to develop a mathematical approximation to a continuous distribution.

Figure 7.5

Step charts. Step charts often can be used in the place of line charts to convey patterns of motion when relatively few points are plotted and when individual levels are to be emphasized.



2 DECISION TABLE

Decision table are tabular technique for describing logical rules

The table has 4 parts

1 condition stub-lists all conditions to be considered

2 condition entries-make up the rules to be followed

3 action entries-Point to actions that may be taken

4 action stub-identifies the action to be followed

the condition stub is rad as an “if” statement, and the action stub is read as a “then” statement. These statements are connected by a rule, which is a combination of condition entry, usually indicated by a Y(yes) or an N(no),and the action pointed to, usually indicated by X

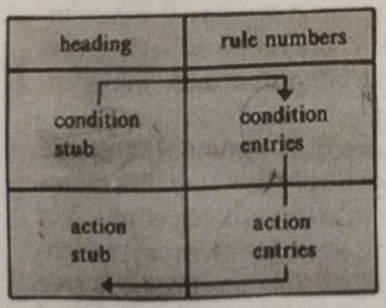
EXAMPLE:

Consider a following cash policy in a market

- If the customer has a valid store identification card,a check may be cashed for the amount of purchase plus $25.00 . If a customer does not have a valid credit card but can show two other identifications, a check may be cashed for the amount of purchase, not to exceed $20.00 . Otherwise , the store manager must be called to authorize the acceptance of the check.

■ **Figure 7.9**

Decision tables. Decision tables are a tabular technique for describing logical rules. They may be used in both manual and automated systems. This example describes the rules for cashing a customer's check at a retail store.



basic format

	check cashing policy	1	2	3	4
conditions	valid store identification card	Y	N	N	N
	purchase > $20.00		N	N	Y
	two other identifications		Y	N	
actions	allow purchase + $25.00	X			
	allow purchase amount		X		
	call store manager			X	X

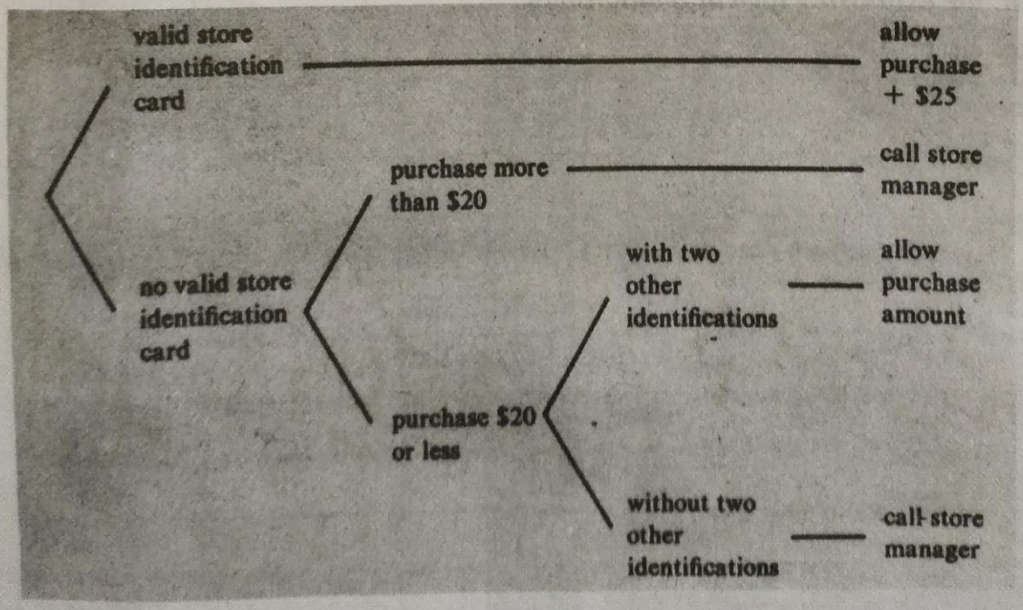
example: check cashing policy

3 DECISION TREE

It is equivalent to a decision table. Like a decision table , it describes logical rules , showing all of the actions that result from various combination of conditions. A decision tree provides a very easily understood pictures since the branches can be read to show how all of the major and minor logical components go together.

Figure 7.10

A decision tree. The branches of a decision tree form a network that represents the logical rules by which a number of conditions are related. Lower-level relationships are nested within higher-level relationships.



4 STRUCTURED ENGLISH

- It is a method for displaying logical processes in an outline format
- It describes system level logic
- It describe the logic of computer programs
- It is used as an alternative to computer program flow charts

Figure 7.11

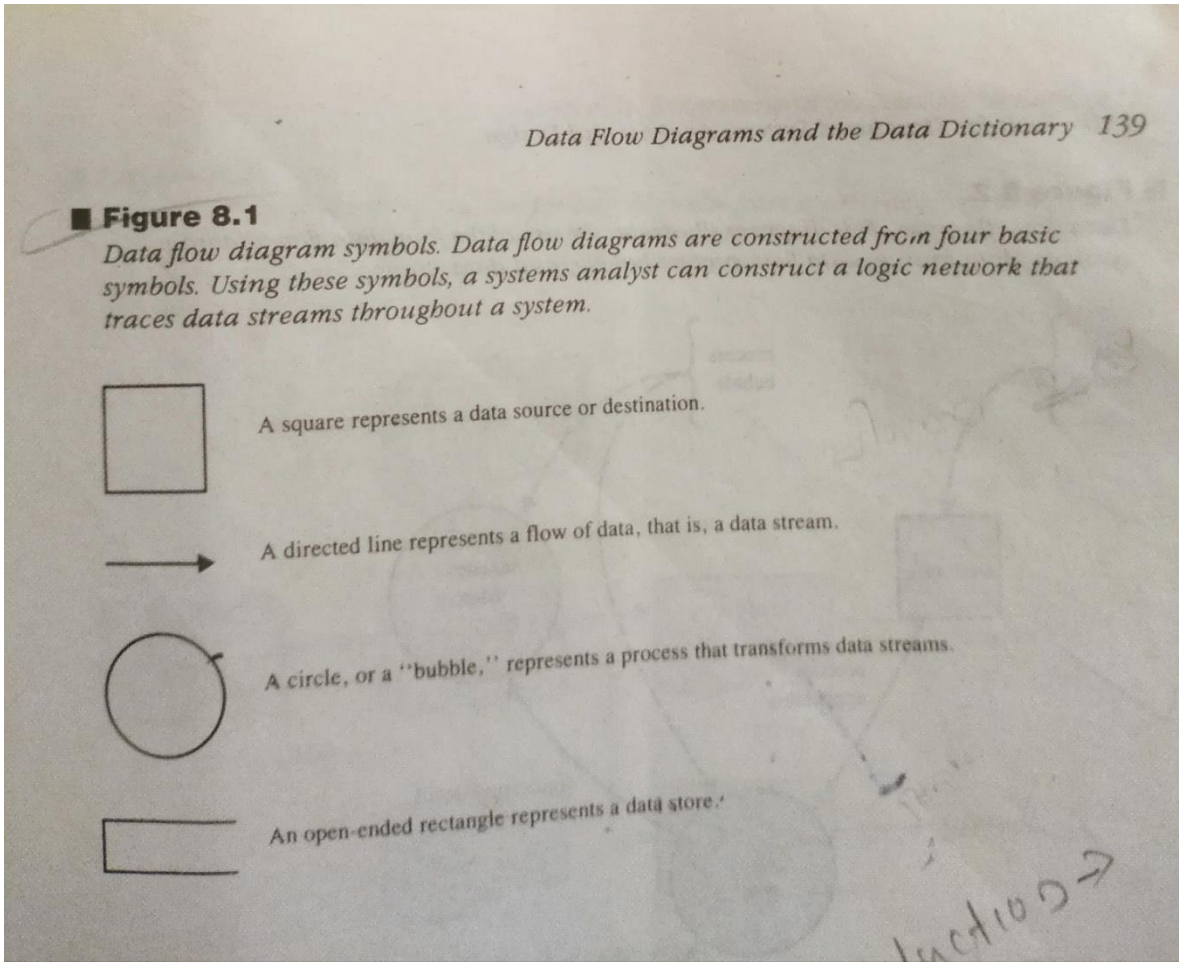
An example of structured English. Structured English uses standard logical terms, such as IF, THEN, and ELSE. It also follows rules, such as successive levels of indentation, for expressing logical relationships.

```
IF valid store identification
    THEN
        allow purchase + $25
    ELSE
        IF purchase more than $20
            THEN
                call store manager
            ELSE
                IF two other identifications
                    THEN
                        allow amount of purchase
                    ELSE
                        call store manager
```

5 DATA FLOW DIAGRAM(DFD)

A dataflow diagram is a network that describes the flow of data through out a system ,datastores, the processes that change,or transform,dataflows.The DFD network is a formal ,logical abstract of system that may have many possible physical configurations

DFD SYMBOLS



Data Flow Diagrams and the Data Dictionary 139

Figure 8.1

Data flow diagram symbols. Data flow diagrams are constructed from four basic symbols. Using these symbols, a systems analyst can construct a logic network that traces data streams throughout a system.

A square represents a data source or destination.

A directed line represents a flow of data, that is, a data stream.

A circle, or a "bubble," represents a process that transforms data streams.

An open-ended rectangle represents a data store.

DFD Decomposition

- Decomposition

  The high level DFD are subdivided or partitioned into a hierarchy of lower level DFDs through a procedure called decomposition

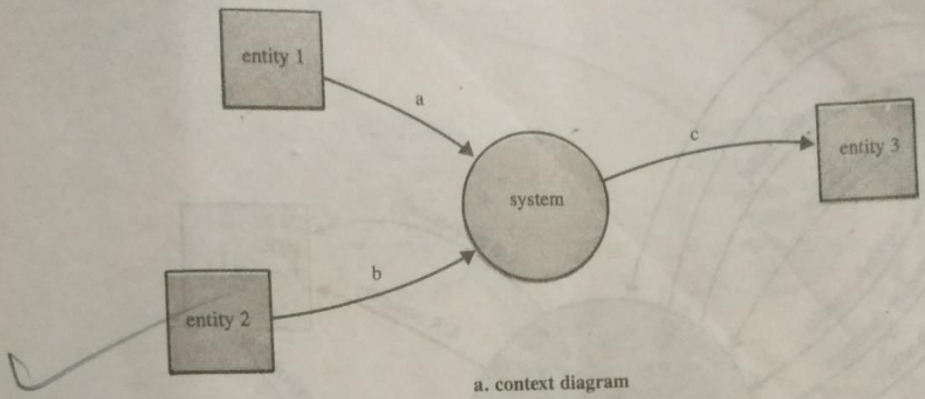
- Context diagram

  A diagram that identifies the domain of a system; it identifies the net input and output dataflow between the system and external entities with which interacts

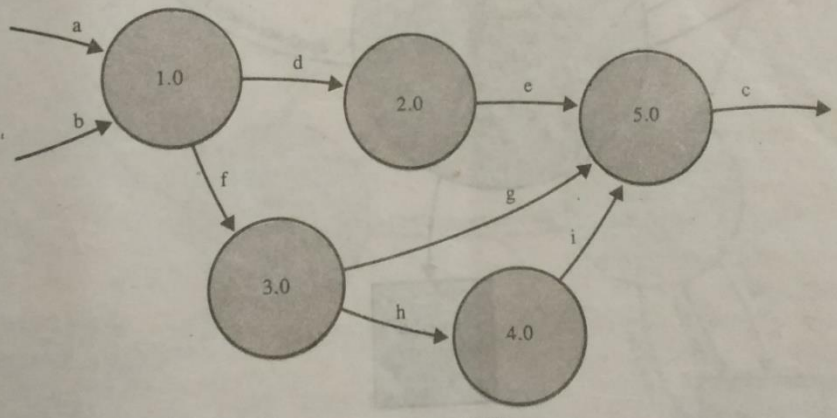
  The context diagram is not considered to be a level of a DFD. The initial DFD that is drawn within the boundaries established by a context diagram is called a level 0 DFD, and it is a graphic picture of major system data flows and the processes that transform them.

The highest level DFD is level 0, and this parent can be decomposed in to subordinate level. At each level , net input and output of the child must correspond exactly to those of the parent. Decomposition should be continued until a bottom set, called set of leveled DFDs, is arrived at for each major transformation process.

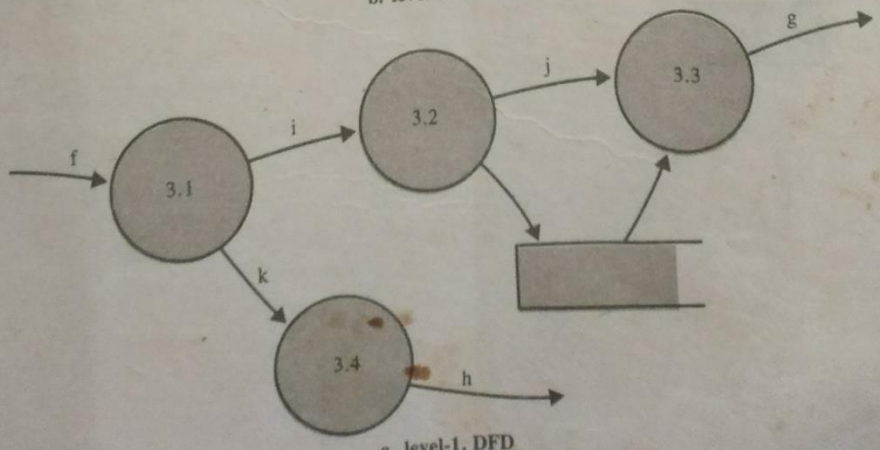
■ Figure 8.6
Context diagram and parent-child concepts. The context diagram establishes the domain of the system. The highest level DFD is level-0, and this parent can be decomposed into subordinate levels; however, each child must exhibit the same net input and output data flows as its parent.



a. context diagram



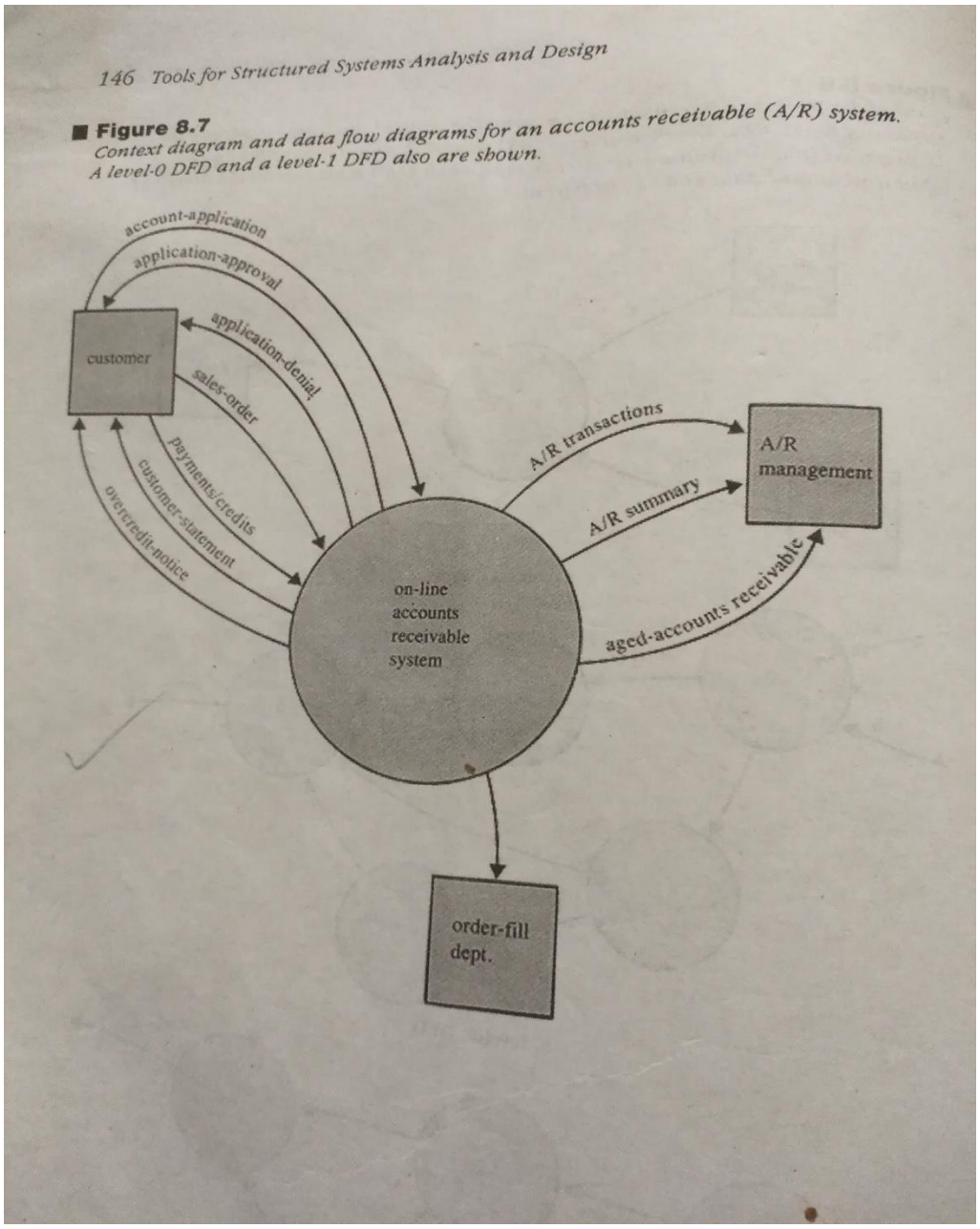
b. level-0. DFD



c. level-1. DFD

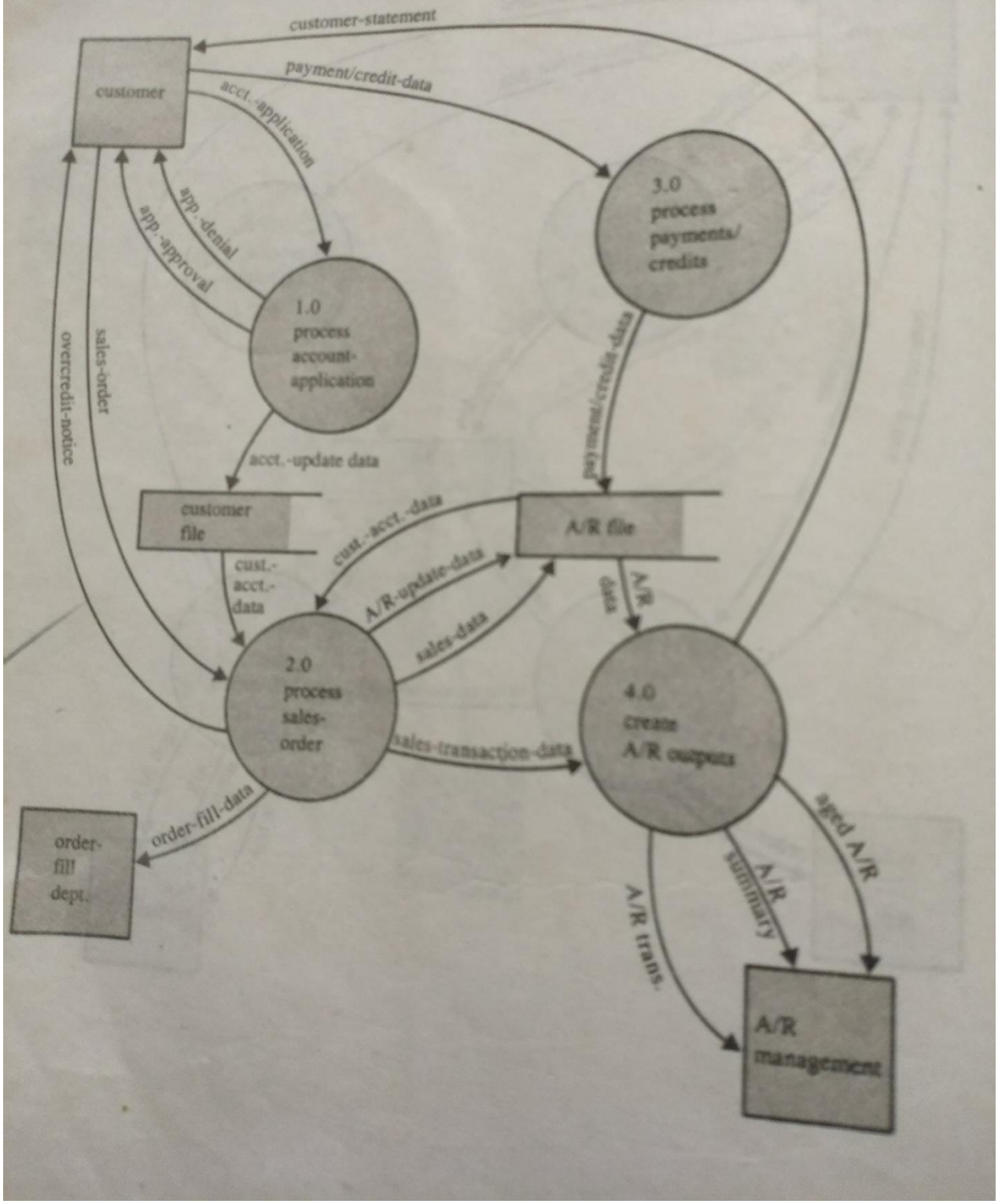
EXAMPLE:

CONTEXT DIAGRAM

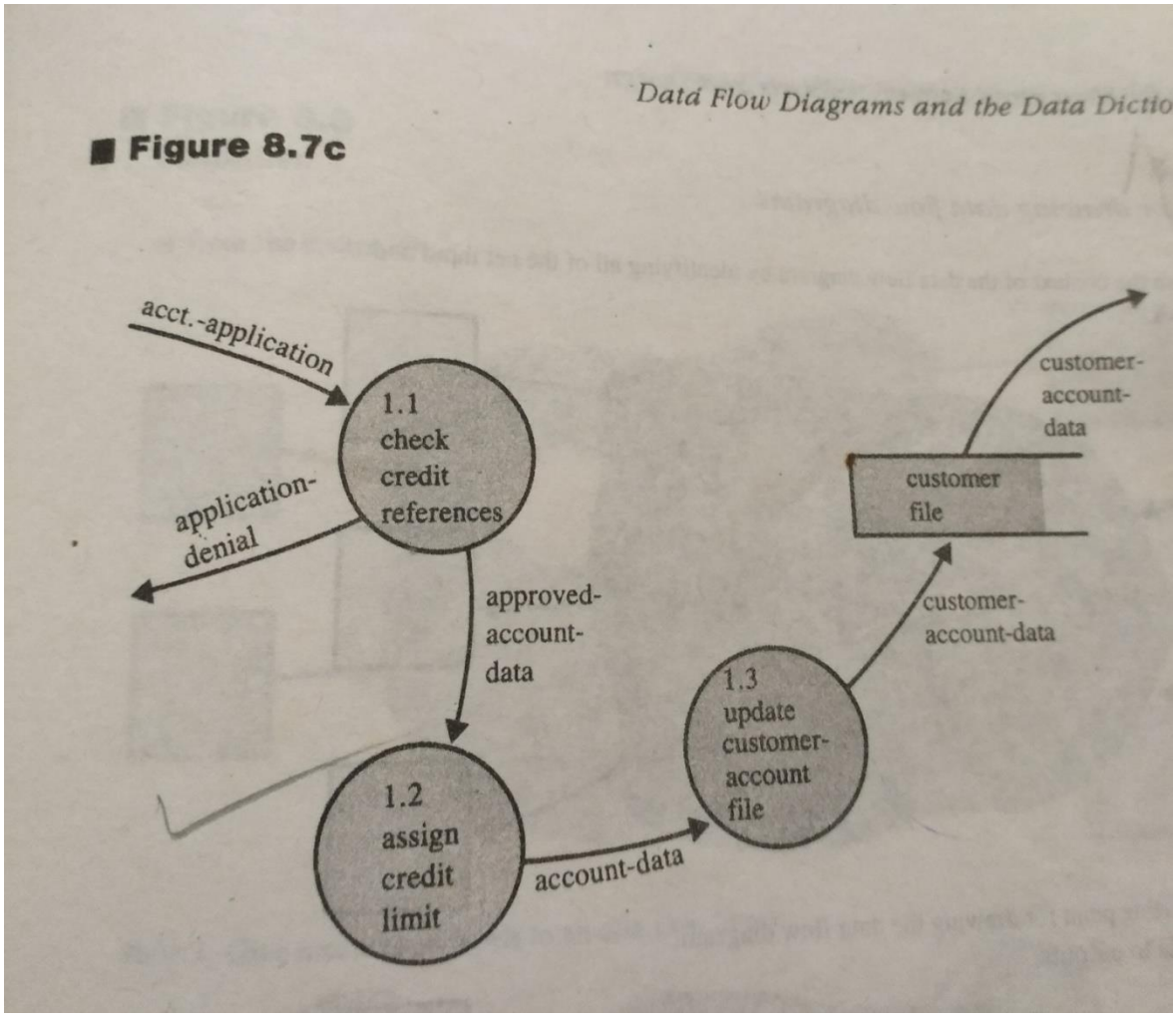


LEVEL -1

■ **Figure 8.7b**


customer-statement
customer
payment/credit-data
acct.-application
app.-denial
app.-approval
3.0
process
payments/
credits
1.0
process
account-
application
overcredit-notice
sales-order
payment/credit-data
acct.-update data
customer
file
A/R file
cust.-acct.-data
A/R-update-data
cust.-
acct.-
data
sales-data
A/R
data
2.0
process
sales-
order
4.0
create
A/R outputs
sales-transaction-data
order-
fill
dept.
order-fill-data
aged A/R
A/R
summary
A/R trans.
A/R
management

LEVEL 2 OF PROCESS ACCOUNT APPLICATION

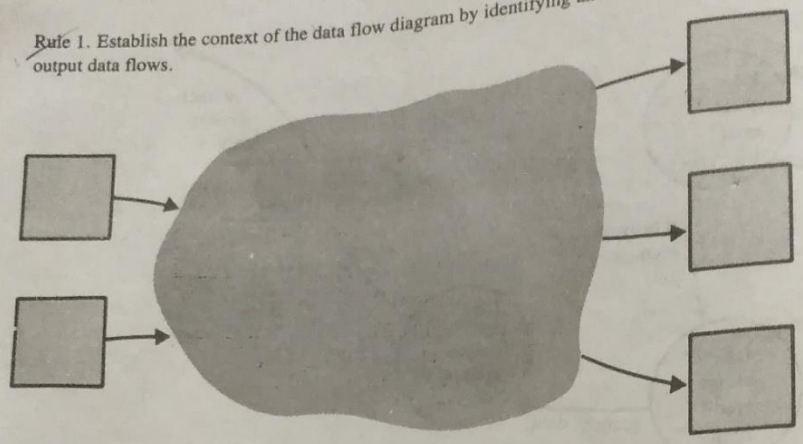


RULES FOR DRAWING DFD

Figure 8.8

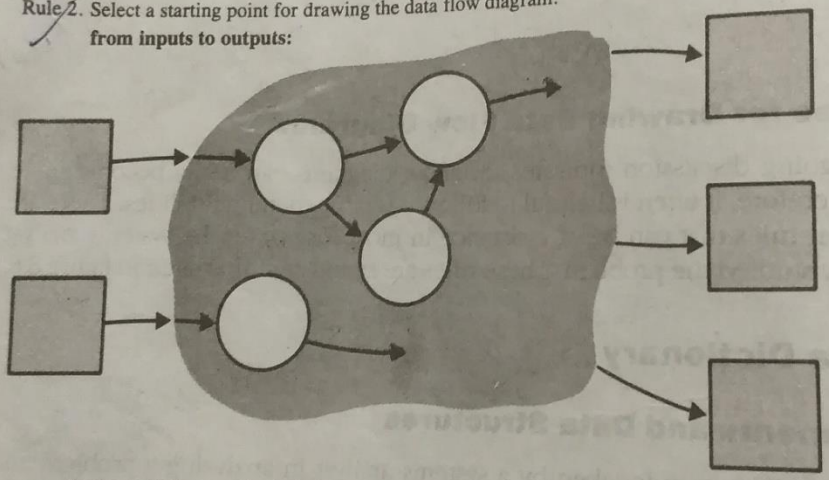
Eight rules for drawing data flow diagrams.

Rule 1. Establish the context of the data flow diagram by identifying all of the net input and output data flows.



Rule 2. Select a starting point for drawing the data flow diagram.

from inputs to outputs:



backwards from outputs to inputs:

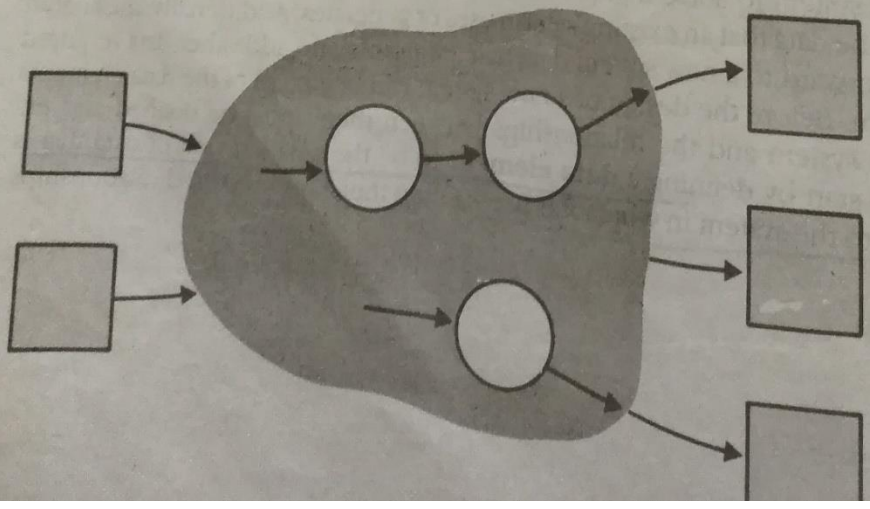
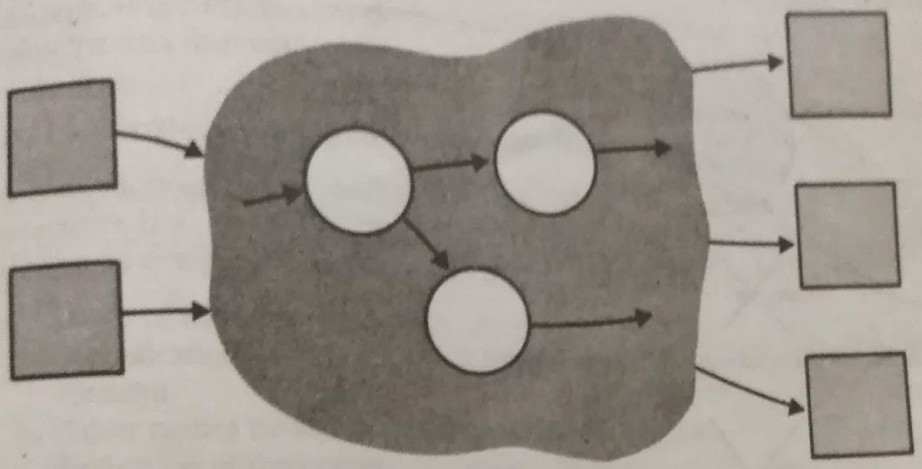
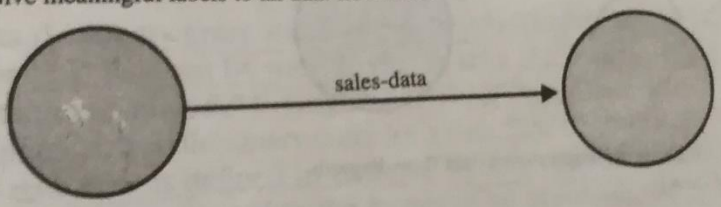


Figure 8.8
continued

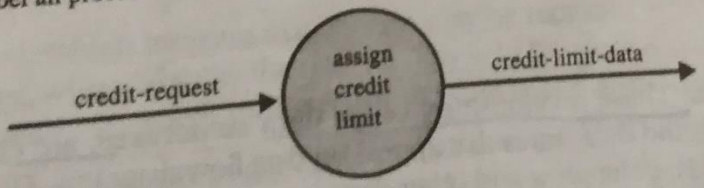
or from the center out:



Rule 3. Give meaningful labels to all data flow lines.



Rule 4. Label all processes with action verbs that relate input and output data flows.



Rule 5. Omit insignificant functions routinely handled in the programming process.
Examples are: **initialization and termination details**

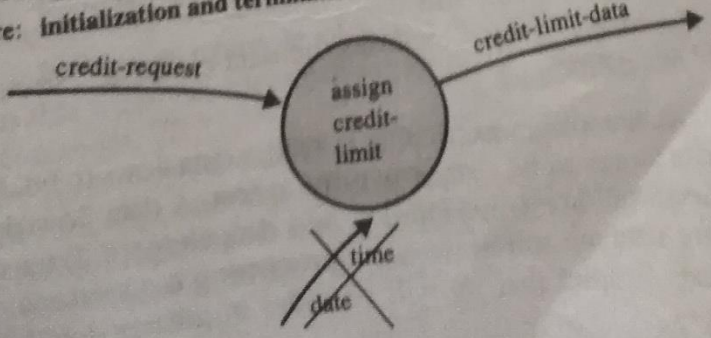
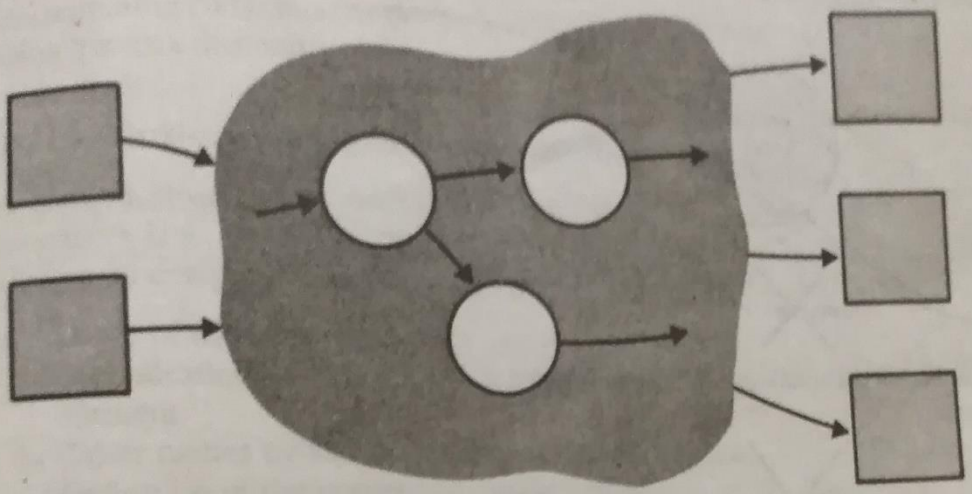
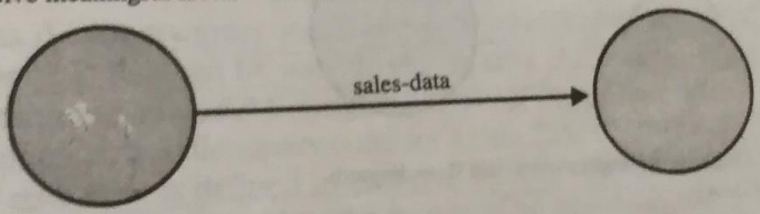


Figure 8.8
continued

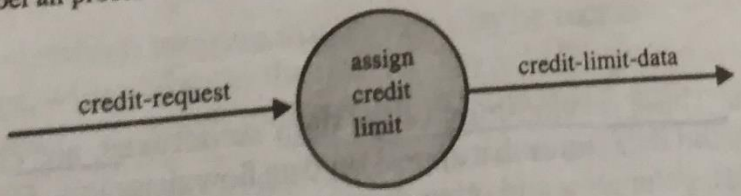
or from the center out:



Rule 3. Give meaningful labels to all data flow lines.



Rule 4. Label all processes with action verbs that relate input and output data flows.



Rule 5. Omit insignificant functions routinely handled in the programming process.
Examples are: **initialization and termination details**

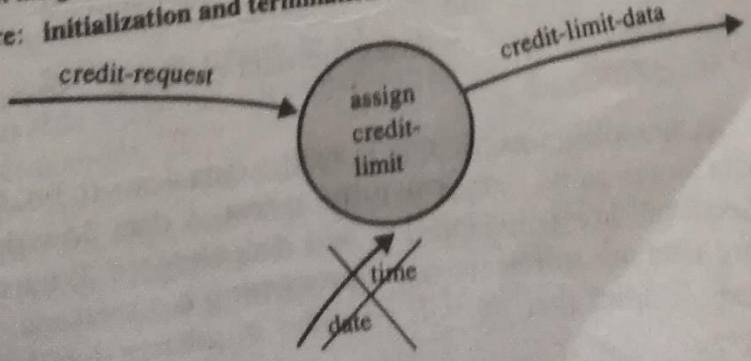
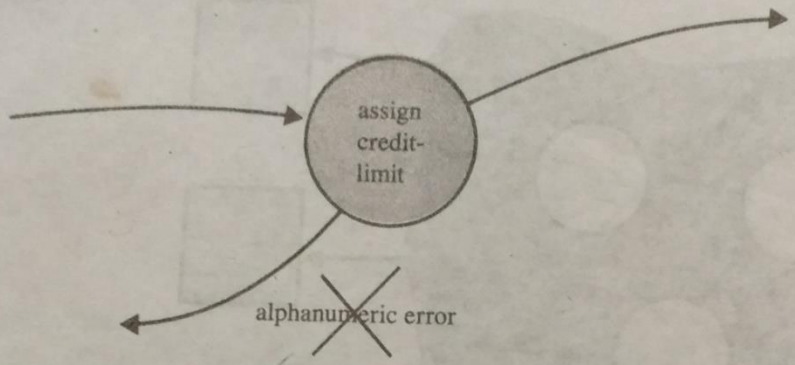
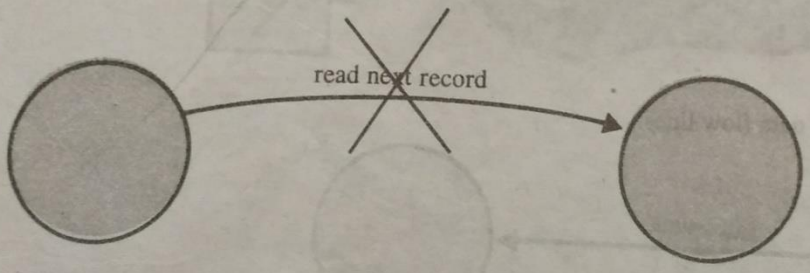


Figure 8.8
continued

details of minor error paths:



Rule 6. Do not include control or flow of control information.



Rule 7. Do not try to put too much information in one data flow diagram. Try to plan for the number of levels.

Rule 8. Be prepared to start over. Often the data flow diagram does not begin to ''flow'' without several false starts.

6 DATA DICTIONARY

Data dictionary is a central respository that defines and describes all of the datastuctures(ie .,dataelements,data flows,and datastores)within a system.

A data dictionary entry should contain at least 4 elements

- Name of the datastructue
- Identification of datastructure as a data flow,a data store, or a data element
- Other names by which the datstructure is called
- Definition of the content of the datastucture
- Significant comments

SYMBOLS USED IN DATADICTIONARY

Dataflow is defined in terms of its subordinate datasructures and that relationships are presented in the form of equation,with the dataflow equated to its component datastructures, which are linked by +signs. Other useful symbols are

Braces{ },which indicate that an item may be repeated .

Underlines, which indicates the item as a keyfield by which a record may be accessed

Paranthesis(),which indicate that the data is optional.

EXAMPLE1

Figure 8.9
Illustration of a data dictionary entry for a data flow. This example shows the data structure for an account-application, which is part of an accounts receivable (A/R) system.

```
                    Data Dictionary Entry

Name of Data Structure:    Account-Application

Type of Data Structure:    Data Flow

Other Names:    Customer-Account-Application

Content:
   Account-Application= Firm-Name +
                        Wholesale/Retail Code +
                        Date +
                        Telephone +
                        Street Address +
                        City-State-Zip Code +
                        { Reference Name +
                        (Branch) +
                        Telephone +
                        Street Address +
                        City-State-Zip Code + }

                        Account-Number +
                        Effective-Date +
                        Credit-Code +
                        Discount-Code +

COMMENT:    If reference is a bank, branch
should be identified: Else, this item
may be omitted. Firm name is included as a
key field in order to produce an alphabetic
listing of customer accounts.
```

EXAMPLE2

Figure 8.10

Illustration of a data dictionary entry for a data store. This example shows the data elements in an accounts receivable (A/R) master-file.

```
                Data Dictionary Entry

Name of Data Structure:    A/R-File

Type of Data Structure:    Data Store

Other Names:    A/R-Master-File

Content:
   A/R-File=              Firm-Name +
                          Street-Address +
                          City-State-Zip Code +

                          Account Number +
                          Amount-Paid +
                          Previous-Balance +
                          Total-Purchase +
                          Total-Payments-and-Credits +
                          Purchases-Month-to-Date +
                          Credits-Month-to-Date +
                          Balance-30-Days +
                          Balance-60-Days +
                          Balance-90-Days +
                          Balance-Over-90-Days +
                          Credit-Code +
                          Discount-Code

COMMENT:    Key fields are account-number and
firm-name, which is included in order to
produce an alphabetic listing of customer
accounts.
```

EXAMPLE3

Figure 8.11
Illustration of a data dictionary entry for a data element. This example describes a data element that is part of an A/R system. It is account-number, and it is a key field by which customer account information may be accessed.

Data Dictionary Entry

Name of Data Element: Account-Number

Other Names: Customer-Number

Format: X X - X X X X X X

Size: 10 Character

Code: X X - X X X X X X

Region Six-Digit Sequence

Source: Account-Application

COMMENTS: All account numbers are assigned and maintained as block sequence codes. The first block is a region, numbered from 01 to 99. The second block is a six-digit alpha numeric sequence code. The first two characters are alphabetic and the last four are numeric. File should be index-sequential.

Example:
12-AA1243

FLOW CHART

- Flowchart is a graphical technique specifically developed for use in data processing
- A flowchart is a pictorial representation that uses predefined symbols to describe dataflow in a business system or the logic of computer program

Uses of flowchart

- Analyse the existing system
- Synthesize new system
- Communicate with others

STUDY PHASE ACTIVITIES

Study phase is the first lifecycle phse in the process of creating a business information system, either a new system or a modification of an existing system .During the study phase a preliminary analysis is carried out in sufficient depth to permit a technical and economic evaluation of the proposed system. At the the conclusion of the study phase, a decision is made whether or not to proceed with a design phase.

The principal study phase activities are

1 USER NEED

Creation of computer based business information system begins with a stated user need.
The statement of need is written request for information systems service which we shall refer to as an **information service request**. The information service request may define the user's needs completely and may sufficient for an analyst to proceed with the system design

2 INITIAL INVESTIGATION

The first step in the initial investigation are directed toward clarifying the problem and strengthening the analyst's background in the problem-area. If there is an existing system that is performing some or all of the functions the new system is to perform the analyst must study this system.

Two major activities are **fact finding and fact analysis**. Fact-finding activities Include reviewing existing manuals and procedures, preparing questionnaires, and conducting personal interviews.

Fact analysis is accomplished by techniques data element analysis, input output analysis, including data flow diagrams, recurring data analysis, and report use analysis

After completing the initial investigation, the systems analyst presents the results and a recommendation to the principal users of the system as a **modified information service request**.

3.USER REVIEW

The modified information service request reflects the analyst's understanding of the problem and states that person's understanding of the system's objectives The modified request is discussed with the user sponsor, and additional revisions e made if necessary with the concurrence of the user

The modified information service request becomes the formal contract between the user sponsor and system analyst .This contract is called a **project directive**. It is the final version of information service request. It establish the scope of the information system project

4 SYSTEM PERFORMANCE DEFINITION

System performance definition is the transition from a logical performance requirement to a physical one. It includes the statement of general constraints, identification of specific objectives, and description of the outputs to be provided.

5 FEASIBILITY ANALYSIS

Feasibility analysis is the identification of candidate system and the selection
of the most feasible. It is accomplished by evaluating alternative methods for converting available input data into the information outputs. Each of the alternative physical system is called candidate system, and each must be described uniquely. Candidate systems are evaluated by Identifying factors that significantly affect system cost and performance and by ranking each candidate in terms of these factors. Typical factors are development costs operating costs, response time,development time, accuracy, and reliability.

6 STUDY PHASE REPORT PREPARATION

After the feasibility study has been completed, a study phase report is prepared for the user sponsor of the system It contains a summary of the feasibility study and presents recommendations related to proceeding with the design phase. An essential part of the study phase report is a user oriented **performance specification.** This specification is the first of the three major baseline specifications. If the recommendation is to proceed with a design phase, a project plan and a cost schedule are prepared, and they are included as part of the study phase report.

7 STUDY PHASE REVIEW

The study phase report is reviewed with the user-sponsor and other affected management. If the recommendations of the report are accepted, the user issues a written approval to proceed. This approval includes an authorization for man power and other resource expenditures required for the design phase.

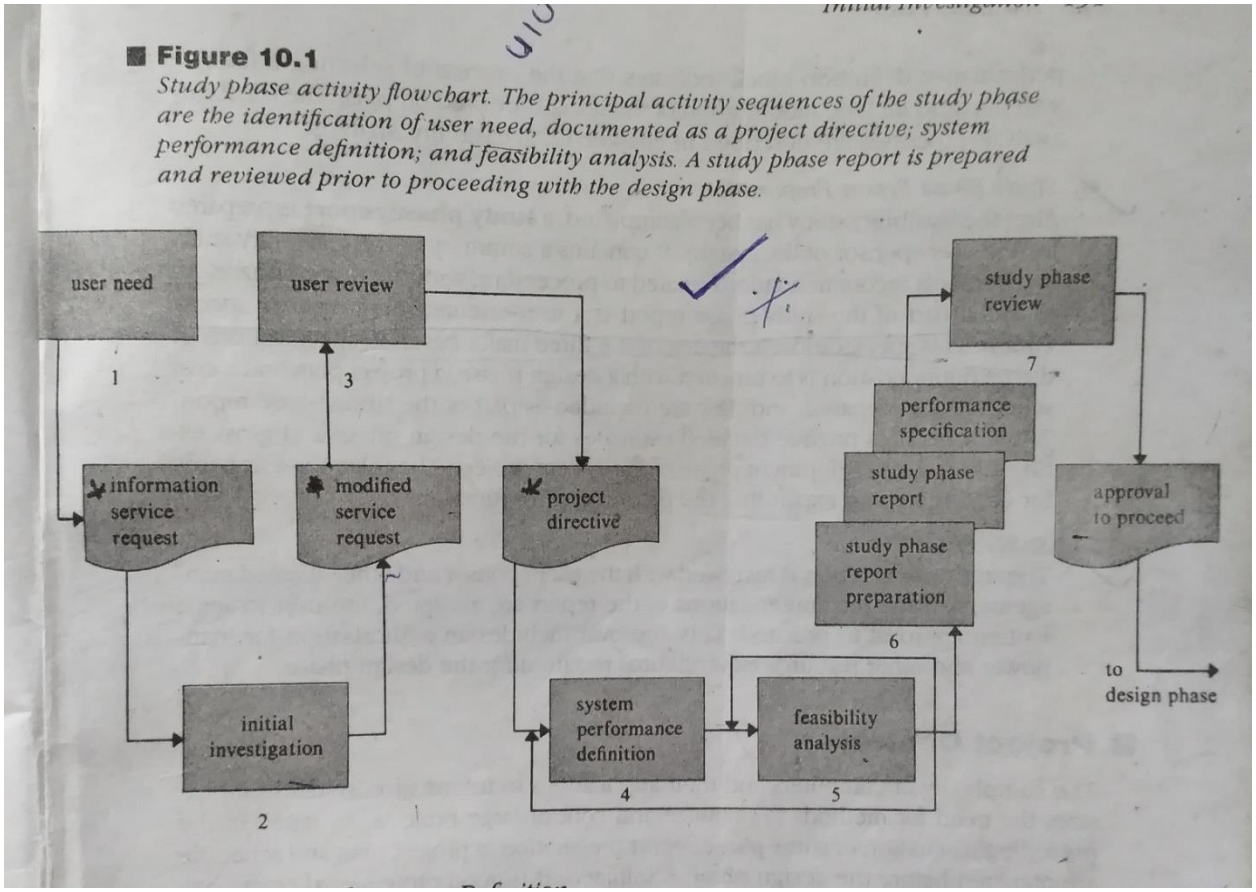


Figure 10.1
Study phase activity flowchart. The principal activity sequences of the study phase are the identification of user need, documented as a project directive; system performance definition; and feasibility analysis. A study phase report is prepared and reviewed prior to proceeding with the design phase.

THE INFORMATION SERVICE REQUEST(ISR)

Creation of computer based business information system begins with a stated user need.

The statement of need is written request for information systems service which we shall refer to as an **information service request**.

We will identify the formal request for information services support as an information service request (ISR). Figure 10.4 is our ISR form. As a typical document of this type it provides for

1Job Title: Name assigned by user to the work requested.

2. New or rev: Identifies the request as a new job ar a revised job.

3.Requested date: Date the request is submitted.

4 Required date: Date the job should be completed.

5 Objective: Briefly states the principal purposes of the job.

6 Labor: Authorization to expend labor hours and dollars (amount).

7 Other: Authorization to expend non labor (for example, computer time) hours and dollars (amount)

8 Anticipated benefits:Lists the principal benefits (for example, cost savings, faster response) the company will derive from the system

9. Output description.

Destination: the external entity that receives the output

Comments: describe significant attributes of the output

10. Input description

Source-the external entity that provides the input

Comments -describe significant attributes of the input

11. To be filled out by requestor:

Requested by-name, department, title, telephone.

Approved by-name, department, title, telephone.

12 To be filled out by information services:

File number-identifier assigned to request by information services.

Accepted or not accepted-explained, as necessary, in remarks.

Signature -name, department, title, telephone:

Remarks-Filled in by information services as appropriate, for example, explanation of non acceptance, indication of limits on the ISR, request for additional information. or Identification of an analyst assigned to the job

13.Addissional information: The request or may use the reverse side of the form, additional pages of the form, or other supplemental pages, as appropriate, to describe more fully any part of the information service request.

Figure 10.4

Information service request. An information service request is a formal request from a user group for support from the information services organization. It provides for statements of objectives and anticipated benefits, and for the description of outputs and inputs.

INFORMATION SERVICE REQUEST				Page ___ of ___
JOB TITLE:	NEW ☐ REV. ☐	REQUESTED DATE:	REQUIRED DATE:	
		AUTHORIZATION		
OBJECTIVE:		LABOR		OTHER
		HOURS	AMOUNT	HOURS / AMOUNT
ANTICIPATED BENEFITS:				

OUTPUT DESCRIPTION	INPUT DESCRIPTION
TITLE:	TITLE:
DESTINATION:	SOURCE:
COMMENTS:	COMMENTS:
TITLE:	TITLE:
DESTINATION:	SOURCE:
COMMENTS:	COMMENTS:

TO BE FILLED OUT BY REQUESTOR			
REQUESTED BY:	DEPARTMENT:	TITLE:	TELEPHONE:
APPROVED BY:	DEPARTMENT:	TITLE:	TELEPHONE:

TO BE FILLED OUT BY INFORMATION SERVICES			
FILE NO:	ACCEPTED ☐	NOT ACCEPTED ☐	
SIGNATURE:	DEPARTMENT:	TITLE:	TELEPHONE:
REMARKS:			

FORM NO: C-6-1	ADDITIONAL INFORMATION: USE REVERSE SIDE OR EXTRA PAGES

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6 Labor: Authorization to expend labor hours and dollars (amount).

7 Other: Authorization to expend non labor (for example, computer time) hours and dollars (amount)

8 Anticipated benefits:Lists the principal benefits (for example, cost savings, faster response) the company will derive from the system

9. Output description.

Destination: the external entity that receives the output

Comments: describe significant attributes of the output

10. Input description

Source-the external entity that provides the input

Comments -describe significant attributes of the input

11. To be filled out by requestor:

Requested by-name, department, title, telephone.

Approved by-name, department, title, telephone.

12 To be filled out by information services:

File number-identifier assigned to request by information services.

Accepted or not accepted-explained, as necessary, in remarks.

Signature -name, department, title, telephone:

Remarks-Filled in by information services as appropriate, for example, explanation of non acceptance, indication of limits on the ISR, request for additional information. or Identification of an analyst assigned to the job

13.Addissional information: The request or may use the reverse side of the form, additional pages of the form, or other supplemental pages, as appropriate, to describe more fully any part of the information service request.

■ **Figure 10.4**

Information service request. An information service request is a formal request from a user group for support from the information services organization. It provides for statements of objectives and anticipated benefits, and for the description of outputs and inputs.

INFORMATION SERVICE REQUEST				Page ___ of ___
JOB TITLE:	NEW ☐ REV. ☐	REQUESTED DATE:	REQUIRED DATE:	
		AUTHORIZATION		
OBJECTIVE:		LABOR		OTHER
		HOURS	AMOUNT	HOURS / AMOUNT
ANTICIPATED BENEFITS:				

OUTPUT DESCRIPTION	INPUT DESCRIPTION
TITLE:	TITLE:
DESTINATION:	SOURCE:
COMMENTS:	COMMENTS:
TITLE:	TITLE:
DESTINATION:	SOURCE:
COMMENTS:	COMMENTS:

TO BE FILLED OUT BY REQUESTOR			
REQUESTED BY:	DEPARTMENT:	TITLE:	TELEPHONE:
APPROVED BY:	DEPARTMENT:	TITLE:	TELEPHONE:

TO BE FILLED OUT BY INFORMATION SERVICES			
FILE NO:	ACCEPTED ☐	NOT ACCEPTED ☐	
SIGNATURE:	DEPARTMENT:	TITLE:	TELEPHONE:
REMARKS:			

FORM NO: C-6-1	ADDITIONAL INFORMATION: USE REVERSE SIDE OR EXTRA PAGES

INITIAL INVESTIGATION

The initial investigation is conducted through following techniques

A. Background analysis
B. Fact finding techniques
C. Fact analysis
D. Organization and presentation of result

A. Background Analysis

The analyst makes background analysis relate to the proposed application in order to become familiar with the organization environment and the physical processes related to the new or revised system

The analyst must understand the structure of the organization within which the current system is operating and within which (often after considerable alteration) the new system will be expected to operate. The systems analyst should 1) obtain or prepare organization chants: (2) obtain or prepare organization function lists, and (3) learn the names and duties of the people shown in the organization chart.

B. Fact-finding techniques

The analyst collects data from two principal sources: written documents and personnel who are knowledgeable about or involved in the operation of the system under study

Fact finding techniques include

1. Data collection
2. Correspondence and questionnaires
3. Personal interviews
4. Observation
5. Research

1 **Data collection**

The analyst collects forms, manuals and data carriers. Examples of data carriers are forms,records,reports,*manuals*,procedures,and CRT display layouts.

2Correspondence and questionnaires

Correspondence enables the analyst to explain the purpose of the investigation activities and to inform people of what is expected from them ..

The questionnaire is an important and often effective type of correspondence For example, it may be the only efficient method of obtaining responses from a large number of people, particularly if they are widely scattered or in remote locations. Questionnaires should be brief in order to increase the promptness and probability of response questionnaire can also be used to solicit responses to specific questions from individuals. Questionnaire should be followed up by personal interviews whenever possible

3 Personal Interview

The personal interview is one of the most soft methods of obtaining information An interview is a person to person communication

The interviews are critical because people are the most important ingredient of any system The success of failure of a system often depends upon the acceptance of the analyst by the personnel who are affected by the system. These personnel determine its usability The following are some interview guidelines

1 Plan the interview just as carefully as you would plan a presentation
2 Adhere to your plan by keeping the interview pertinent. However, be flexible. Do not force the interview to follow a preconceived pattern.
3. Be informed, but do not attempt to present yourself as the expert.
4. Arrange for a meeting time and place free from interruptions and other distractions
5 Be punctual.
6 Know the name and position of the person you are interviewing
7 Be courteous at all times Avoid the use of potentially threatening devices, such as tape recorder and cameras.
These guidelines are intended to help the analyst to create an atmosphere of cooperation, confidence, and understanding.

4 Observation

In the course of data collection, interviewing, and other fact-finding activities, an ex experienced analyst observes the operation of the ongoing system and begins to formulate questions and draw conclusions on the basis of what is observed. Skilled analysts are able to discipline their powers of observation and recall.
Observation is a continuous process, it usually is informal. Observation technique that often is effective as a means of communication is the construction of data flow diagram

5 Research

Research is of particular importance when a new application is being considered because it is a means of stimulating creative approaches to problem solving. All the fact finding methods we have discussed are forms of in house research However, there are many out of house sources of Information. These include trade and professional publications, such as the Journal for Systems Management, published by the Association for Systems Management (ASM), and Data Management, published by the Data Processing Management Association (DPMA). Other organizations such as the American Management Association, also publish books and reports that provide detailed information in specific applications areas

Two relatively time- current research resources are vendors and personal contacts.

Analysts should establish and maintain contacts with their counterparts in other companies.

C. Fact-Analysis Techniques

Fact finding and fact analysis are related activities, As they collect information, effi cyient analyst organize, analyze, and use it to identify additional information needs. There are many useful techniques for the organization and analysis of collected documents.
Four general techniques are:

1. Data element, analysis 2. Input- output analysis

3. Recurring data analysis 4. Report use analysis

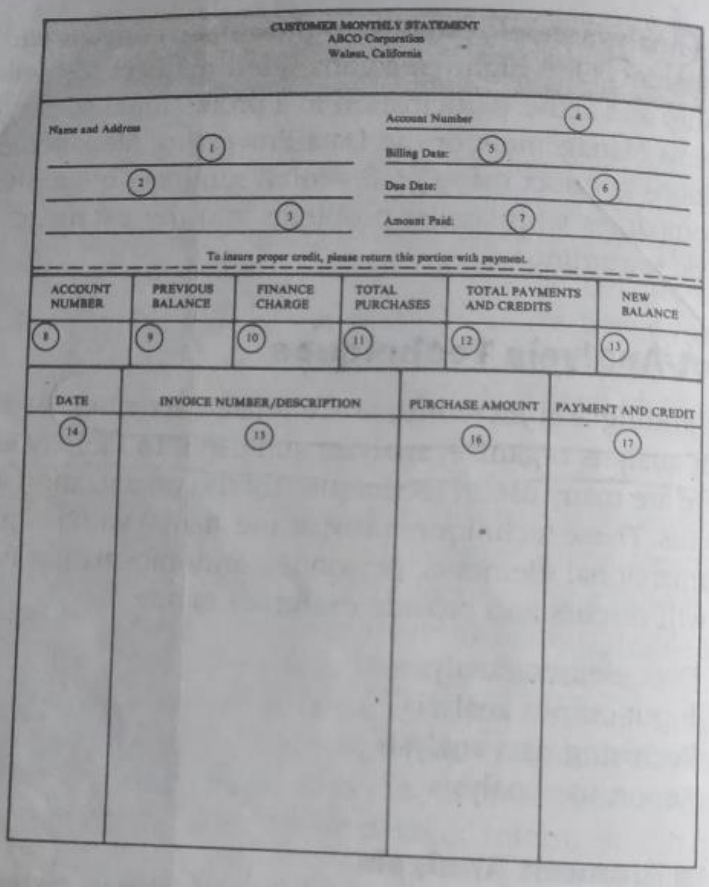
1 Data Element Analysis

By analyzing data elements and data structures, systems analysis sure themselves that they understand the meanings of the data names and the codes that appear in the manuals, procedures, charts, and other forms of documentation they have collected, One method of data element analysis has two steps

1 Assign a number to each data element
.2 Head a separate piece of paper with the title or other identification of the data carrier and write the meaning of each numbered data element or code.

Figure 10.8 is an example of a document, in this case a customer monthly statement, taken through the first step. Figure 10.9 a partial analysis of the same document.

Figure 10.8
Document numbered for data element analysis. The first of two steps in data element analysis is to assign a number to each data element on a document.



CUSTOMER MONTHLY STATEMENT
ABCO Corporation
Walnut, California

Name and Address (1) (2) (3)

Account Number (4)
Billing Date: (5)
Due Date: (6)
Amount Paid: (7)

To insure proper credit, please return this portion with payment.

ACCOUNT NUMBER	PREVIOUS BALANCE	FINANCE CHARGE	TOTAL PURCHASES	TOTAL PAYMENTS AND CREDITS	NEW BALANCE
(8)	(9)	(10)	(11)	(12)	(13)

DATE	INVOICE NUMBER/DESCRIPTION	PURCHASE AMOUNT	PAYMENT AND CREDIT
(14)	(15)	(16)	(17)

Figure 10.9

Data element analysis. The second and final step in data element analysis is to record the meaning of each data element, in order to be certain of a common understanding by the user and the analyst.

DATA ELEMENT ANALYSIS

DOCUMENT: Customer Monthly Statement

DATA ELEMENT:

1. Company Name
2. Address: Number and Street
3. Address: City, State, Zip Code
4. Account Number: Customer Account Code, 6 digit simple sequence code.
5. Billing Date: Closing date of billing cycle--month, day, and year
6. Due Date: Date after which account becomes delinquent.
7. Amount Paid: Filled in by customer to correspond to amount of check.
8. Account Number: Same as item 4
9. Previous Balance: Balance on previous month's statement.
10. Finance Charge: charge on unpaid balance.
11. Total Purchases: Total amount of purchases covered by this statement.
12. Total Payments & Credits: Total amount of payments and credits covered by this statement.
13. New Balance: Amount due equal to previous balance and total purchases--total payments and credits.
14. Date: Date of each transaction--month and day.
15. Invoice Number/Description: Invoice number or transaction description (e.g., credit)
16. Purchase Amounts: Net amount of reference purchases.
17. Payments & Credits: Amount of payment or credit.

2 Input-Output Analysis

Input output analysis is a general term for all analysis techniques based upon the perception of a system as a process that converts inputs into outputs Information oriented system flow chart, process-oriented system flowchart, and data flow diagrams are excellent tools for input-output

Figure 10.11 is an example of an input-output analysis sheet prepared for an accounts receivable department

Figure 10.11

Input-output analysis sheet for an accounts receivable system. Input-output analysis sheets are high-level IPO (input-processing-output) charts that describe the relationships between inputs, processing functions, and outputs for an organizational entity. The processes and files described are external to data processing.

INPUT-OUTPUT ANALYSIS SHEET

ORGANIZATION: Accounts Receivable Dept. SYSTEM: Accounts Receivable DATE: 9/3/XX

INPUT	PROCESSING FUNCTIONS/FILES	OUTPUT
Customer Account Application	• Customers submit account applications, which are processed by the Accounts Receivable/Credit department. • If an application is accepted, it is sent to Data Processing for entry into the system. Data Processing returns the application for filing.	Customer Account Application
Sales Order	• Sales orders are sent directly to Data Processing for order processing. The customer retains the carbon copy.	Sales Order
Customer Payment	• Payments are sent to the Accounts Receivable department. • A payment/credit memo is generated and sent to Data Processing. Data Processing returns the memo for filing.	Payment/Credit Memo
	• An aged A/R report is sent to the Accounts Receivable department from Data Processing each month.	Aged A/R Report
	• Data Processing sends overcredit notices to a credit clerk whenever a new order would exceed the customer's credit limit. If the additional credit is approved, the notice is returned to Data Processing with an authorization to process the order. If the additional credit is disapproved, the order and the notice are returned to the customer.	Overcredit Notice
	• Customer account lists are produced on demand and sent to the Accounts Receivable department for distribution.	Customer Account List
	• Customer statements are sent to Accounts Receivable in duplicate. The original copy is sent to the customer; the duplicate is filed. One-third of the statements are produced each ten days of the month, that is, on the 1st, 10th, and 20th.	Customer Statement
	• A daily A/R transaction register is sent to the Accounts Receivable department.	Daily A/R Register
	• The accounts receivable summary report is prepared weekly and sent to the Accounts Receivable department for distribution.	A/R Summary Report

3 Recurring Data Analysis

The significance of recurring data analysis is twofold: (1) Unnecessary input and output data duplication can be detected. This leads to form simplification, consolidation, and elimination (2) Redundant data elements and files can be located. This leads to clarification of data dictionary entries and to more efficient use of storage media.

Figure 10.15

Recurring data analysis sheet. Recurring data analysis sheets are used to identify data duplication in order to eliminate, or consolidate, forms and files.

RECURRING DATA ANALYSIS SHEET

DATA ELEMENT \ FORM NAME	Sales Order	Shipping Order	Shipping Invoice
Customer Name	✓	✓	✓
Customer Address	✓	✓	✓
Invoice No.	✓	✓	✓
Account No.	✓	✓	✓
Date	✓	✓	✓
Quantity Ordered	✓	✓	✓
Description	✓	✓	✓
Unit Price	✓		✓
Amount	✓		✓
Customer Signature	✓		
Sales Person	✓		
Total Amount	✓		✓
Ship to		✓	
How Shipped		✓	
Quantity Shipped			✓

Report Use Analysis

Report use analysis sheet asist the system analyst in identifying data element not used by individuals the distribution list. Th leads to reduced distribution, consideratio or elimination of repor

(After completing initial investigation) the system analyst pres results and the recommend principle used of the

4 Report Use Analysis

Reports and copies of reports tend to proliferate. Many individuals are collectors of reports, more because of fear of being left out than because of any legitimate need for information A useful technique for dealing with reports that are suspect because of a lengthy distribution list is a report use analysis.

Report use analysis sheets assist the system analyst in identifying data elements not used by the individuals on the report distribution list. This leads to reduced distribution, consolidation, or elimination of reports

Figure 10.16

Report use analysis sheet. Report use analysis sheets assist the systems analyst in identifying data elements not used by individuals on the report distribution list. This leads to reduced distribution, consolidation, or elimination of reports.

REPORT USE ANALYSIS SHEET

REPORT DESCRIPTION: Customer Monthly Statement

DATA ELEMENT \ USER NAME/FUNCTION	Customer	Customer Account Credit Clerk	Accounts Receivable Department (File copy)			
Customer Name	✓					
Customer Address	✓					
Account No.	✓	✓				
Billing Date	✓	✓				
Due Date	✓	✓				
Amount Paid	✓	✓				
Previous Balance	✓	✓				
Total Purchase	✓	✓				
Total Payments & Credits	✓	✓				
New Balance	✓	✓				

D. Results of Analysis

The systems analyst usually collects and analyzes large amounts of data. In the course of the initial investigation, the analyst has to discard data that is irrelevant and organize and summarize that which is relevant. After completing the process of organizing and summarizing data, the analyst should have a file of current information and a thorough knowledge of the current system. The information file should include:

1. Updated system documentation, including copies of all pertinent forms and reports
2. Correspondence and completed questionnaires.

3. Interview records,

4. Results of fact analysis, including data flow diagrams and other flowchart prepared during the investigation.

FEASIBILITY ANALYSIS

The process of evaluating the selected candidate is called a feasibility analysis and its purpose is two fold

1To describe the attitudes of each candidate system in detail

2 Tổ select and recommend the best of most feasible, among them.

In most instances, the best system is the one that satisfies all of the system performance objectives and constraints at the lowest cost.

Steps in a Feasibility Analysis

There are nine identifiable steps in performing a feasibility analysis:

1. Complete the formation of the system team.
2. Review the system data flow diagrams
3. Develop the system candidates
4. Perform preliminary evaluation of candidates.

5. Prepare detailed descriptions of candidates
6. Identify meaningful system characteristics
7. Determine performance and cost for each candidate
8. Weight the system performance and cost characteristics by importance
9. Select the "best" candidate

Step 1: Complete the Formation of the System Team

The first step in the feasibility analysis is to complete the system team by adding additional qualified participants to it typical additions to the team include one or more representatives from management and someone with up to date technical information from data processing.

The team should be a group of of Involved, interested people who can represent their respective areas to help define system problems and develop methods of solution

Team members usually supply excellent ideas for consideration Another benefit of the system team is that the involvement of use and management in planning system makes the system “their system”

Step 2: Review the System Data Flow Diagrams

The second step of the feasibility analysis is to review the data flow diagrams developed during the system performance definition activities During the system performance definition, we made a transition from the what of the system to the how of the system. That is, we went from the logical description to the physical description of the system The

sketches of the various outputs, along with the DFDS, will help us to focus on the system inputs, outputs, and data transformations of the new system

Step 3: Develop the System Candidates

The third step the feasibility analysis is to develop candidate physical systems that produce the outputs identified in the data flow diagrams. This step includes a consideration of hardware devices able to accomplish each of the four basic system functions of input, processing, storage and output

■ **Figure 12.2**

Candidate system matrix format. This table can be an effective means of presenting and comparing the basic functions of each potential system candidate.

CANDIDATE SYSTEM / FUNCTIONS	I	II	III	IV	V	VI
OUTPUT						
INPUT						
STORAGE						
PROCESSING						

,

Figure 12 2 shows a table that can be used the development of system candidates The table, called a candidate system matrix, lists functions to be performed and alternative systems for performing them. It is an effective means of presenting and comparing the basic function of each candidate.

Step 4: Perform Preliminary Evaluation of Candidates

Fourth step in the feasibility analysis to make a preliminary evaluation of the system candidates and thus narrow down the number of candidates to manageable Number. In the preliminary evaluation, any system that would not be practical because its obvious high cost. Candidate system overkill for the task at hand is eliminated. Candidate system that require technical knowledge beyond that available to the company or that do not fit the corporate philosophy should also be dropped from consideration.The process of elimination should continue until the number of candidates reduced to a manageable size.

Step 5: Prepare Detailed Descriptions of Candidates

Figure 12.5
Candidate system matrix. This candidate system matrix depicts, in part, the system candidates generated by the system team. Each candidate is described by its output, input, storage, and processing functions.

candidate system / functions	I	II	III
output	all outputs printed at central site	all outputs generated at central site; all outputs printed	all outputs generated locally; printed and/or displayed as appropriate
input	dumb terminal each store	intelligent terminal each store	intelligent terminal attached to minicomputer located at each store
storage	data base on magnetic disk at central site	master file on magnetic disk at central site; diskette local storage for batch transmission to central site	master file on magnetic disk at local store
processing	all processing at central site	local data editing; all other at central site	all A/R system processing done locally

The fifth step in the feasibility analysis is to prepare detailed descriptions of the system appearing in the candidate system matrix. The detailed descriptions should include flow charts and narratives specific constraints, identified inputs, processing requirements, and storage requirements.

Step 6: Identify Meaningful System Characteristics

Figure 12.8
Candidate evaluation matrix. The candidate evaluation matrix is used to record the performance characteristics and cost of each candidate. The performance and cost evaluation criteria shown in this example are typical of the criteria used to evaluate computer-related systems.

candidate system / evaluation criteria	candidate I	candidate II	
performance			
accuracy			
control			
flexibility			
growth potential			
response time			
storage requirements			
usability			
costs			
system development			
system operations			
payback			

Figure 12.8 depicts the system evaluation criteria to be used to evaluate the three remaining OARS candidates. This table is called a **candidate evaluation matrix**. When completed, it lists evaluation criteria and rates alternative systems in terms of this criteria.

Step six of the feasibility analysis is to select the criteria for evaluating the

candidate systems .The candidates are evaluated by two major categories of criteria performance

characteristics and costs. The performance evaluation criteria relate to the satisfaction of specific objectives identified and ranked in the process of system performance definition. Typical criteria are accuracy, çontrol capability flexibility growth potential response time storage requirements, and usability.

System costs include the costs of developing the system and operating it after its implementation. Cost factors that may be particularly important to evaluate system are those of equipment, facilities, and training .Equipment costs are important when additional equipment, such as computers and word processing machine must be acquired, or existing equipment must be modified. Facility costs reflect costs of additional buildings or rooms, or the modification of existing facilities Training costs are

usually not collected unless they can be easily identified.

Step 7: Determine Performance and Cost for Each Candidate

Figure 12.17

Candidate evaluation matrix. This candidate evaluation matrix summarizes the estimated performance and costs of each of the three candidate systems. It is a combination of quantitative and qualitative evaluations.

candidate system / evaluation criteria	*candidate I*	*candidate II*	*candidate III*
performance			
accuracy	good	very good	very good
control	good	good	very good
flexibility	very good	good	very good
growth potential	poor	poor	very good
response time	good	good	very good
storage requirements	very good	very good	fair
usability	fair	good	very good
costs			
system development	$118,500	$145,000	$175,000
system operation	$1.26 to 1.09	$1.30 to 1.13	$1.45 to 1.16
payback	13 months	18 months	21 months

The next step in the feasibility analysis is to develop the entries for the candidate evaluation matrix .

The **accuracy** of a candidate refers not to the accuracy of the equipment, but

of the system Accuracy, therefore, relates to the steps involved in getting source data

into the system and the steps that are taken to keep the data as error free as possible. **Control capability** relates to the security of the system, it also provides for auditing of the system .Control capability provides protection from mistakes made by humans and from fraud or illegal data manipulation. **Flexibility** refers to the ease of making adjustments to the system, such is modified or new output .**Growth potential**" is a measure of how much the system can continue to A system's response time is the total elapsed time between submission of data by a user and its return as a computer output .**Storage requirements"** refers to

computer based systems and refers to both main storage size and required auxiliary storage for all files. One of the most important criteria is **usability** It is a measure of the "User friendliness" of the system and it is the final measure of its acceptance.

Step 8: Weight the System Performance and Cost Characteristics

Figure 12.18

Weighted candidate evaluation matrix. The evaluations in this matrix are quantitative. The system team converted each of the performance and cost evaluations to a relative rating on a scale of 1 to 5. In addition, the evaluation criteria were assigned a weight to reflect their relative importance. The recorded scores are equal to the product of the assigned weights and ratings. The candidate with the highest total score that is consistent with the team's confidence in the data is the "best" system candidate.

candidate system / evaluation criteria	candidate I		candidate II			
	rating	score	rating	score	rating	score
performance						
accuracy (wt 2)	3	6	5	10	5	10
control (wt 4)	3	12	3	12	4	16
flexibility (wt 2)	5	10	3	6	4	8
growth potential (wt 4)	1	4	1	4	5	20
response time (wt 5)	3	15	3	15	5	25
storage requirements (wt 2)	5	10	5	10	2	4
usability (wt 5)	2	10	3	15	5	25
costs						
system development (wt 5)	5	25	4	20	2	10
system operation (wt 2)	5	10	4	8	3	6
payback (wt 2)	5	10	4	8	3	6
total score		112		108		130

In some cases the performance and cost data collected for each candidate will show one candidate as the obvious choice When this occurs, the task of the feasibility analysis is completed. Many times,

however, the "best" candidate is still not clearly identified. The eighth step of the feasibility analysis is to prepare a weighted can candidate evaluation matrix. This is a matrix that weights the candidate evaluation entries by their importance and then applies a rating number, it is a means of calculating total numeric scores for each candidate.

A weighted candidate evaluation matrix is prepared in five steps:

1 Divide the evaluation criteria into categories of importance, for example very important, moderately important, important

2. Assign a weighting factor to each category. The weighting factors should be in proportion to each criterion's effect on the success of the selected candidate system.

3 Rate each candidate for each criterion relative to the other candidates. This relative rating is often with a scale of 1 to 5, with 5 being the best and 1 the lowest 4Calculate the candidate's score for each criterion by multiplying the relative rating by the weight assigned to the category.
5 Add the score column for each candidate to determine its total score.

Step 9: Select the "Best" System

The last step is to select the best candidate system. The weighted candidate evaluation matrix summarizes the facts collected, as well as the subjective impressions about each candidate .The candidate with the highest total Score probably is the best system .The analyst must select a candidate to present to the users and to

management for their acceptance or rejection. If the total scores of two or more candidates are close, the analyst should reexamine the weights and ratings that differ the most, or in which the team has the least amount of confidence. Finally, the analyst should select the candidate with the highest total score that is consistent with the teams confidence in the data.

The "best" system usually is the system that meets the performance requirements at the least cost

Study phase report preparation

- Performance specification is contained in the study phase report
- Performance specification is the first baseline specification that describes what the computer based system is to do
- Content of performance specification is divided in to two parts.
- First part describes the interaction of the system with its operating environment, that is, inputs, outputs, interfaces with other systems, and resource needs. The resource needs include personnel, facilities, and system and equipment. These interactions are external to computer program and this part of performance specification is called **external performance description**. It include DFD or Information oriented flow chart.
- The second part of the performance specification ,the **internal performance description**,describes internal environment of the system. It includes a dataflow diagram or a process oriented flow chart and describes the related data processing operations and storage requirements.
- study phase report is a management oriented report that must be free of computer jargon so that it can be understood by senior managers who may not have a computer oriented background.

Study phase review

The study review is held to present the user with the result of study phase activities and with recommendations for future action. The study phase review should be attended not only by the principal user, but also by senior representatives of other affected organizations

If the outcome of the study phase review is a decision to proceed with the design phase , the user sponsor issues a written approval to proceed.

DESIGN PHASE ACTIVITIES

The Design phase is the life cycle phase in which the detailed design of the system is accomplished. In the course of the design phase, the performance specification is expanded in to the design specification.

The design phase activities are:

1. Allocation of functions

The dataflow diagrams or information oriented flowcharts and process oriented flowchart prepared during the study phase are reviewed expanded in order to allocate functions between manual tasks and computer program functions. The alternatives are analysed until all functions have been allocated.

2. Manual task definition

The requirement resulting from human interface with the computer based component of the system are described. Human interfaces include preparation of source documents, operation of equipment (for example machine operation, display console operation, data entry), and other input and output related activities.

3. Reference manual identification

Reference manual required by user personnel, programmers, and equipment operators are identified .

4. Equipment functions definition.

The functions to be performed by hardware (rather than by computer programs or manual operations) are defined. Special functions unique to the application (for example console displays)are described in detail

5. Equipment specification

The hardware configuration used to convert input data to meaningful output information is described. If the existing hardware is not adequate alterative, which may range from adding special equipment to procuring an entire computer system, must be considered

6. Computer program function definition

The specific functions of the computer program component of the overall system are defined and design requirements for external system input are established. For example, when data entry required from an input source document, a visual display screen layout in made. In addition input frequency, quantity, and source are specified. Similarly, the design requirements for the system outputs are established. Report frequency, size,

quantity and number of copies are stated. Control requirements are specified .These requirements include input preparation, Input acceptance, and processing controls.

7. Data base design

Relationships between data elements, functions to be performed, and techniques for file organization are studied in detail so the most appropriate storage devices can be selected and an efficient data base design can be achieved.

The storage requirements for all the data elements on which the computer programs operate are calculated, taking into account the size and volume of the records to be stored and the methods of file organization and access .The interface between the system data base and other data bases are identified by specifying the data that must flow between them

8. Computer program design

The computer programs, which make up the overall computer program component, share the system data base. However, they have their own output input, and processing requirements, which must be specified for each one. Special hardware and supporting software requirements also are identified. As necessary additional decomposed data flow diagrams or expanded system flow charts are prepared at the computer program and subprogram levels .Narratives, equations, algorithms, and decision tables or trees may be developed as aids in defining the functions of the computer programs. Control requirements are also extended to the computer programs.

9. System test requirements definition

Requirements are established for the tests necessary to verify the performance of the entire computer based system. This is accomplished in parallel with the activities associated with system design,

10. Computer program test requirements definition

Requirements also are determined for the tests necessary to verify the performance of the major computer programs, This is done after the definition of the system test requirements.(However, these tests are performed prior to the system tests.)

11. Design phase report preparation

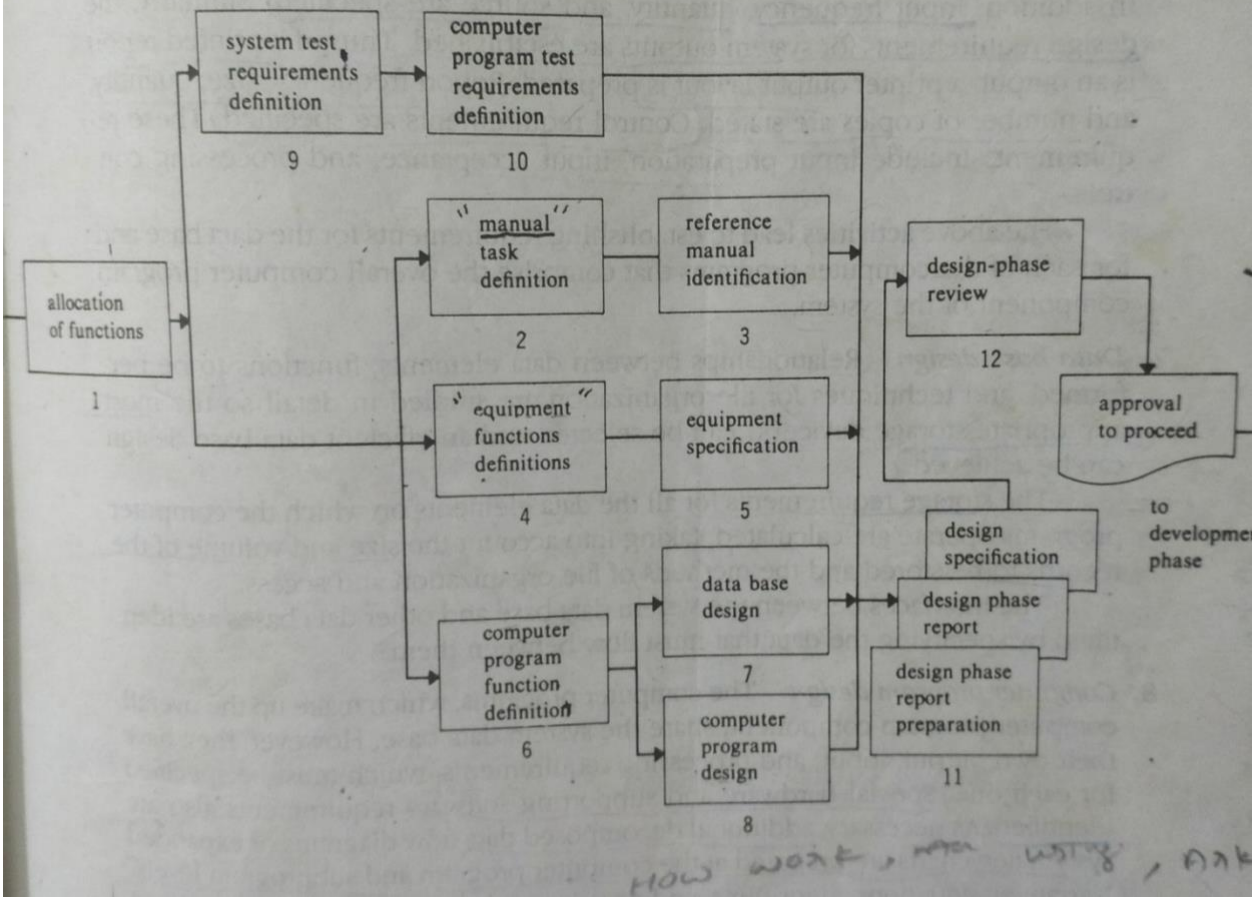
Design phase report is prepared at the conclusion of the design phase. This report is the outgrowth of the data acquired and added to the project file during the design phase. An extension of the study phase report/it contains a summary of the results of all significant

activities undertaken during the design phase. An important element of the design phase report is a recommendation relative to proceeding with the development phase. If the recommendation is to proceed, a detailed project plan is provided for the remainder of the project. The design specification is included in the design phase report. It is the second major baseline document. It represents an expansion of the performance specification into a blueprint for the development of the computer-based business system. It is a “build to” specification.

12 Design phase review

The system design is reviewed at the conclusion of the design phase by the management of the user organization and by representatives of the information systems organization. The principal documents upon which the review is based are the studyphase report including the performance specification and the design phase report, including the design specification. Any changes to the performance specification as a result of the design phase activities are identified and discussed. The detailed progress plan and the cost schedule for the development phase are reviewed, as are the estimates of operational costs . After the conclusion of a successful design phase review, manpower and other resources are committed. Written approval to proceed with the development phase is provided by the user organization.

Design phase activity flowchart. After the allocation of functions, the principal activity sequences of the design phase relate to the definition of manual tasks, equipment functions, and the definition of test requirements.



ALLOCATION OF FUNCTIONS

The first major activity of the design phase is the allocation of functions to manual operations, equipment, or computer programs. This is accomplished by expanding the result of the study phase activities to greater levels of detail.

Manual Tasks

Typically, human interface with computer –based systems in at least six principal ways, each involving manual task

1. Human prepare source documents.
2. Humans enter data from source documents for conversion to a machine readable format.
3. Humans prepare and use control documents
4. Humans write computer programs.
5. Humans operate equipment
6. Humans use computer –produced outputs

All the reference manuals to be used by programmers users, and operators are identified in the design phase. Their principal content may be outlined .

Equipment Functions

The process of allocating functions between manual tasks, equipment, and the computer program took into account the computer equipment resources currently available, and an additional resources that might be required. The range of equipment options includes:

1. Acquire a computer system.
2. Current computer equipment is adequate.
3. Add some components to the current equipment .
4. Greatly modify the current equipment .
5. Replace the current equipment by a new computer system.

Within each of these options there may be many equipment choices .

The equipment selection process would involve the following steps:

1 Define the equipment functions to be performed by the computer system

2 Identify the required capabilities of the computer system.

3 Evaluate the candidate computer systems

4 Select the computer system to be acquired on the basis of performance and cost.

The definition of the functions to be performed by the system begins with an analysis of the workload that the system is expected to process.

Whichever technique is used the sample workload should be representative of the tasks the computer must perform. This is called "benchmark testing because identical series of tasks can be used to compare two or more computers.

Another alternative is the use of a simulation program, which makes one computer to perform like another computer. The inputs to the simulation program are the input, processing and output tasks desired, and the frequency of their occurrence.

Growth is the ability of the equipment to meet not only the current workload but also future workloads. Three common ways of providing for growth are equipment with reserve power, (2) equipment with add-on capability, and 5) equipment that is compatible for upward conversion.

Computer Program Functions

The computer program component of an information system can be broken down into the functions of its individual computer programs .Each program performs one or more functions. These are typical functions provided by programs

1. Master file load or creation

2 Master file update

A Master file backup

4. Master file maintenance

5 Input data editing

6. Report/screen generation

Test Requirements

Identification of Test Requirements

The requirements for tests are established after the allocation of functions is completed. They are established in the following sequence

1 System test requirements
2 Subsystem test requirements
3 Component test requirements.

The requirements for overall system performance are established first t because they will determine the requirements for each subsystem .The requirements for testing the components of each subsystem are defined last .Computer based business system has manual, equipment, and computer program subsystems. Typically, the most important subsystem is the computer program subsystem. Its components are computer programs.

Structured Walk-throughs

Structured reviews are a technique used in developing efficient and reliable systems. A structured walk through is a technical review to assist the technical people working on a project . It is a "structured" review because it is one of a series of reviews that are a planned pan of the system design and development activities. It is referred to a walk through because the project is reviewed in a step by step sequence. Structured walk through can be a valuable tool in the design and development of y system component. They are especially valuable in the design and development of computer programs. The purpose of structured walk through is to discover errors in logic of a computer program or problems with other system components. The study, design, and development phase reviews are structured reviews.

OUTPUT DESIGN

In the study phase, outputs were identified and described generally in the project directive. A tentative output medium was then selected and sketches made of each output. In the feasibility analysis, a "best" new system was selected; its description identify the input and output media. In the design phase the system design process has included an evaluation and selection of specific equipment for the system. The design team must now refine the sketches into detailed description of the outputs. To do this, we must plan the output with a specific medium.

The most common output media are

1 Computer printers

2 VDT screens

Computer print charts and VDT display layout sheets are used for the detailed description of outputs. Microcomputers are having a dramatic impact on output design. The availability of graphics soft ware and desktop publishing systems can make the automation of form design a reality for even small organizations.

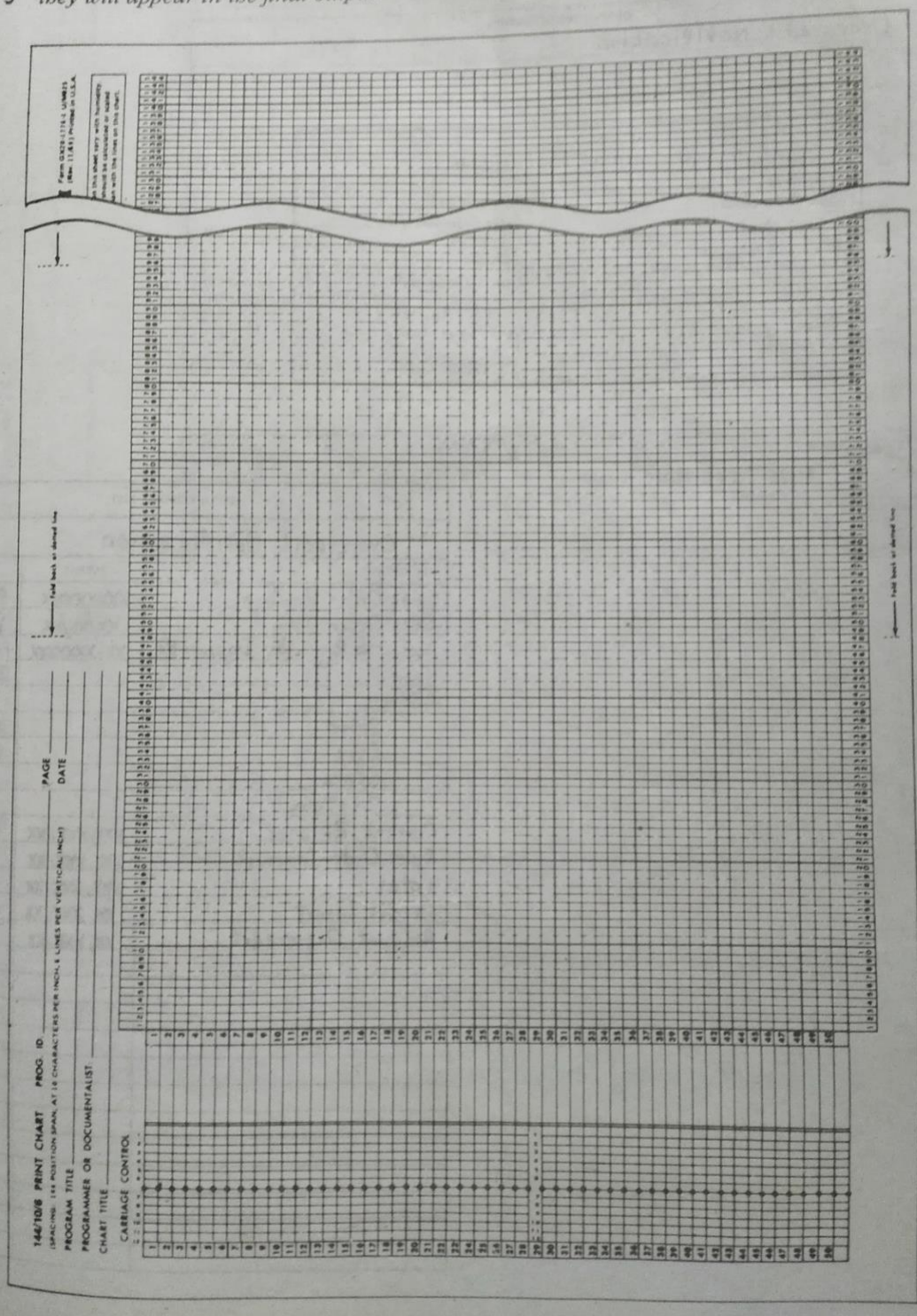
Computer Output

Computer Printer Output

Computer Print Charts are used to prepare detailed description of computer printed outputs. Each of the small squares on the chart represents a possible printing position. The titile,column headings,detail, and total lines can be shown exactly as they will appear in the final output.

■ **Figure 15.1**

Print chart. Print charts are used to prepare detailed descriptions of computer printed outputs. Each of the small squares on the chart represents a possible printing position. The title, column headings, detail, and total lines can be shown exactly as they will appear in the final output.



The Figure 15.1 depicts a typical form used to make this detailed description. The example print chart allows for 144 possible printing positions. Computer printers typically have a maximum of either 120 or 132 print positions and may use forms of much narrower width. A vertical line should be drawn to indicate the desired width of the form. Form length also varies with the needs of users. Older computer printers had a physical device that could read carriage control data from a closed loop, called a carriage control tape. The carriage control data recorded by punching holes within areas called channels. This tape is described on the left end of print charts. Modern printers no longer have a physical carriage control device. Instead, they store the carriage control information within a small memory buffer. The data in the carriage control buffer functions just as the carriage control tape did on older equipment. Carriage control data are most often used to identify the first and last line of printing for a form on a computer.

VDT Screen Output

The principles used in designing VDT screen output are similar to those of form design and computer printer output. VDT displays typically include titles, column headings, detail data, and, possibly, totals. These are the same requirements identified with computer print charts. The major differences are: (1) the size of the screen, and (2) the amount of data to be outputted as a record. The typical screen size is 80 characters across and 24 lines down.

Display layout sheet a form used to design VDT screen layouts. The form is divided into 24 lines of 80 characters each to simulate the possible display positions on a screen.

Graphics and Desktop Publishing

Printers

Dot-matrix printer

In the past all printed output was produced on printers that have fixed character sets. That is the characters are formed by striking a ribbon with a font that has a raised character shape. This approach produces a high quality image of the character, but it limits the characters that may be printed to those fonts on the printer. Dot-matrix printers form the printed image by striking the ribbon with a matrix of small rods or pins. Each pin produces a small dot on the paper with the pattern of dots forming the image The term image is used rather than character because the dot-matrix is not limited to forming characters. The image may be any shape. With this flexibility, dot-

matrix printers can print images such as line, bar, and pie charts, data-flow diagram, organization charts, forms, or any other image that can be described.

The **disadvantage** of the dot-matrix printer has been its low quality of print as compared to fixed character printers. Generally, the quality has not been good enough for business or professional use.

In the last few years dot-matrix printers called NLQ or near letter quality, have been introduced. These NLQ printers produce an image of relatively high quality by double striking each line to fill in the spaces between the dots to make a more solid-looking character

Laser printer

The most recent improvement in character printers has been the introduction of reasonably priced laser printers. Laser, or page printers, produce an image using hardware similar to a copier. The output of the laser printer is produced as a series of dots, as with the dot-matrix, but the dots are much smaller and very close together. The common laser printers print three hundred dots per inch. Laser printers can print image, including text, pictures, graphs, and so on. Some high quality and high cost) Laser printers can produce images with up to twelve hundred dots per inch. This quality is equal to that found in the glossy magazines.

Desktop Publishing

Desktop publishing is a term applied to the combination of desktop or personal computers and laser printers. With the flexibility of the laser printer to print any kind of image, text and graphics can be easily combined into a single image on a page. This allows users to produce newsletters, advertising copy, and brochures on their own personal computer. Most of the desktop publishing software packages also allow direct input into automated typesetting equipment for very high-quality reproduction.. The desktop publishing software format the page images almost in any way you desire. The buzzword for desktop publishing is WYSIWYG (pronounced wizzy wig). It means What You See, Is What You Get . The layout on the screen is exactly what you will see on the printed page. That includes text rotated and printed up the side, graphics, proportional print, and anything else that you require.

INPUT DESIGN

The most common source of data processing errors is inaccurate input data .Effective input design minimizes errors made by data entry operator.

Input design is the process of converting a user oriented description of the computer based business system into a programmer oriented specification. Inaccurate input data is the most common cause of data processing errors.
In the design phase, the input design process was continued. Specifically:
1. The decomposed data flow diagrams or expanded system flowchart identified master files (the data base), transaction files, and the computer programs.
2. The input media selected in the study phase were reviewed. Additional studies of alternatives were performed as required, and tasks were allocated among equipment, manual operations, and computer programs,

Input Design Considerations

In addition to the general form design considerations, such as collecting only required data, and grouping similar or related data, input design requires consideration of the needs of the data entry operator. The data entry considerations are:

1. The field length must be documented.
2. The sequence of fields must match the sequence of the fields on the source document.
3. The data format must be identified to the data entry operator

VDT Screen Design

Visual display terminals are becoming increasingly important as input devices. It is a terminal with a keyboard for inputting and a display screen for outputs Effective screen design can not only reduce data entry errors, it can also increase productivity and user satisfaction. Many of the on-line data entry stations are VDTS provide both a visual verification of input data and a means of prompting the user. As data is entered it is echoed, or displayed on the screen. The user can modify or delete any data display before sending it to the computer system for storage and processing Each display station has its own memory, called a buffer, for storing data. The input design goal is to input data as accurately as possible.

Display layout sheet

The display layout sheet is used to plan the layout of a VDT screen.The form is divided into 24 lines of 80 characters each to simulate the possible display positions on a screen.

Screen design Aid(SDA)

Many modern computer systems have software utilities to assist in the design and development of screen layouts As an example, IBM has a utility called Screen design Aid

(SDA), With this utility, it is possible to eliminate filling out the display layout sheet. The screen layout can be designed at the terminal. The utility allows the designer to

add, delete, or move the display components. When the design is completed, SDA outputs a printed record of the design that looks much like the displaylayout sheet. In addition, the utility generates the program code to produce the design display.

Some screen design rules that are important for user satisfaction are:

1. Use the same format with related screens.
2. Do not overcrowd the screen.
3. Provide instructions. Tutorial information that is easily accessible is help users, particularly infrequent users.
4. Use consistent terminology:
5. Keep instructions brief and grammatically similar.
6. Coordinate forms and screen design. This is particularly important for data entry, where data elements are common to the source document and to the screen

Other Input Media

Optical Readers

Optical readers are examples of input devices that can capture data directly.
Three important types of optical devices are mark readers, barcode readers, and character readers. Optical mark readers are able to accept data in the form of pencil marks on paper.

Optical bar-code readers detect combinations of marks by which data is coded. These systems usually are complex to design; the most widely known is the Universal Product Code (UPC), which appears on most retail packages.. The human readable characters are printed alongside.

Optical character reader (OCR) devices have been designed for applications that can make use of special, optically readable symbols. A typical design application embossed credit cards, which produce an imprint that can be read by optical scanners.

Optical readers are good examples of the expanding Technology to minimize errors creating large volumes of input data. To extent that human operations can be replaced by machine operations, the integrity of input data, and therefore of system output, can be improved.

Design Phase Report

The design phase activities are concluded by three major events.
These are
(1) completion of the design specification
(2) preparation of the design phase report
(3) conduct of the design phase review.

Design Specification

The design specification is the technical core of the design phase report. This second major baseline document is the "blueprint" for constructing the computer based business system. It is the communication link between the analyst and the programmers who will be assigned to the project. Figure displays the content of a typical design specification.
The design specification is an extension of the performance specification prepared at the conclusion of the study phase.

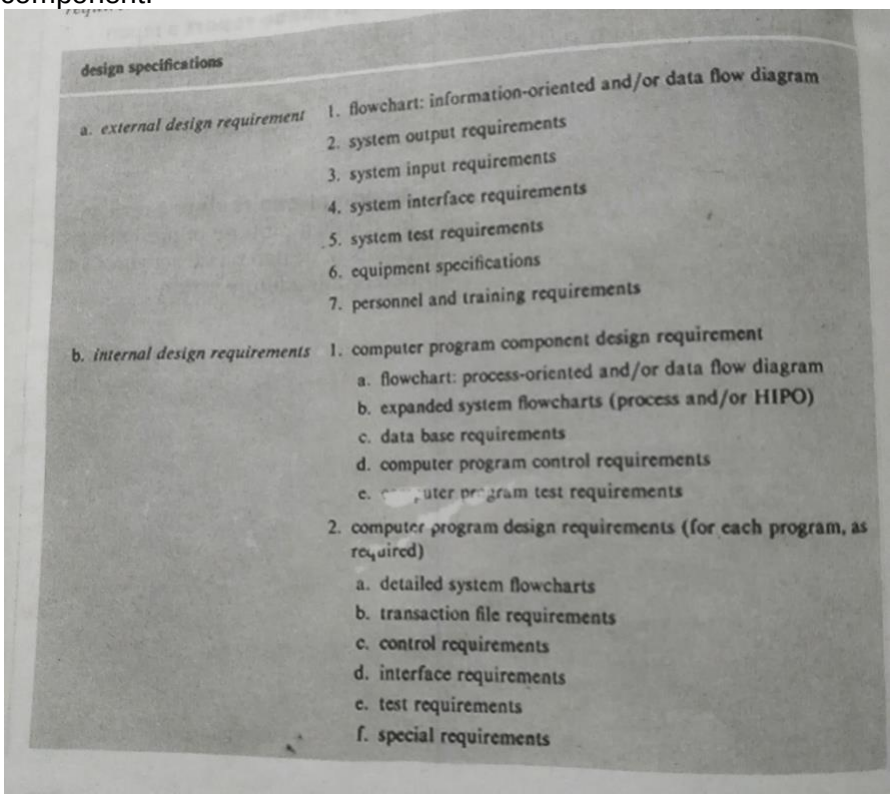
It also is divided into two parts.

External design requirement

The first part is an external design requirement that relates to the interaction between the system and its operating environment.

Internal design requirement

The second part of the design specification is an internal design requirement This part establishes design requirements for the overall computer program component of the business information system and for the individual programs that are the building blocks for this component.



design specifications	
a. *external design requirement*	1. flowchart: information-oriented and/or data flow diagram
	2. system output requirements
	3. system input requirements
	4. system interface requirements
	5. system test requirements
	6. equipment specifications
	7. personnel and training requirements
b. *internal design requirements*	1. computer program component design requirement
	a. flowchart: process-oriented and/or data flow diagram
	b. expanded system flowcharts (process and/or HIPO)
	c. data base requirements
	d. computer program control requirements
	e. computer program test requirements
	2. computer program design requirements (for each program, as required)
	a. detailed system flowcharts
	b. transaction file requirements
	c. control requirements
	d. interface requirements
	e. test requirements
	f. special requirements

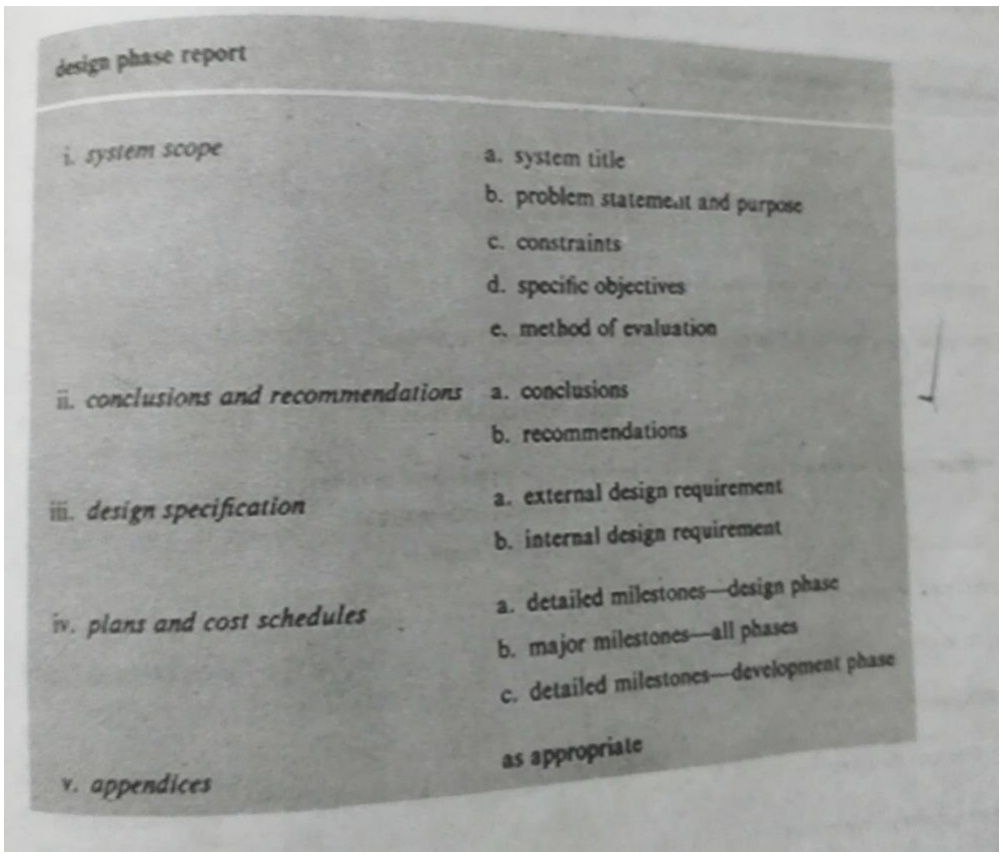
Design Phase Report

Structure and Content

The structure and content of the design phase report are shown in figure. As shown in this figure, the design phase report has the same five major parts as the study phase report. They are

1. System scope
2. Conclusions and recommendations
3. Design specification
4. Plans and cost schedule
5. appendices

The system scope section is brought forward to refamiliarize reviewers with the project. Of course, the system scope section in the design phase report should identify and explain any changes that occurred during this phase. The life-cycle project plan and the cost schedule, which were prepared at the conclusion of the study phase, are updated to show progress in reaching the design phase milestones. A detailed milestone plan and cost schedules are now pre plated and presented for the development phase, for which authorization to proceed is being requested. Appendices should be included in the design phase report as required. It usually is a good idea to place complicated analyses in appendices.



design phase report	
i. *system scope*	a. system title
	b. problem statement and purpose
	c. constraints
	d. specific objectives
	e. method of evaluation
ii. *conclusions and recommendations*	a. conclusions
	b. recommendations
iii. *design specification*	a. external design requirement
	b. internal design requirement
iv. *plans and cost schedules*	a. detailed milestones—design phase
	b. major milestones—all phases
	c. detailed milestones—development phase
v. *appendices*	as appropriate

Design Phase Review

The design phase review is a particularly critical review. It is a review for the dual purpose of presenting results of design phase It is a true test of sponsor confidence. Up to this point, the computer-based business system activities were visible to the user-sponsor. The principal user was able to follow the study phase efforts that resulted in the preparation of the performance specification and the study phase sport. This person can comprehend most of the design tasks that are summarized in the design specification. Now the system is on the verge of moving into the de development phase. In the design phase review user must make decision about future activities that cannot be visualized clearly or followed in detail,

Development phase activities

The development phase is the third of the four systems development life cycle phases. It is the life cycle phase in which the system is constructed according to the Design specification

The principal activities performed during the development phase can be divided into two major sequences

1 Activities external to computer program development
2 Activities Internal to computer program development

The development phase activities are

1. Implementation Planning
2. Computer Program Design
3. user review
4. Equipment Acquisition and Installation
5. coding and debugging
6. Computer program testing
7. System Testing
8. Reference manual preparation
9. Personnel training
10. Changeover plan preparation
11. Development phase report preparation
12. User acceptance review

1. Implementation Planning

After the initiation of the development phase is approved, implementation planning begins.

Essential parts of the implementation plan are:

- Test plan-. plan for testing the computer program component, both as the integrated assembly of its individual programs and as an element of the overall business system.
- Training plan-plan for training the personnel who are to be associated with the new system .This includes persons who will provide inputs to receive outputs from, and operate or maintain the new system.
- conversion plan- This plan provides for the conversion of procedures, pro grami und files preparatory to actual changeover from the old system to the new one. The conversion plan also includes a preliminary plan for actual changeover from the old to the new system

2. Computer Program Design

Computer program design is begun parallel with the implementation planning effort. As necessary, system flowcharts are expanded to show additional detail for the computer

program components. The complete database is developed . Input and output files are identified and computer program logic flowcharts prepared for each computer program component

3.User review

Reviews are held with the principal user throughout the development phase. It helps to keep the user informed of general project progress and to secure cooperation in areas in which the sponsor can be of assistance to the project. Review of test plans,design plans, and conversion plans is essential because user personnel are directly involved in the implementation activities.

4 Equipment Acquisition and Installation

In the design phase, special hardware required to support the system may have been identified .If not ordered during the design phase this equipment is ordered at this time, and delivered, installed, and tested.

5 Coding and debugging

Each of the computer programs that make up the computer program component of the overall system is coded and debugged This means that each is compiled without error and successfully executes its program logic, using data supplied by the programmer

6. Computer Program Testing

The computer programs are tested in a planned, top-down sequence that includes structured walk -throughs .The testing continues until the programs can be assembled as a component that can be tested as a unit. The analyst supplies data for testing the programs.

7 System Testing

System tests are performed to verify that the computer based business system has met its design objectives. The system includes the computer program component as one of its major elements. The user is responsible for supplying the input data and for participating in the evaluation of the system test results. System test reports are prepared to validate system performance

8 Reference Manual Preparation

Appropriate reference manuals for the various individuals who will work with the new computer based information system must be prepared These reference documents are based upon the system specification. The three principal manuals are for programmers operators and users.Forms and procedures are important elements of the reference manuals.

9 Personnel Training

Operating programming and user personnel are trained using the reference manuals, forms, and procedures as training aids .The training schedule is closely coordinated with the schedule for completing the development phase. All essential training must be completed prior to the user acceptance review, which occurs at the end of the development phase.

10 Changeover Plan Preparation

The preliminary changeover plan, whích was an element of the conversion plan. is updated. Changeover from the old to the new system takes place at the beginning of the operation phase. The changeover plan specifies the method of changeover, giving a detailed schedule of activities to be performed and identifying the responsibilities of all personnel involved in these activities,

11. Development Phase Report Preparation

The conclusion of the development phase the development phase report is prepared, documenting the development of the system in accordance with requirements specified in the design phase report. This report contains a summary of all of the pertinent activities undertaken during the development phase.

The development phase report includes a system specification the third major baseline document which evolves from the performance and the design specifications. The system specification contains the complete technical specification for the computer related business information system and its components. It contains, for instance, detailed flowcharts, data base specifications and computer program listings. The system specification contains all of the essential system documentation, it is the baseline reference for the preparation of manuals and training aids.

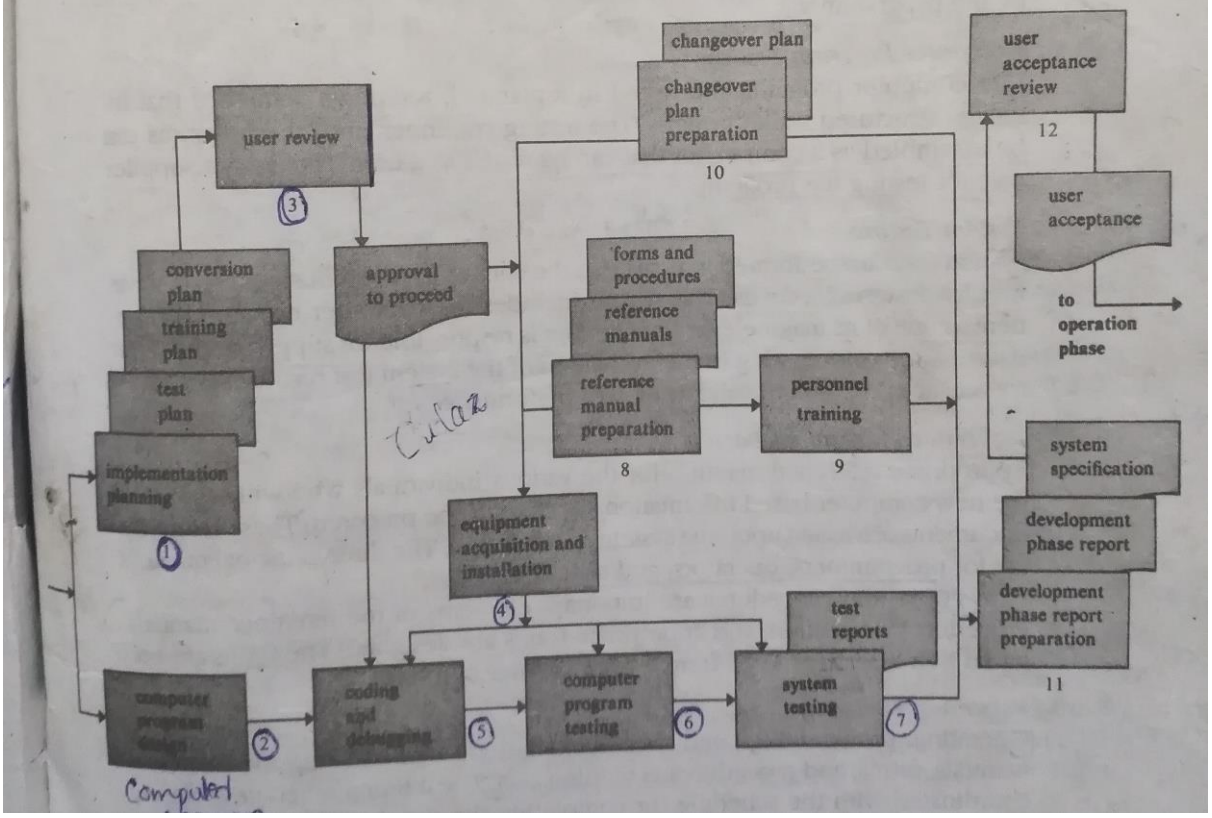
12 User Acceptance Review

At the conclusion of the development phase the computer based business system is reviewed by the management of the user organization. Representatives of the Information service organization and other affected organizations participate in this review. The principal documents upon which the user acceptance review is based are the design phase report, the development phase report. test reports, and the changeover plan.

After the conclusion of a successful acceptance review the user organization issues a written memorandum of acceptance and the system enter the operation phase of its life cycle.

Figure 19.1

Development phase activity flowchart. The principal activity sequences of the development phase relate to (1) implementation planning, including conversion to the new system; and (2) computer program design and system testing.



IMPLEMENTATION PLANNING

The Implementation process

Implementation is the process of bringing developed system into operational use and turning it over to the user.

The major elements of the implementation planning are

A. Test plan
B. Training plan
C. Equipment installation plan
D. Conversion plan

A) Test Plans

There are two methods of planning for the development and testing of computer programs. These are

1. Bottom up method
2. top down method.

Bottom-up Computer Program Development

The older method for scheduling and managing the tests of computer programs is to develop hierarchical structure within which the lowest level programs are tested individually and then combined into higher level modules, which are tested next. This process, which sometimes is called string testing, is illustrated in figure 1. an example of bottom-up computer program development.

A typical development and testing sequence (from 1 to 11) is shown in this figure. Modules that have been coded from the bottom-up and those that are not yet coded are shown. Eventually, all the module s will be strung together at successively higher levels to form the complete computer program.

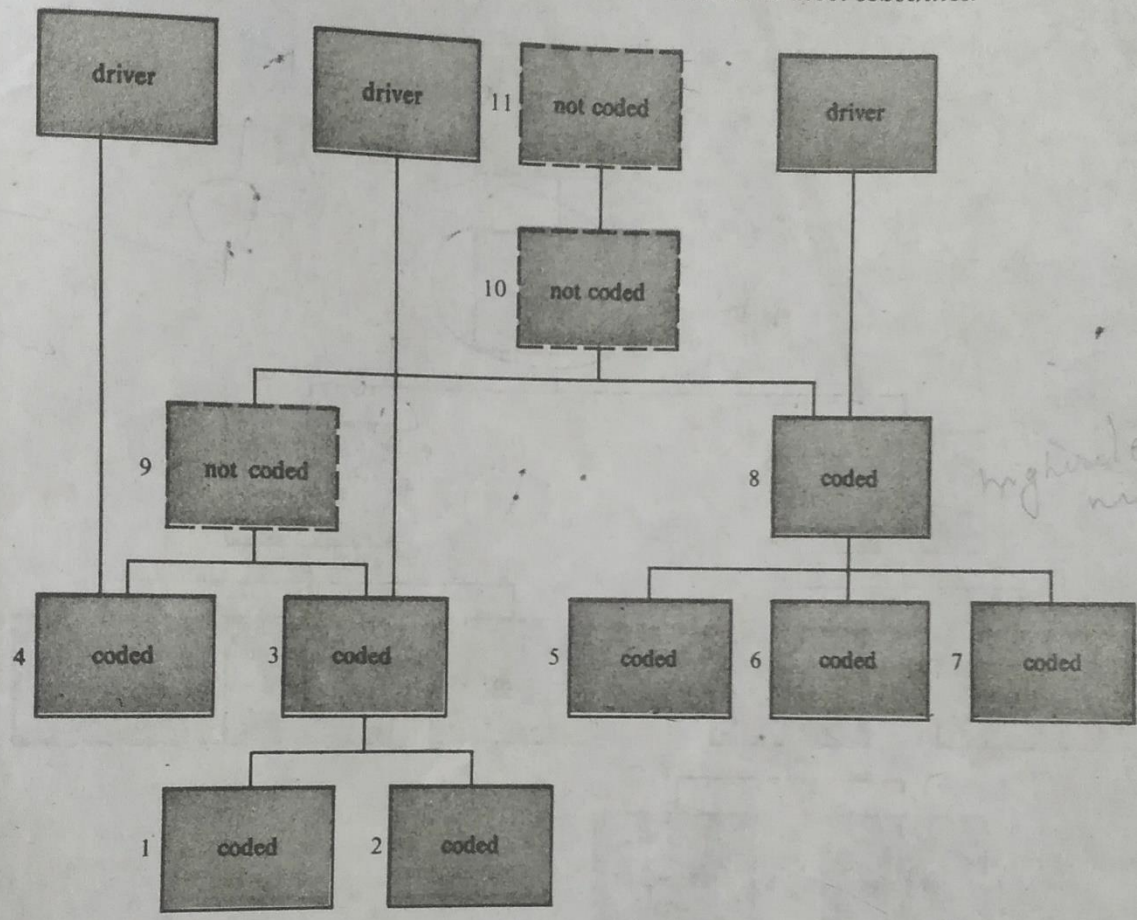
Disadvantages of Bottom up testing

- There have been many difficulties with this traditional method of developing computer programs. Often special programs, called "driver' programs, have to be written to test the higher level modules as they are created. For example, in figure modules 3, 4, and 8, which are the highest level coded modules at the stage of development depicted, must be tested with driver programs that supply calling and control instructions not yet available from other modules in the computer program development hierarchy

- In addition, interfaces between modules must be developed, and the modules must be integrated successfully to create a complete and functional computer program.Failure of some components to mesh at the project has caused serious errors. Changes made at this time, high in the level of the system hierarchy, could cause much of the lower level development and testing to be redone, causing overruns in cost and failures to meet schedules.

Figure 19.2

Older bottom-up computer program development. The bottom-up method for developing computer programs is based upon proceeding from lower-level modules to higher-level, more complex ones. Failure of all of the modules to mesh at the highest level often produced cost overruns and inabilities to meet schedules.

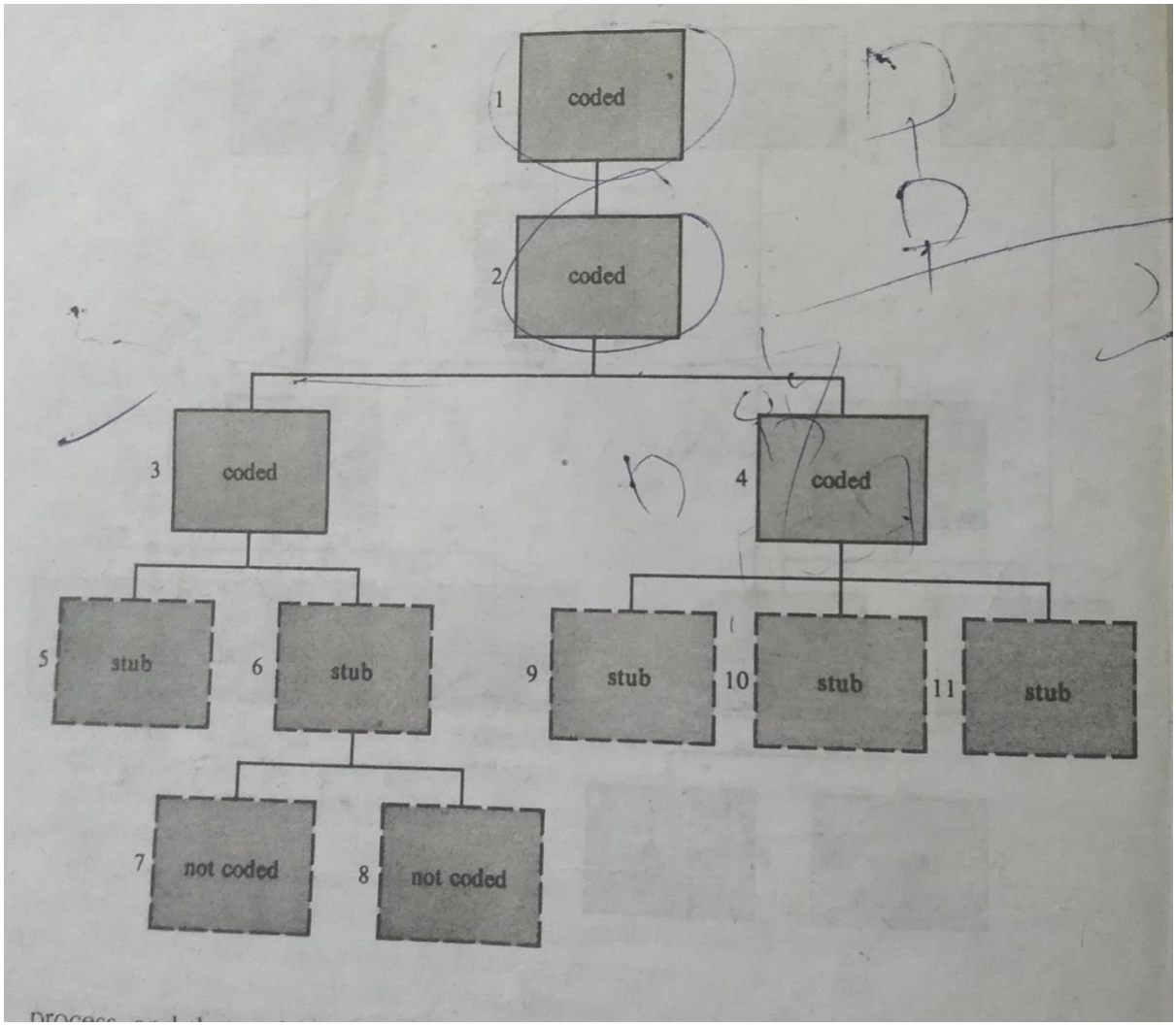


Top-down Computer Program Development

The top-down computer program development and testing approach is a structured technique that starts with a general description of the system and expands into the greater levels of detail

The top down approach to computer program development and testing is shown in figure . This structured technique for computer program development is a logical extension of the top down, hierarchical approach to system design characteristics of structure charts such as HIPO charts

Modules are developed downward from nucleus at the top of the computer program hierarchy. Driver programs are not necessary Instead modules that display message acknowledging receipt of higher level program control are used. These module are called stub.



The advantage of top-down structured testing

- computer program continues to operate as stubs are removed and modules added.
- Managers thus have continuous control over the computer program development process
- problems that can arise from an overall integration effort are minimized.
- At the end of the project integration effort is eliminated and total machine usage for testing is reduced.
- Early testing can verify the correctness of the higher level computer program routines responsible for the major logic and overall program control, and can, increase the reliability of the final product.

B)Training plan

- Their purpose is to ensure that all the personnel who are to be associated with the computer based business system possess the necessary knowledge and skills.

- Operating, programming, and user personnel are trained using reference manuals as training aids.
- All essential training must be completed prior to the user acceptance re view at the end of this phase.
- Training programs begin with the selection of appropriate participants and the preparation of different types of training programs for programmes operators, and user personnel.
- User personnel are those person who will prepare inputs, follow procedures and user outputs
- Additional training programs must be conducted for management level personnel, not only to familiarize manager with the new system, but also to obtain their active support and cooperation during implementation.

Programmer Training

- programmers assigned to develop the computer based business system project at the beginning of the development phase.
- The programmer's reference manual is the most comprehensive of the reference manuals. It Informs an experienced programmer, unfamiliar with the system, about the aspects of the computer program.
- The manual should enable this person to (1) understand existing program components, (2)modify existing program components, and (3) write new program components.

Operator Training

- If new equipment is to be installed, operator training is completed in conjunction with its installation and checkout. Different kinds of operational personnel may be involved in the operation of the system, such as computer operators, console operators, and data entry operators. Therefore, more than one type of manual may be required. It should provide purpose and step by step operating instructions. These instructions should cover both normal and abnormal situations. They should be written it a style that easily understood by the intended users of the system.

User Training

- Prior the system to begin operation, a sufficient number of users must be trained before the end of the development phase.
- As with operator's s reference manuals, usually more than one type of user's reference manual is required. Each one should be self contained and should explain the system

in terms of the user's specific needs. The text should be factual, concise, specific, and clearly worded and illustrated.

- Sentence should be simple and direct.Discussions of theory and detailed technical matters should be avoided.
- The manual should provide overview of the system.

C)EQUIPMENT INSTALLATION

The principal equipment related activities that must be implemented are

1. Site preparation
2. Equipment installation
3. Hardware and software check out

D)Conversion

Conversion is the process of performing all of the operations that result directly in the turnover of the new system to the user. Conversion has two parts

1. The creation of a **conversion plan** at the start of the development phase and the implementation of this plan throughout the development phase.
2. The creation of a system **changeover plan** at the end of the development phase and the implementation of the plan at the beginning of the operation phase

CONVERSION PLAN

Conversion Activities (Development Phase)

A conversion plan is prepared at the start of the development phase.
Its principal elements concern are

1. Procedure conversion
2. Program conversions
3. File conversion

1 Procedure conversion
Often a new system will incorporate many of the old system's forms and procedures, but some of these may require modification to fit into the new system.
The procedures that require change must be identified, and the changes explained during training of personnel.
2 Program Conversion
The new computer based system may include some computer programs that are part of an existing system. A conversion problem may arise if new equipment is installed, if the inputs and outputs of existing programs change, or in the existing programs are not efficient in their new environment. Even if new equipment is not involved, all the existing programs

must be re-evaluated. Reprogramming should be considered when programs are poorly documented, heavily patched, or not efficient enough. For instance, many all programs might be replaced by a single program that performs a repetitive function more effectively.

3 File Conversion

File conversion can be the most time-consuming and expensive step in the entire project. The magnitude of this task often is underestimated .For example, if many thousands of customer account records are to be stored on a magnetic disk instead of kept in filing cabinets-possibly located in different parts of the company-the conversion effort could be expensive. Existing files must be converted into a format acceptable to the computer program and equipment. Duplicate files must be consolidated and errors corrected before changeover to the new system starts. File conversion activities include many basic systems analysis activities, such as fact finding and analysis, forms design, procedure writing, and computer program design We can divide file conversion into a sequence of three major activities. These are
(1) collection of file conversion data
(2) conversion of files
(3) testing of converted files
In many circumstances file conversion data must be collected from a variety of sources. Some data may already be in machine-readable form; however, it often is necessary to create new data to supplement that which is already filed in some form.

Verifying data going into the new files is an important and often laborious task. All too often a high percentage of "current" data is incomplete or in error. Discrepancies are common, f-instance, between data stored in two redundant files that are to be consolidated into a shared data base. Before consolidation can take place, it must be determined which (if either) file is correct. Verification usually requires the extensive assistance of user personnel.

Changeover Plan (Operation phase)

By the time of the acceptance review at the end of the development phase, forms and procedures have been prepared and used, computer programs have been written and tested, and old files have been converted to new tiles The next step in the conversion process is the actual changeover from the old system to the new, which takes place at the beginning of the operation phase A changeover plans that identifies and schedules all changeover activities should be available at the acceptance review. It should specify the method of changeover and identify the roles and responsibilities of all personnel.

The three general methods of changeover from the old system to the new system are
1. parallel operation,
2. immediate replacement
3. phased changeover.

Parallel Operation

In parallel operation , data is processed by both the old and new systems. In theory, this method offers many advantages. The have maximum flexibility because they do not have to begin using the new system until they are certain it is producing acceptable outputs. In practice, unfortunately, there are several reasons why a "pure" parallel operation method of changeover seldom is possible:

1. The new system is different from the old system.
2. Parallel processing may be too time consuming or expensive, particularly if personnel are not available to operate both systems. This is particularly true if the volume of work is large.
3. Determining which system is in error can be difficult.

Immediate replacement

Immediate replacement usually occurs are those in which

1. A high percentage of outputs are new
2 The system is not so critical that failure is a disaster
3. No type of parallel processing is possible
4. The user exerts "pressure for use of the system output
5. An alternate, or fallback, system is available.

Phased change over

Phased change over compromise between parallel operation and immediate replacement; it is recommended over the other two methods. In this method users process some percentage, perhaps 10 percentage of the normal volume of transactions, through the new system with the remainder proceed the through the old system. Thus users can become familiar with the operation of the new system, and the task of correcting errors is manageable with existing resources.

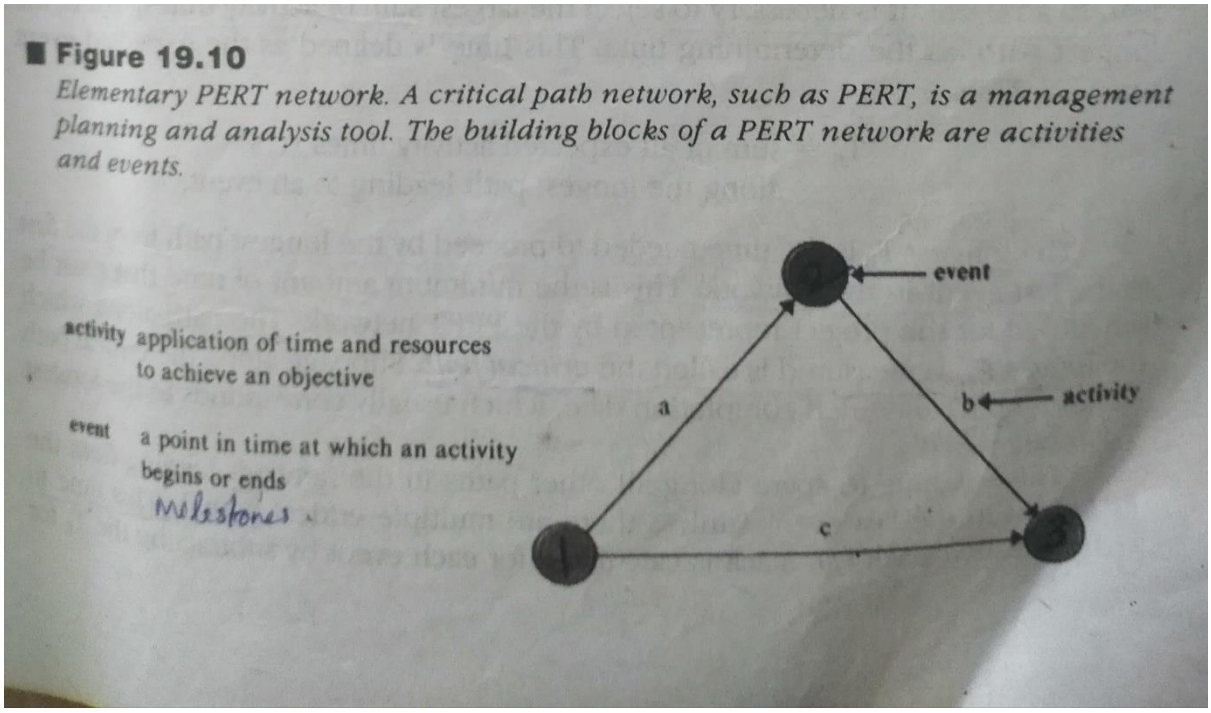
Network Techniques: PERT(Program Evaluation Review Technique)

PERT (Program Evaluation Review Technique) is a management planning and analysis tool that uses a graphical display called a network to show relationships between tasks that must be performed accomplish an objective. PERT is a means of creating a "master plan" for the control of complex projects.

PERT is a management tool that provides a manager with an orderly approach to planning .By forcing the manager to construct a network, PERT points out relationships between tasks that might be otherwise overlooked. It also brings about coordination of effort , since it requires that participants in a project communicate with each other in order to establish and review the network. In short, PERT is a technique at helps managers answer questions such as these:

1. What, work is to be done?
2. How will the work be done?
3. When is the work to be done?
4. What management actions can be taken?

To answer the question “What, work is to be done?” we must specify objectives and develop a plan identifying the tasks to be completed to achieve this objectives.I n PERT the plan is represented by a network like that in figure which displays related activities and events. A network is a graphical representation of related activities and events .An activity is the application of time and resources to achieve an objective. It is measured in units of time, usually weeks, and is represented on the network by an arrow, The arrows labelled a, b and c in figure 19.10 represent activities.



An event is point in time at which an activity begins or ends, It is represented on a PERT network by a circle. Thus, in figure 19.10, event 2 represents the end of the activity a and the start of activity b. That is, each internal activity has a predecessor and a successor

The PERT network helps to answer the question How will the work be done? By displaying the sequences in which activities must occur if specified events are to be reached. , it identifies two independent paths along which activities must be completed. Along One path, activities a, b and c must be performed in sequence. Along the other path, activity c must be performed concurrently with activities a and b

PERT networks also help to answer the question "When is the work to be done? This is accomplished by estimating an expected time for each activity

It is calculated according to the following form
$T_e=(O + 4M +P)/6$

where

T_e =Expected activity time (in weeks)

O- Optimistic estimate (how long the activity would take if everything

well)

M - Most likely estimate the normal time the activity should take
P - Pessimistic estimate (how long the activity could take under adverse conditions)

The time to reach any event along a network path can be calculated the sum of the activity times along the path However, since more than one path my lead to an event, it is necessary to select the largest sum of activity times, that is the longest path, as the determining time. This time is defined as the expected event time, T_E

T_E= sum of all expected activity times (t's) along the longest path leading to an event.

The longest T_E is the time needed to proceed by the longest path from the to the last event in the network. This is the minimum amount of time that must be scheduled for the project represented by the PERT network. The path along the longest T_E is measured is called the critical path .Slippage along the critical path can cause the scheduled completion date, which usually corresponds to the longest T_E, to be missed.

There is time to spare along all other paths in the network leading from the first event to the last event (unless there are multiple critical paths). This time spare is called sack (s). Slack is calculated for each event by subtracting the T_E for that event from the latest allowable time T_l which is the latest time that an event can be reached without causing any path on which the event lies to exceed the critical path. Thus
$S= T_l - T_E$
$T_l = T_l$ (successor)-t_e(activity).

We now can consider the question "What management actions can be taken?"

The PERT network lends itself to "exception" reporting. This means that the manager need focus attention only on those activities and events that are not proceeding according to schedule .The PERT network can be expanded to provide more detailed coverage in areas requiring management attention.

PERT provides the manager with an early warning of possible difficulties. The manager has many ways of reacting to problems if made aware of them with sufficient time for action. For example, the manager may:

1. Add new resources along a path with zero or negative slack. (Negative slack occurs when the slippage is such that the path length exceeds that of the critical path)

2. Trade off resources by shifting them from less critical to more critical activities
3. Extend the scheduled completion time.

Steps in Computer Program Development

The steps in computer program development are

1) define the function of the program
2) plan the logic of the program,
3) code the program
4) test and debug the program
5) complete the documentation.

1) Define the function of the program

Although the programmer is responsible for writing the computer program, the system analyst must communicate the computer program requirements to the programmer. Detailed data flow diagrams (or process oriented flowchart) are prepared for each program from the decomposed DFD created during the design phase. These DFD define the function of each program.

2) Plan the logic of the program,

Algorithms, computer program logic flowcharts, and structure charts are useful tools for program planning. Algorithms are sets of rules or instructions used to accomplish tasks. They may be stated as formulas, decision tables, or narratives. The program logic flowchart , pseudo code, structure chart, and algorithms that result from program planning are retained and become part of the project documentation

3) Code the program

The next step., writing, or coding, a program, is the actual writing of computer instructions. These instructions will be translated to machine code and followed by the computer, they should follow the steps of the program logic plan.

4) Test and debug the program

Testing and debugging a programme involve (1) translating the coded program into machine language, a process called compilation and (2) testing the translated program with sample data and checking the result . If the results of testing are no correct, the program is said to

have bugs. Debugging is the process of correction computer programs to obtain correct results.

5) complete the documentation.

The last step is to complete the documentation for the program. The documentation must include

- a statement of the purpose of program(from step1)
- a description of solution logic(from step 2)
- a listing of program instructions(from step 3)
- a sample output from the completed program(from step 4)
- information provided to the programmer by the analyst, such as description of program inputs, outputs ,and files should be included.

Structured Programming

Structured programming is a top-down approach to the creation of a program that is comparable to the approach defined by the system development life cycle concept. Structured programs are made up of a series of program modules, each of which performs a single function. The first module of the program logic has the most general function (the top). All following modules develop the logic to more detailed levels, with the last modules each performing the specific detailed function.

Structured programming has often been described as writing programs with no "GO TO" Instructions. Structured programs are made up of combinations of only four logical structures

1 Sequence-where instructions are executed in the sequence they are coded

2. If Then Else the decision structure that states a condition and then what should be done if the condition is true "else" what to do if the condition is false

3 Iteration (looping)-the structure that causes a module to be repeated

4. Case- selection structure that allows for the execution of one Of several modules, depending upon a data element value.

All programs can be written using only these four logical structures .

Advantages

The major advantages of structured programs are:

1. The initial development time and cost of the program is less because even complex programs are easier to code, test, and debug than are non structured programs

2. The time and costs associated with modifying a structured program are less because the program logic is easier to understand and update.

Development Phase Report

Development phase report prepared at the end of the development phase; it is an extension of the design phase report and summarizes the results of the development phase activities.

Development phase report is built around the system specification the third and final major baseline document. The system specification is an "as built specification. It is the major reference document for all personnel who will use, maintain, or operate the computer based business system.

Structure and Content

The development phase report contains the same five sections as the studyphase and design phase reports:

- System scope
- Conclusions and recommendations
- System specification
- Plans and cost schedule
- Appendices

  However the content is expanded to include results of development phase activities.

The conclusions and recommendations relate to the next life-cycle phase, the operation phase, and focus on the next major decision. This is the decision to change over from the existing system to the new system. Important inputs to the changeover decision are (1) the completed system specification, (2) satisfactory system test reports, (3) the availability of trained personnel, and (4) a changeover plan.

development phase report

- i. *system scope*
  - a. system title
  - b. problem statement and purpose
  - c. constraints
  - d. specific objectives
  - e. method of evaluation
- ii. *conclusions and recommendations*
  - a. conclusions
  - b. recommendations
- iii. *system specification*
  - a. external system specification
  - b. internal system specification
- iv. *plans and cost schedules*
  - a. progress plans
    1. detailed milestones—development phase
    2. major milestones—all phases
    3. changeover plan
    4. operational plan
  - b. cost schedules
    1. project cost—development phase
    2. project cost—major milestones
    3. operation phase—recurring costs
- v. *appendices*

DEVELOPMENT PHASE REVIEW

It is a review held with the user organization at the conclusion of the development phase to determine whether or not to enter the operation phase. The immediate consequence of an approval to proceed is the initiation of the changeover activity.

Operation Phase Activities

The operation phase follows the development phase Usually it is the longest of the life cycle phase and is characterized by four distinct stages.

System changeover

Normally a period of transition is required to change from an old system to new one. If all the development phase implementation activities have been performed adequately, the necessary manuals and documentation for the new system are available. There is a nucleus of trained personnel (user, programming and operations) to assume responsibility for the new system.

System change over is the most critical period in the entire life cycle of the computer based system. Positive support by all user organizations is essential.

Routine operation

At the conclusion of the changeover process the system is considered to be operational. The user organization and other operating personnel assume their respective responsibilities, and procedures are established for change control.

System performance evaluation

After the computer based business system has been operational for reasonable period, its performance is fully evaluated. The result of evaluation are documented in an evaluation report, which should be

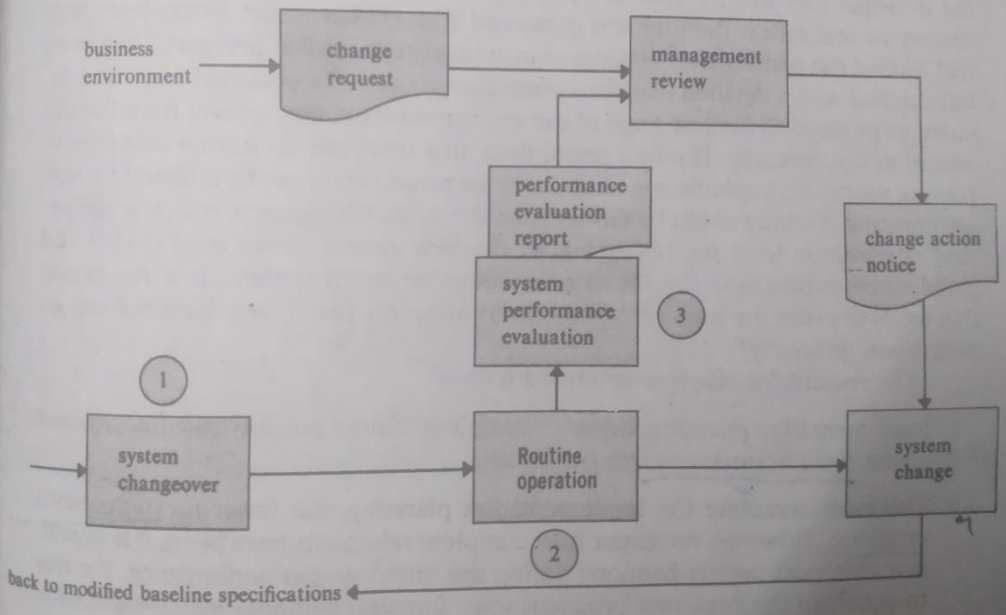
presented to a management review board, typically called a performance review board. The performance review board should be mainly user oriented. The board should be headed by principal user of the system.

System Change

The modern business system environment is dynamic, subject to carry internal and external influences. As shown in figure 22 .1, the business environment may trigger a change request, which is then reviewed by management. This process may range from a brief analysis of the requested change to an extensive investigation. This investigation may cause a return to an early point in the life cycle. The investigation could cause a return to the study phase, in which case the resulting new design and development activities might yield a greatly modified system

At the conclusion of the review and analysis of the requested change, the responsible management organization issues a change action notice. The actual change action is then taken. The potential impact of the change action is shown in figure 22.1 by the arrow that indicates feedback to the modified baseline specifications.

Figure 22.1
Operation phase activity flowchart. Principal activity sequences of the operation phase relate to changeover from the old system to the new; routine operation; and system change, which usually results from system interaction with the business environment.



The Changeover "Crisis"

The reasons for changeover crisis are these

1. Implementation planning, however complete, cannot possibly take into account all the real life situations that can occur.

2. The more complete the implementation planning, the fewer the unforeseen problems. However, no matter how complete rehearsals have been, if is unrealistic to expect perfect harmony during the initial system performance. For this to occur, all the computer programs must function without error people must not make mistakes, equipment must not

malfunction, files must not contain residual elements of contaminated data, and, above all, everyone should be pulling for the success of the system.

3. All changeover methods contain risks. Three changeover methods: parallel operation, immediate replacement, and phased changeover. All introduce new tasks into an actual operational environment. Therefore, mistakes and problems are to be expected

4. Changeover is an emotional activity. Change suddenly becomes a reality. Things will be different. This realization is-sufficient to create tensions that cause and amplify mistakes.

Changeover Activities

The change over activities are

1 Compare new outputs with old outputs as much as possible. If outputs differ only in format, It usually is possible to verify content.

2. Check inputs and outputs to be certain that they conform to specifications.

3. Follow up immediately on all errors, Correct the manual or machine processes casing the errors .

4 Keep a log. Use a changeover action log to record actions, responsibilities, assignments, and completion dates.

5 Solve all problems promptly. Seek the cooperation of the user groups in resolving problems and in deciding on immediate corrective measures.

6 Defer any refinements or changes in the system until changeover has been completed.

Data processing performance standards

Response time

The time that elapse between the release of input data by a user and receipt of computer output is the response time.

Throughput time

Throughput time is the time required for work to flow through the machine room

Turnaround time

It is the time that lapses between data arrival at the computing enter and the availability of output for pickup.

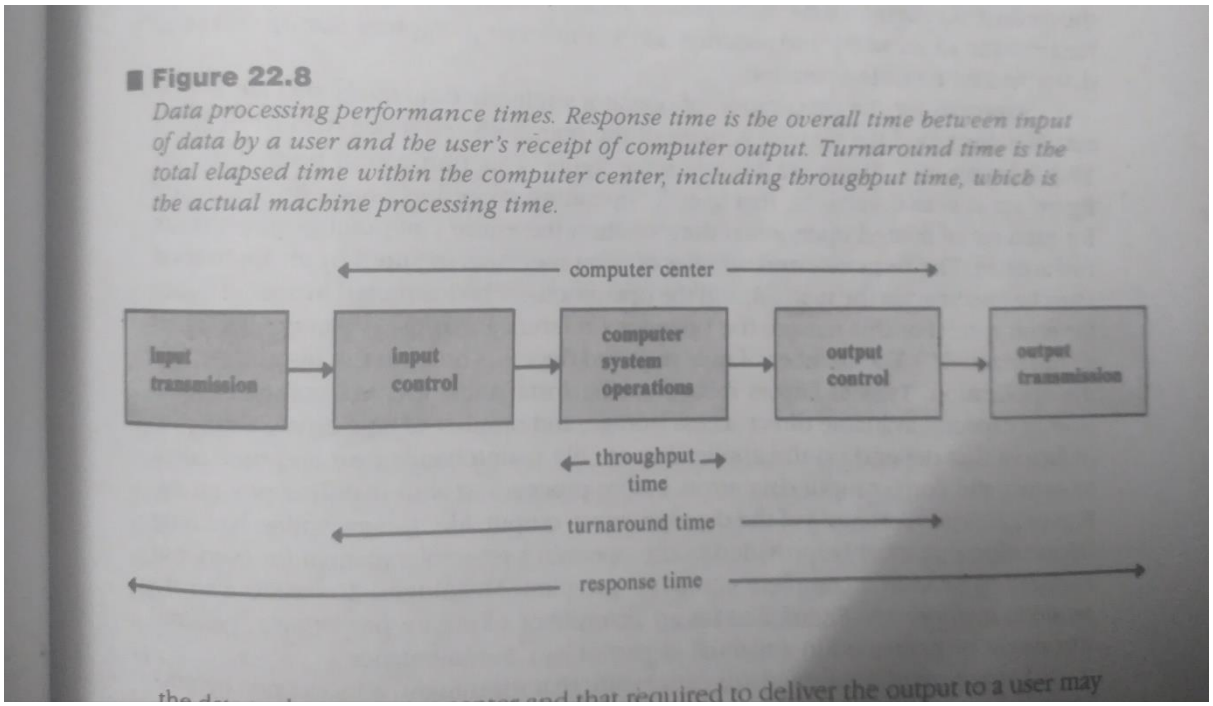


Figure 22.8
Data processing performance times. Response time is the overall time between input of data by a user and the user's receipt of computer output. Turnaround time is the total elapsed time within the computer center, including throughput time, which is the actual machine processing time.

the ... and that required to deliver the output to a user may

Security

Management concern about the security of computers often is inflamed by highly publicized incidents of computer related fraud. To provide protection against disasters, certain steps should be taken:

1. Physical Location

Select a computer site away from natural hazards: Take steps to reduce known risks. For example, water risk can be reduced by storing data in high locations and by providing drains, pumps, and plastic covers for equipment.

2. **Physical Access Control**

Use badges and controlled entry points. However, the key factor is an alert computer staff who will challenge all strangers

3 Fire Protection

Locate the computer center away from fire hazards. Provide early warning devices, fire detectors, portable extinguishers and emergency procedures.

4 Media Protection

Store vital files in a separate room or vault.

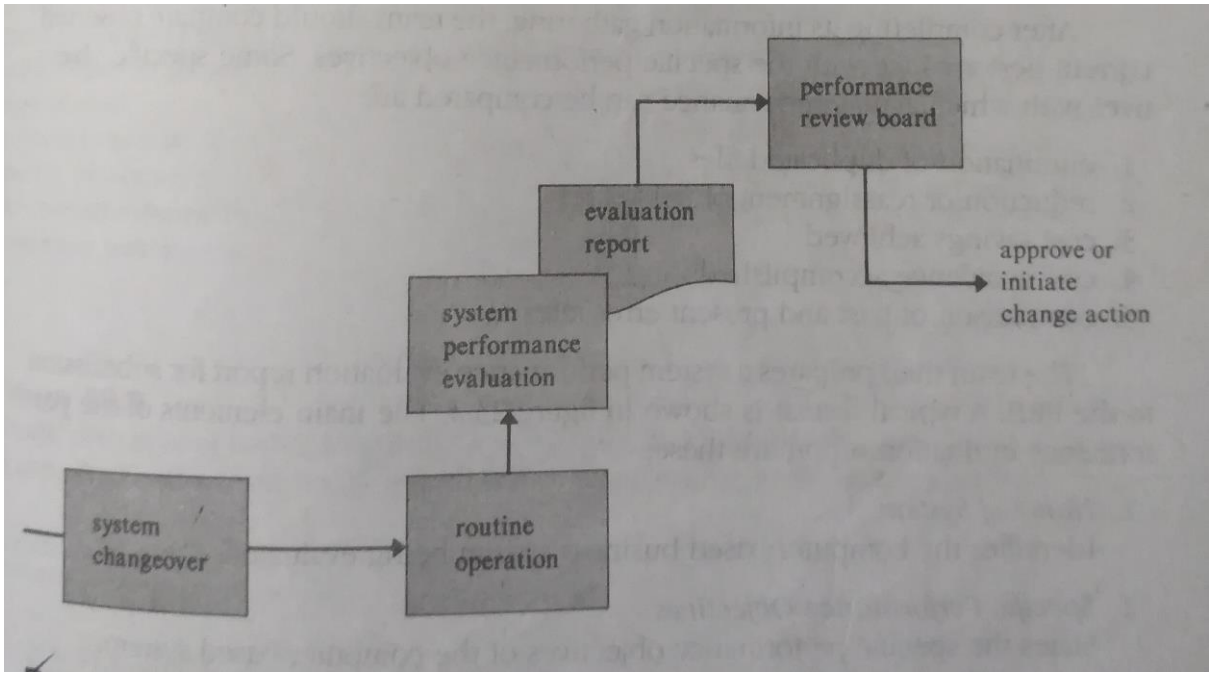
5. Backup and "Fall Back Capabilities

If possible, make arrangements with similarly equipped data processing centers.

6. Risk Insurance

Evaluate insurance policies to cover data processing losses.

Performance Evaluation



After system changeover is completed and after the computer –related information system enters routine operation, formal performance evaluation occurs. An evaluation report is prepared for review by a performance review board.

Performance Review Board

It is a user oriented board responsible both for the periodic evaluation of the performance of a computer based business information system and for maintaining its integrity.

Post-installation Review

System performance evaluation begins with the post-installation review. Which is intended to determine how well actual performance compares with promised performance.

Post –installation review should not be scheduled until the change over crisis is over. Usually this is two or three months after the system has been declared operational.

Periodic Review

The post-installation review is followed by periodic review, which are intended both to insure that the integrity of the system is maintained and to identify special areas requiring management attention.