WHAT IS A COMPUTER

A computer is an electronic device capable of manipulating numbers and symbols under the control of a set of instructions known as a computer program. A computer program directs the computer to solve a particular problem and display results. Computer programs are written using programming languages such as BASIC, FORTRAN, COBOL, PASCAL, C, ALGOL, and so on.

COMPUTER HARDWARE AND SOFTWARE

A computer basically consists of electronic components which are supported by electrical devices and mechanical systems. All these electronic, electrical and mechanical components used in a computer are called Computer Hardware.

Computer hardware components are actuated and controlled with the help of computer programs called Computer Software. Computer softwares are classified into two categories:

(i) Application softwares are programs used to solve specific problems (tasks) like railway reservation, banking, etc.

(ii) System softwares are programs used to handle the computer hardware and to execute the application programs. Operating systems and language processors (compilers) are also system softwares (which shall be discussed later).

STAGES OF DEVELOPMENT (COMPUTER HARDWARE)

Computers became commercially available during the early 1950's and many significant technological developments have taken place thereafter. The stages of development are termed as first, second, third, fourth and fifth generation computers.

First-generation Computers

The following are the characteristics of first-generation computers:

- Vacuum tubes were used as principal electronic component which occupied large space and generated more heat
- Speed of computing was measured in milliseconds
- Limited storage capacity
- Punched cards were used for input/output operations

Second-generation Computers

The following are the characteristics of second-generation computers:

- Solid state electronic components such as transistor and diodes were the principal electronic components
- Speed of computing was measured in microseconds
- Considerable reduction in heat generation
- Remarkable improvement in reliability
- Increased storage capacity
- Magnetic tapes besides punch cards are also used for input/output operations

Third-generation Computers

The following are the characteristics of third-generation computers:

- Use of Integrated Circuits (IC)
- Speed of computing was measured in nanoseconds
- Occupied less space
- Improved input/output devices like visual display unit (monitor), line printers, magnetic tapes and so on were used.

Fourth-generation Computers

The following are the characteristics of fourth-generation computers:

- Use of microprocessor chip (the entire CPU on a single silicon chip)
- Speed of computing was measured in nano and picoseconds
- Occupied lesser space
- Commonly available as personal computers
- Mini- and microcomputers were developed from microprocessors

Fifth-generation Computers

The following are the characteristics of fifth-generation computers:

- Use of super large scale integration (SLSI) chip in computers (supercomputers)
- Supercomputers are capable of performing millions of instructions (expressed in units of MIPS) in a second.
- Speed of processing is high
- Use of RISC (Reduced Instructions Set Computing) for processing
- Supercomputers are expensive

ORGANISATION OF A COMPUTER

A computer system has five major units:

- Input unit
- Output unit
- Control unit
- Memory unit
- Arithmetic and logic unit

The input and output units are devices that are used to receive inputs and display solution. Keyboard, mouse, monitor, printer and so on are the common input/output devices used in a computer.

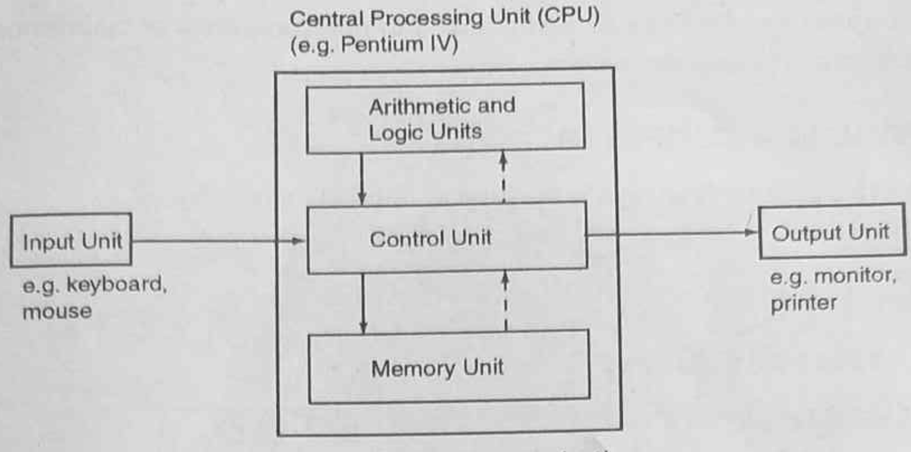


Fig. 3 *Computer organisation*

Control unit, memory unit and arithmetic and logic unit constitute the central processing unit (CPU) of a computer. Their purposes are as follows:

(a) The control unit controls all the component activities of the computer. It sends command and control signals and finds the sequence of instructions to be executed.

(b) The memory unit is the place where all input data and results are stored. The CPU memory is also called as Memory Register. Computer memory is also available in the form of Random Access Memory (RAM).

(c) The arithmetic and logic unit consists of circuits and registers which perform arithmetic (+, -, *, /, etc.) and logic (<, >, <=, >=, etc.) operations.

All units in a computer other than the central processing unit are called Peripherals.

TYPES OF COMPUTERS

Based on speed of operation, memory capacity, hardware facilities and cost, computers are classified as follows:

(i) Mainframe Computers

(ii) Minicomputers

(iii) Microcomputers

Mainframe computers work at a higher speed and have higher storage capacity. These computers support a large number of terminals to use a variety of software applications. Thus, these computers are costly.

Minicomputers are medium sized and powerful computers used to serve many users simultaneously.

Microcomputers are the commonly used general purpose computers. The latest microcomputers work at greater speed and they can be easily linked to minicomputers or mainframe computers. Microcomputers are comparatively cheaper.

DATA STORAGE IN A COMPUTER

Storage of data in a computer is always in the form of Binary Digits (bits):

4 bits = 1 Nibble

8 bits = 1 Byte

1024 bytes = 1 k or 1 KB (Kilo Byte)

1024 KB = 1 MB (Mega Byte)

1024 MB = 1 GB (Giga Byte)

PERSONAL COMPUTERS (PC'S)

Personal computers (Figs. 4 and 5) are microcomputers commonly used for commercial data processing, desk top publishing (DTP), engineering applications, and so on.

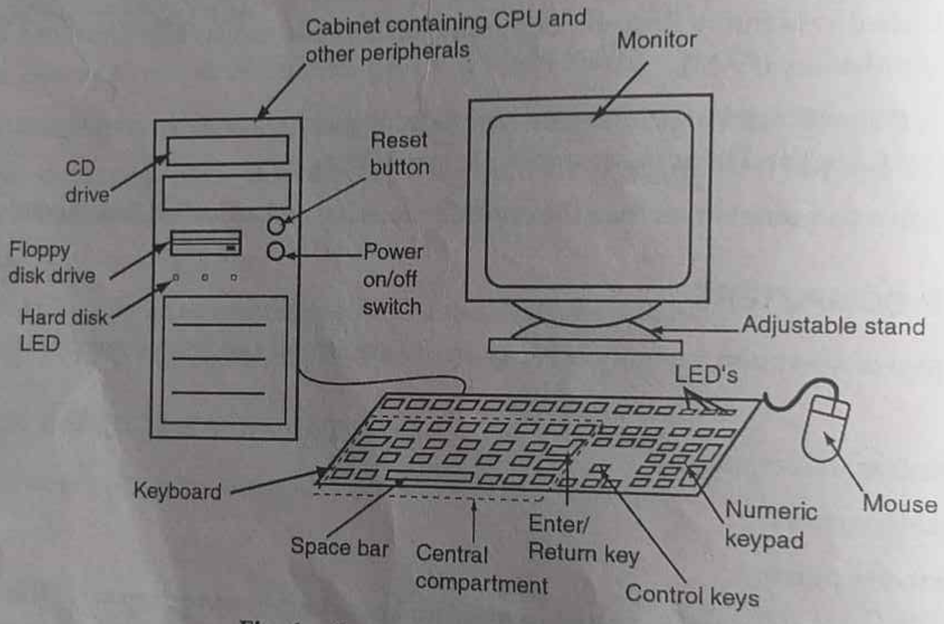


Fig. 4 *Computer and its peripherals*

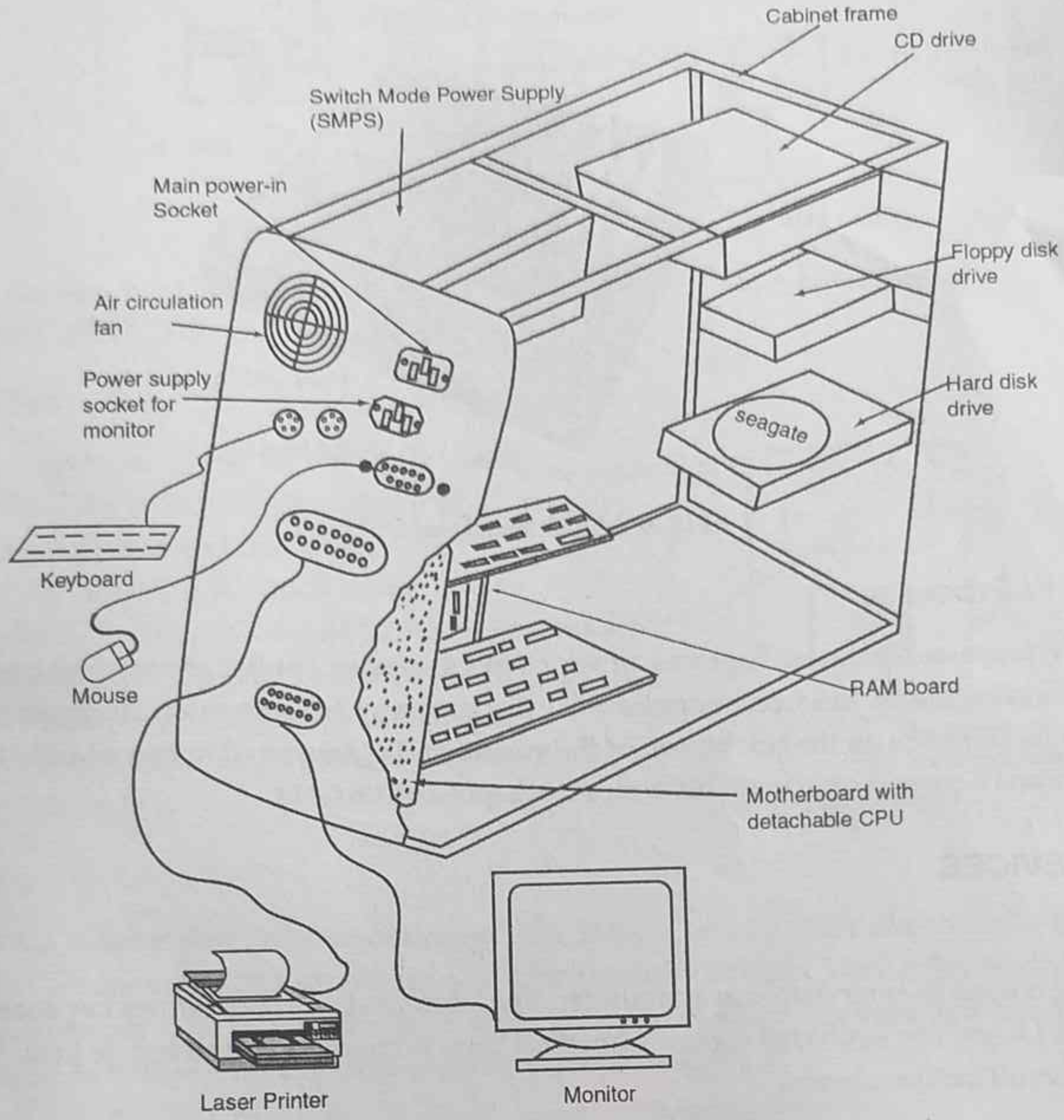


Fig. 5 *Computer cabinet showing the main circuit boards and peripherals with connectivity*

PARTS OF A PERSONAL COMPUTER

A personal computer commonly available today comprises a processor (Pentium IV), a keyboard, a mouse, a floppy disk drive (FDD), a hard disk drive (HDD), a compact disk drive (CDD), a color monitor, a printer (dot matrix/inkjet/laser), RAM (Random Access Memory) and ROM (Read Only Memory). The microprocessor/CPU, RAM, ROM and other supporting circuitry are interconnected on a single board called motherboard as shown in Fig. 6.

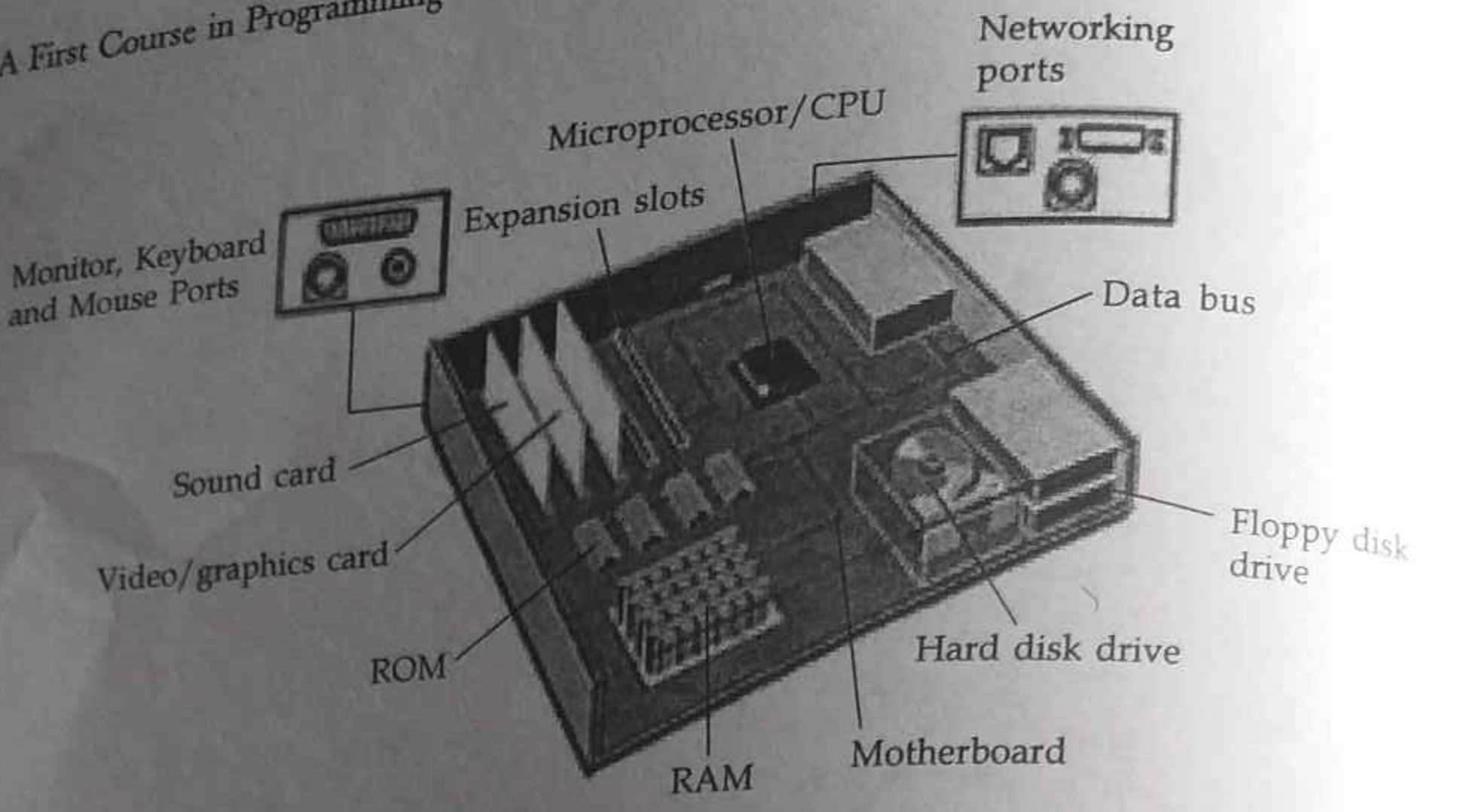


Fig. 6 *Motherboard and CPU*

Pentium IV Processor

Pentium IV processor is the microprocessor which has the control unit, memory unit (register) a arithmetic and logic unit. Electronic engineers call this processor the computer. The processing spe of a computer depends on the clockspeed of the system and is measured in mega hertz (MHz). T latest Pentium IV processor is available with a clockspeed of 1.6 GHz.

INPUT DEVICES

Keyboard

A keyboard is used to enter data into a computer. The latest keyboard (Windows keyboard) is ava able with 104 keys. The keyboard contains function keys, numeric keys and toggle keys (Caps loc Num lock, Scroll lock) and so on.

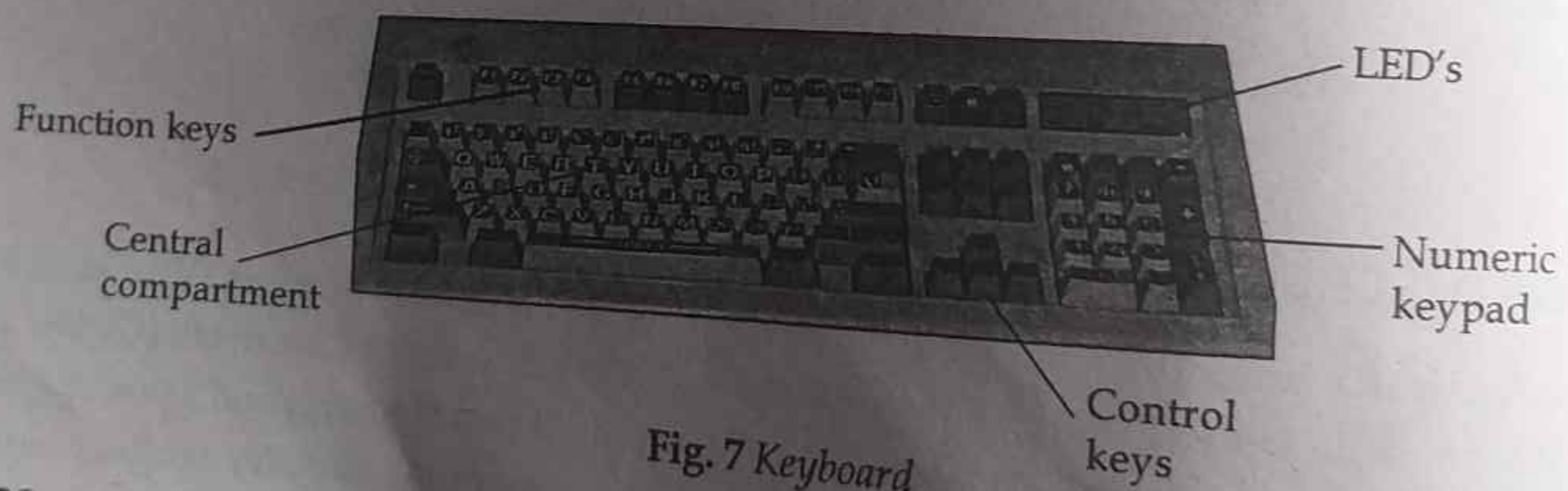


Fig. 7 *Keyboard*

Mouse

A mouse is a picking device used to select a command by moving it in any direction on a flat surface It has two or three buttons to confirm the selection.

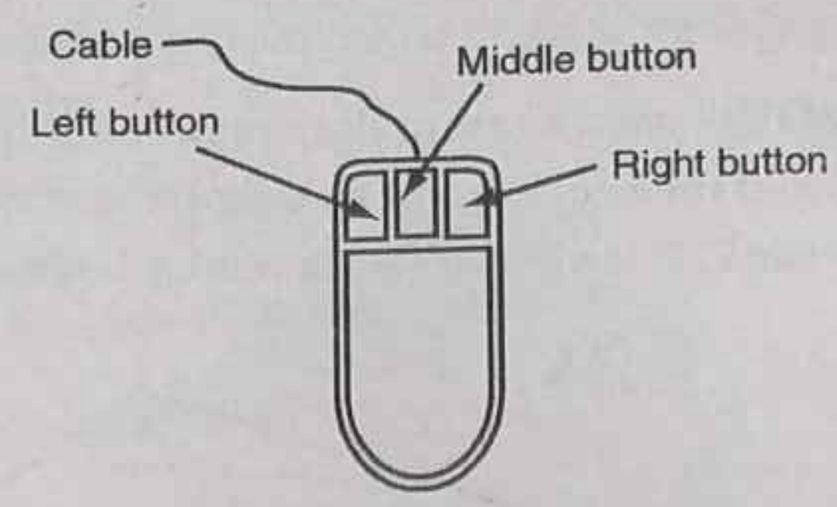


Fig. 8 *Mouse*

STORAGE DEVICES

Floppy Disk

A floppy disk is used to store data permanently. It has a flexible disk coated with magnetic material and is enclosed in a plastic cover. Floppy disks of 3½ inch diameter having a storage capacity of 1.44 MB are commonly available. The FDD has a read/write head which reads/writes data on to the disk. The disk makes 360 rpm while reading or writing data on to it.

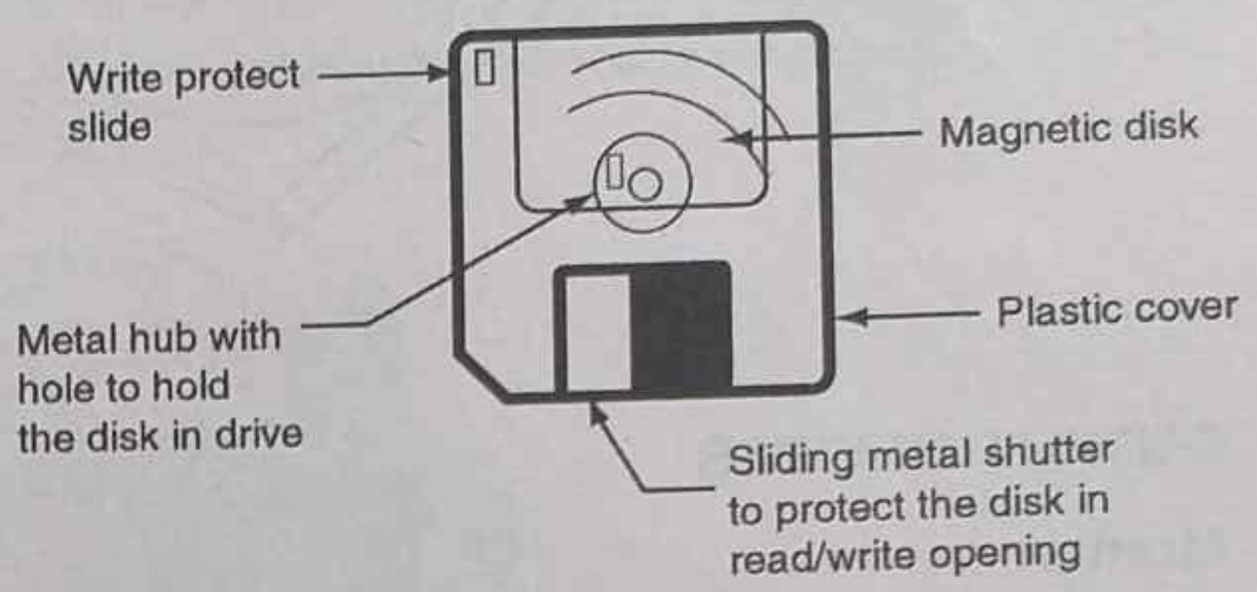


Fig. 9 *Floppy disk*

Hard Disk

Hard disk is a reliable and permanent storage disk. It has a set of metal disks coated with magnetic material and are mounted on a central spindle which makes 7200 rpm. Unlike floppy disk, hard disk rotates continuously. The HDD has a set of read/write heads which are mounted on an arm. Latest hard disks are available with a storage capacity of more than 40 GB.

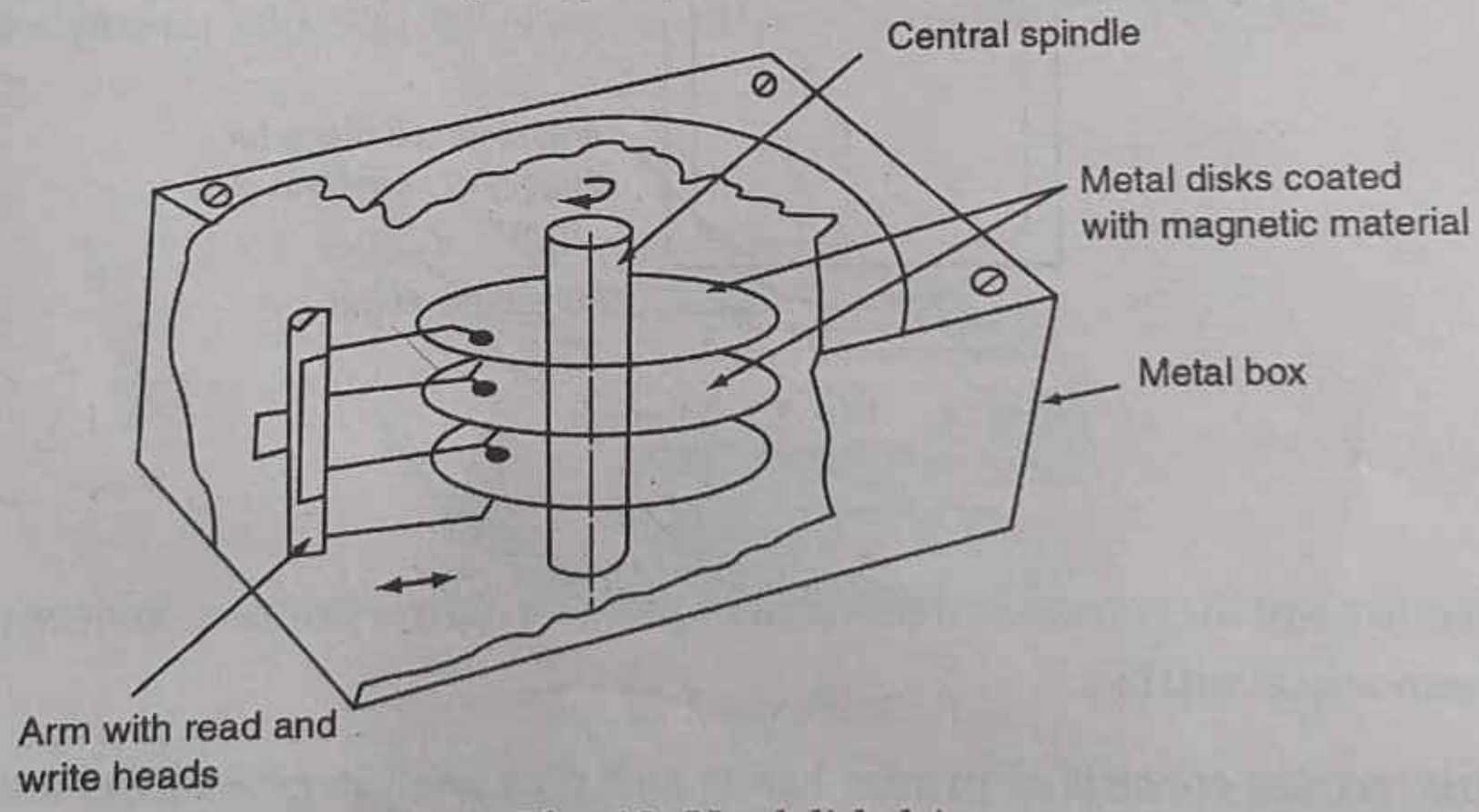


Fig. 10 *Hard disk drive*

Compact Disk

Compact disk (CD) is an optical disk used to store data permanently. It is the most reliable storage media available today. Data stored on a compact disk cannot be erased. The CD drives commonly available are read only. Read/write CD drives are also available but are expensive. Storage capacity of a CD is 700 MB.

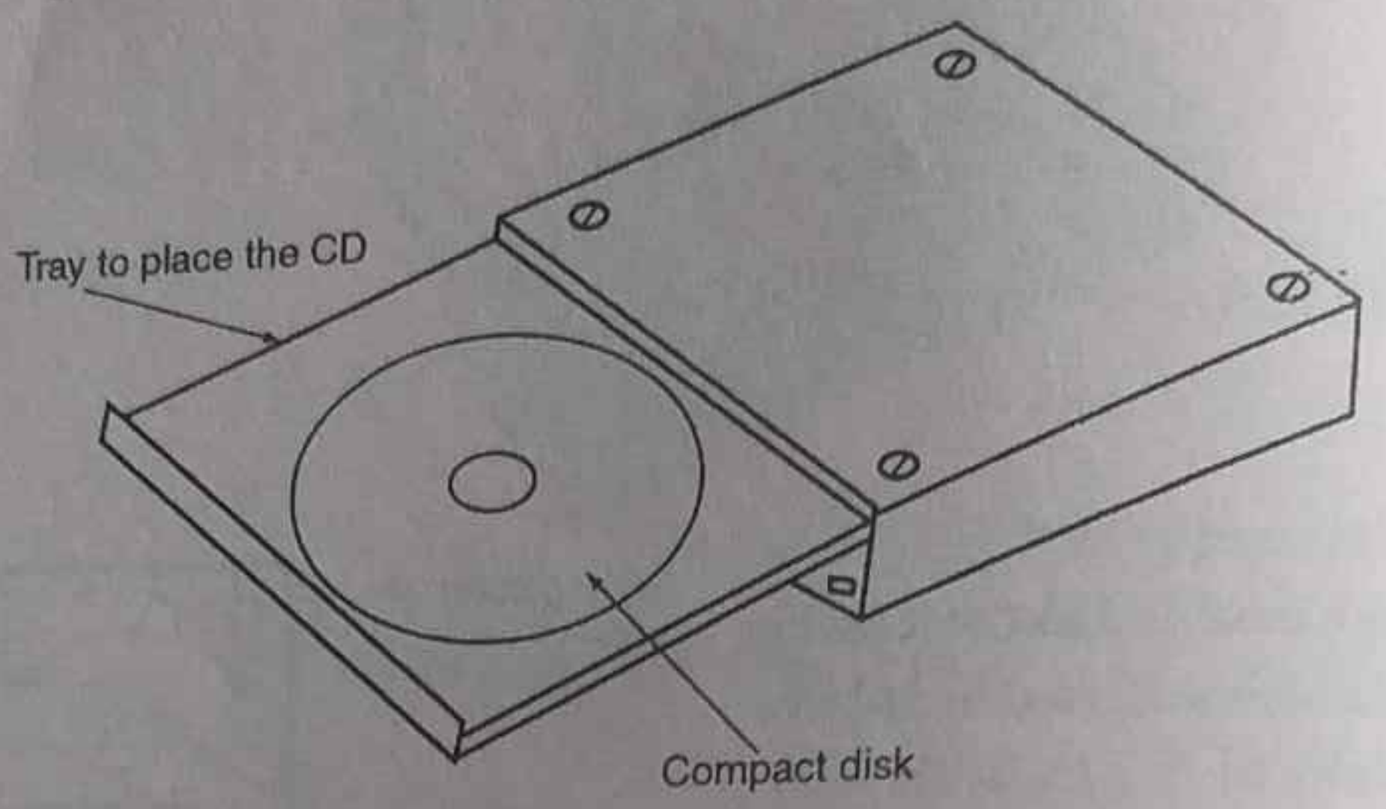


Fig. 11 *CD drive*

OUTPUT DEVICES

Monitor

A monitor is a display device. The size of a commonly used color monitor is 15 inches. The electronic circuit board which is used to display text/picture smoothly on the screen is called as a monitor adopter card. SVGA (Super Video Graphic Adopter) or AGP (Advanced Graphic Port) adopter is commonly used in the latest personal computer to display text/picture in natural colors.

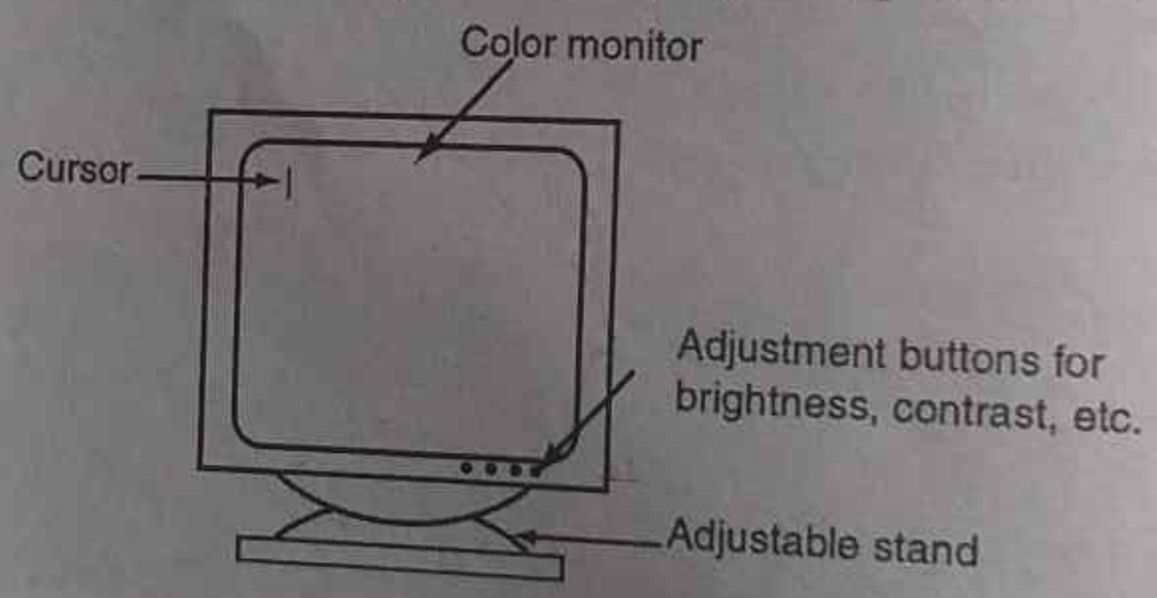


Fig. 12 *Monitor*

Printers

Printers are used to print the results and text on a paper. Dot matrix printers, inkjet printers and laser printers are commonly available.

A dot matrix printer consists of printer heads and pins used to generate characters on paper. Similar to a typewriter a continuous printer ribbon moves between the printer head and paper. Both

COMPUTER MAIN MEMORY

RAM (Random Access Memory)

Random Access Memory is a temporary storage medium in a computer. All data to be processed by the computer are transferred from a storage device or keyboard to RAM during data processing. Results obtained from executing any program are also stored in RAM. All data stored in RAM will be erased when the computer is switched off. RAM is a volatile memory. Latest computers use RAM with a memory of more than 32 MB. Provisions are also available to increase the RAM memory in any computer. Most software packages require higher RAM for speedier processing.

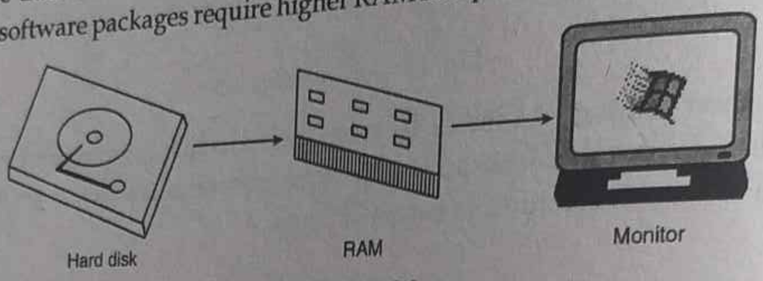


Fig. 16 *RAM*

ROM (Read Only Memory)

Read Only Memory is a permanent storage medium which stores start up programs (operating system programs). These programs are loaded to the computer when the computer is switched on. ROM stores essentially the BIOS (Basic Input Output System) programs which are recorded by the manufacturer of the computer system. ROM is a non-volatile memory.

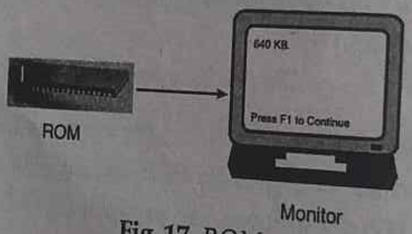


Fig. 17 *ROM*

STAGES OF DEVELOPMENT (COMPUTER SOFTWARE)

Any instruction to the computer is given in the form of a computer program. Basically computer system components communicate in binaries (0's and 1's – 0's refer OFF state of the circuits and 1's refer ON state of the circuits). The various stages of development in computer software are discussed here.

First-generation Language

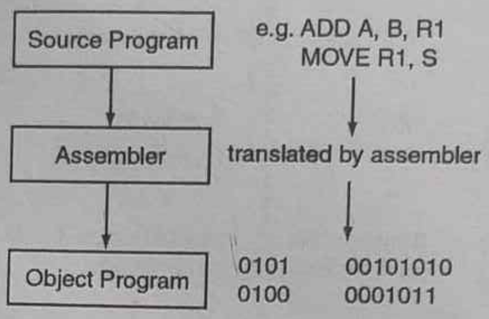
In first-generation language, all instructions were given in the binary form and is referred to as machine language or low level language (LLL). It is very difficult for us to write or read instructions written in binaries. Consider the following instruction written in binaries.

```
0100 00011001     0101 01010011
```

Second-generation Language

In second-generation language, instructions are written with mnemonics to simplify the program. The symbolic instruction language is called Assembly Language. In order to execute these instructions, all mnemonics are converted into binaries with the help of a translator known as Assembler. The program written using mnemonics is called Source Program; the binary form of the source program is called Object Program.

American Standard Code for Information Interchange (ASCII) is commonly used to translate the source program into object program. (Refer Appendix for complete ASCII list and its binary equivalents.) Consider the following example which executes an assembly language program.



Assembly language programs are commonly used to write programs for electronic controls using microprocessors, e.g. computerised copier machine, computerised telephone billing and so on.

C language is one of the programming languages used to access the assembly language instructions as its subroutine for any lower level programming.

Third-generation Languages

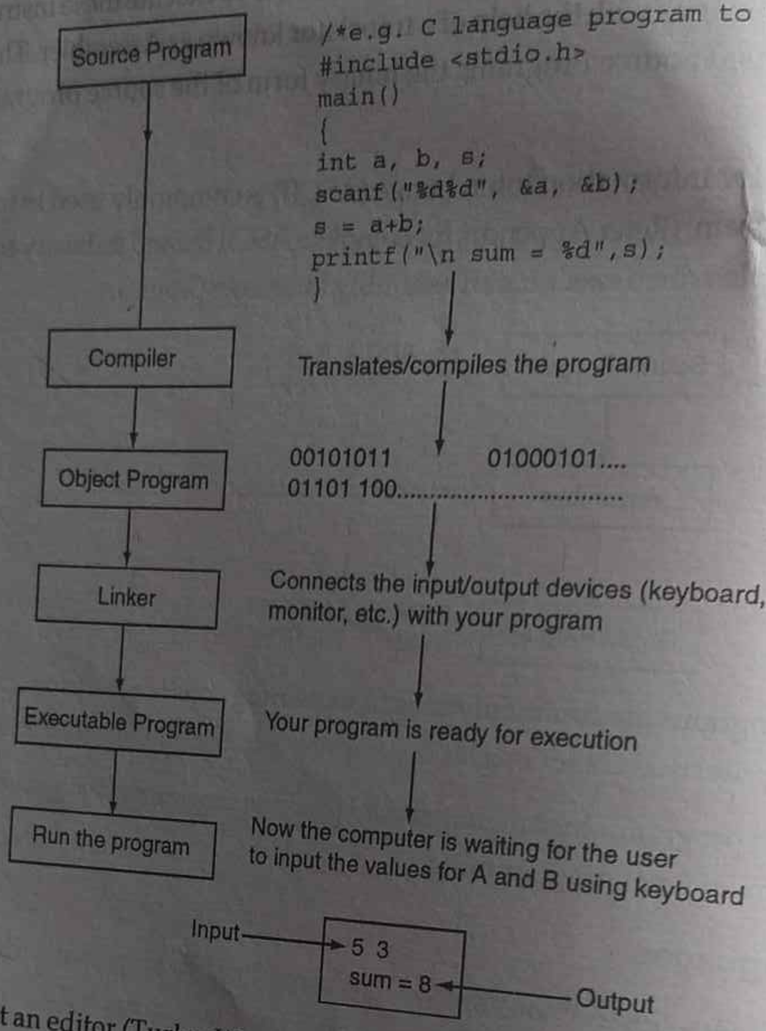
In third-generation languages, instructions are written using English language with symbols and digits. Third generation languages are also known as high level languages (HLL). The commonly used high level languages are FORTRAN, BASIC, COBOL, PASCAL, PROLOG, C, C++, etc. The complete instruction set written in one of these languages is called a computer program or source program.

In order to execute the instructions, the source program is translated into binary form by a compiler or interpreter. A compiler is also used to translate source program written in English into an object program. An interpreter is also used for translation which translates the program line by line.

C language uses a compiler as its translator to translate or compile the complete C program. It is also necessary to create an executable program to execute the instructions given in a source program by linking the input (usually keyboard) and output (usually monitor) devices with your program. A linker (another program) is used to link the input/output devices and generate an executable program from an object program.

The command Run executes the executable program and allows the user to input values and get the output. An executable program can also be run by typing its filename when the computer

displays the prompts C>, D> and so on. (The method of executing a C program will be discussed in detail in the next chapter.) Consider the following example to execute a high level language program.



Note that an editor (Turbo, Wordstar, NE, EDIT and so on) may also be used to type the source program and store the program in disk. C language commonly uses a turbo editor in MS-DOS system and Vi editor in UNIX system.

Fourth-generation Languages (4 GLs)

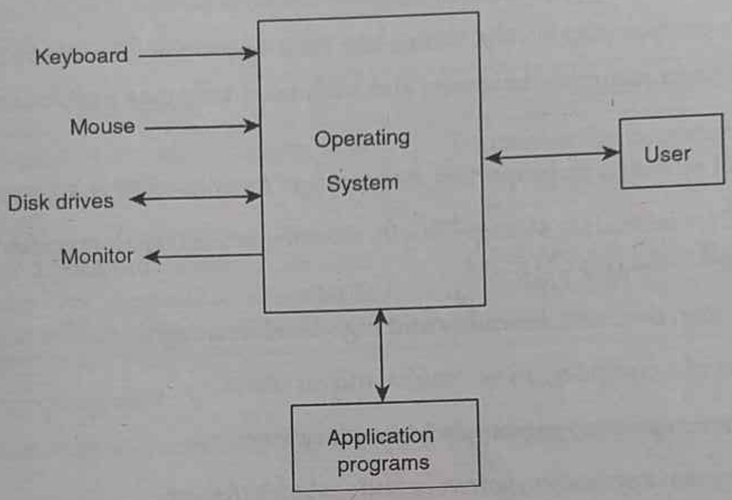
Fourth-generation languages refer to software packages which are mostly written in one of the languages (FORTRAN, C and so on) for any specific application. It is very useful for the user to perform a task without writing programs. The user has to enter the command to call the program which is readily available in the package. This language is also called as command line language.

Some of the commonly used 4 GL packages are dBase, FoxPro, Oracle, SQL (database management); WordStar, MS Word, PageMaker (desktop publishing); Lotus 123, MS Excel (electronic spreadsheets); AutoCAD (computer aided design and drafting); IDEAS, PRO/E, Unigraphics Solidworks (computer aided design and solid modelling); ANSYS, NASTRAN, ADINA (finite element

analysis for engineering components). These programs specially produced for specific tasks are called Application Software.

OPERATING SYSTEM

An operating system is a program which connects the user and the electronic hardware in a computer. It has a set of programs which supervise the activities of a computer and activate/control the operations of the hardware components such as CPU, main memory, disk drives, keyboard, monitor, printer, and so on.



Some of the start up programs initially loaded to RAM are stored in ROM, mainly the BIOS programs which are recorded by the manufacturers of the computer system. Service programs available in operating system for operations like copying a file, deleting a file, formating a disk, printing a file, etc. are usually stored in the disk. Any malfunctioning of hardware components are instructed to the user by displaying error messages on the screen by the operating system. Operating system programs are also called as System Software.

There are many operating systems used in computers. Commonly used operating systems are MS-DOS (Microsoft Disk Operating System), Windows 95/98/2000, Windows NT, UNIX and so on. Nowadays Windows 2000 operating system is widely used in personal computers, and UNIX is used in Mainframes, Servers, Graphic workstations and also personal computers. The operating system UNIX itself is written using C language.

FEATURES OF A LATEST COMPUTER

Computers are popular in a number of applications because of its speed of operation, high storage capacity of a media like hard disk, CD and so on, consistency and accuracy in computations and support to other electronic devices for engineering applications.

REVIEW QUESTIONS AND EXERCISES

1. What is a computer? What are the types?
2. Explain the organisation of a computer.
3. Mention the computer hardware used in personal computer.
4. Explain the computer software and its generation.
5. Explain the program execution sequence in third generation language.
6. Explain the storage devices used in personal computer.
7. Explain the input and output devices in a PC.
8. Write short note on operating system. Name any three commonly used operating systems
9. Distinguish between assembly language and high level language and list four high level guage.
10. Explain the main memory, its properties, its types and its units of measurement.
11. What is the need for secondary storage? Briefly describe secondary storage devices like (i) Flo disk, (ii) Hard disk, and (iii) CD ROM.
12. Distinguish between machine, assembly and high level languages.
13. List the functions of a compiler, an assembler and an editor.
14. Differentiate between primary memry and secondary memory.
15. Differentiate between application software and system software.
16. Why are input and output devices necessary? Mention any two input and output devices co monly used in PCs.
17. Describe the salient characteristics features and important application of digital computer.

SHORT QUESTIONS AND ANSWERS

1. What is a computer program?

   A set of instructions written in one of the programming languages to solve a problem is called computer program.
2. What is a computer hardware?

   All electronic/electrical components and circuits used in a computer system are called computer hardware.
3. What is a computer software?

   A computer is actuated and controlled with the help of computer programs called computer software.

4. ASCII refers to _____.

   American Standard Code for Information Interchange.

5. One Nibble is equal to ___ bits.

   4

6. What is an assembler?

   An assembler is a program used to translate an assembly language program into binary form.

7. What is a compiler?

   A compiler is a program used to translate a high level language program into binary form.

8. Mention two differences between compiler and interpreter.

Compiler	Interpreter
1. Translates or compiles the complete program into binary form (object program).	1. Translates the program line by line as soon as a line is typed by the user.
2. An object program is generated and is used to generate executable program which is stored in disk.	2. Object and executable programs are generated and are normally stored in RAM.

9. What is a source program?

   The set of instructions written in any one of the programming languages is called source program.

10. What is an object program?

    The translated or binary form of a source program is called an object program.

11. What is an executable program?

    A program generated from object program by linking the input/output devices in order to execute the instructions given in a source program is called an executable program.

12. What is a text editor?

    A text editor is a program which is used to type and edit your computer program or document. Commonly used editors are Turbo, NE (Norton Editor), Vi editor (used in UNIX system).

13 What is an operating system (OS)? Mention its function.

    An operating system is a collection of programs used to connect the user with the electronic hardware. The OS programs actuate and control the activities of a computer.

14. Mention any four operating systems commonly used.

    (i) Windows 95/98 (ii) Windows NT (iii) UNIX (iv) LINUX

15. A computer cannot do anything by itself, it is always actuated by computer programs. (True/False)

    True

16. _____ memory requires rechargeable cycle in order to retain its information.

    Random access

17. A _____ is a program that serves as an interface between application programs and a set coordinated and integrated physical files.

    System software

18. An interface between the user and the system is _____ .

    Operating system

19. Mention the main components (hardware units) of a computer and their functions.

    Central processing unit (CPU) - to process the data

    Input device - to enter data into the computer

    Output device - to display/print results by the computer

20. Give any four examples of supporting devices.

    Keyboard, monitor, floppy disk and printer

21. Define system software.

    System software is a collection of programs which are used to assist the user to handle the computer hardware like printer, disk and so on and execute the application programs.

22. Define application software.

    Application softwares are programs which are used to solve specific problems/tasks. Examples include railway reservation, banking and so on.

23. Mention any four application software packages.

    FoxPro - used in database management
    MS Word - used in desktop publishing
    AutoCAD - used in computer aided drafting and modelling
    PRO/E - used in computer aided design and modelling

24. High level languages are otherwise termed as _____ generation languages.

    Third

25. Give an example of volatile memory.

    RAM (Random Access Memory)

26. Which translator reads an entire program written in a high level language and converts it into machine language?

    Compiler

COMPUTER PROGRAMMING

Computer programs are written using one of the programming languages (FORTRAN, C, C++ and so on). A program has a set of instructions written in correct order to get the desired result. The method of writing the instructions to solve the given problem is called programming.

PROGRAMMING TECHNIQUES

There are two types of programming techniques commonly used:

(i) Procedural Programming

(ii) Object Oriented Programming (OOP)

Procedural Programming

In procedural programming, for a given problem, variables are identified and instructions are written using the variables in the correct sequence to get the required result. Sometimes the program may require unconditional transfer of control from one part of the program to another using GOTO statements. This can be avoided by writing the statement sequence using many blocks; this is called structured program.

The procedural programming method is commonly used to solve scientific and engineering problems involving variables. Discrete results are expected as the output of the program.

Object Oriented Programming (OOP)

In object oriented programming, objects which have data related to a person or item are used. A program can be written using many functional blocks. The functional block contains instructions similar to procedural programming.

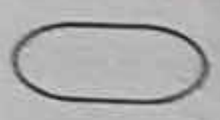
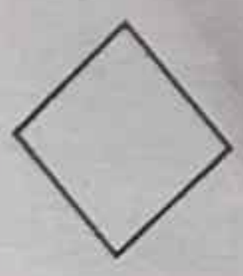
Object oriented programming method is commonly used to develop software packages. C++ is one of the commonly used object oriented programming languages.

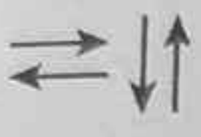
ALGORITHM AND FLOWCHART

In order to write computer programs without any logical error, it is recommended programmers prepare a rough writing showing the steps involved in the program. This is called an algorithm.

An algorithm presents step-by-step instructions required to solve any problem. These steps can be shown diagrammatically using a flowchart.

Flowchart is a symbolic or diagrammatic representation of an algorithm. It uses several geometrical figures to represent the operations, and arrows to show the direction of flow. Following are the commonly used symbols in flowcharts.

Symbol	Operation	Meaning
	Start/Stop	Represents the beginning and the end of the flowchart.
	Input/Output	Represents the values to be given by the user and the results to be displayed.
	Processing	Represents the arithmetic operations to compute a value.
	Checking/ decision making	Represents the logical checking to decide the flow sequence.

	Looping	Represents the looping which is repeated based on a condition/ value of a variable.
	Connector	Represents the continuity of the flowchart in another place/ page.
	Arrows	Represent direction of flow.

It is recommended beginners must practice algorithm and flowcharts before starting to write programs.

Example 1

Write the algorithm and draw the flowchart to find the sum and product of given two numbers.

Solution

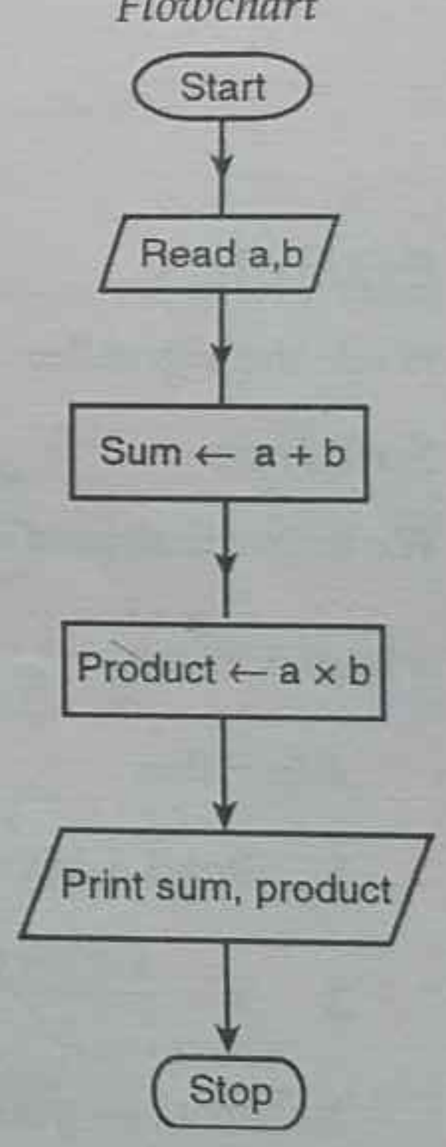
It is necessary to understand the data given in the problem and the results expected.

In this problem, two numbers, say A and B, are given (input) and the results, sum (A+B) of two numbers and product (A × B) of two numbers, are to be calculated.

Algorithm

1. Read a, b
2. Sum ← a + b
3. Product ← a × b
4. Print sum, product
5. Stop

Flowchart



Note:

(i) Usually words Read, Accept or Input can be used to represent input operation to give values of variables to the computer.

(ii) Print, Write or Display can be used to represent output operation to show the results computed by the computer.

(iii) Back arrow (←) represents the value obtained by evaluating the right side expression/variable to the left side variable. The symbol '=' can also be used instead of ' ← ' but it leads to confusion in certain applications. (e.g. S = S + X) representing the logical equivality and so on.

(iv) Down arrow (↓) is optional.

Example 2

Write the algorithm and draw the flowchart to convert the temperature in °f to °c using the formula °c = 5/9 (°f - 32)

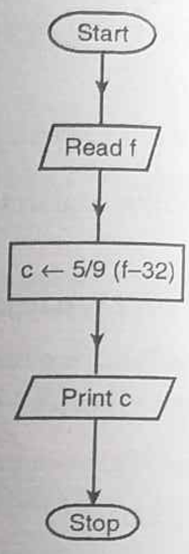
Solution

The input variable is f (represents temperature in °f) and the output variable is c (representing temperature in °c).

Algorithm

1. Read f
2. $c \leftarrow \frac{5}{9}(f-32)$
3. Print c
4. Stop

Flowchart



Example 3

Write the algorithm and draw the flowchart to find the area of a triangle whose sides are A, B, and C

Solution

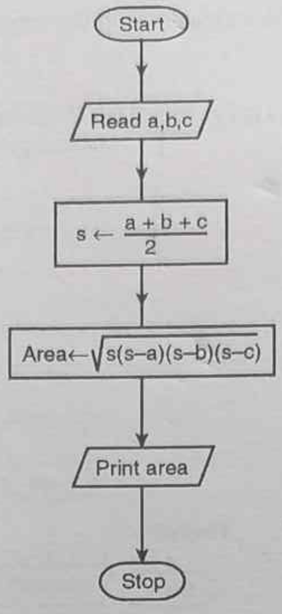
We know that area of a triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

where $s = \frac{a+b+c}{2}$

Algorithm

1. Read a, b, c
2. $s \leftarrow \frac{a+b+c}{2}$
3. Area $\leftarrow \sqrt{s(s-a)(s-b)(s-c)}$
4. Print area
5. Stop

Flowchart



Example 4

Write the algorithm and draw the flowchart to find the biggest of the given two numbers.

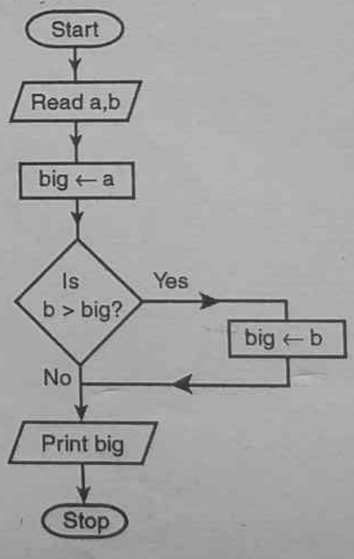
Solution

For this problem, a new name `big` is used to store the biggest value. Initially `a` is assumed as `big`, then `b` is compared with the existing `big` to get the biggest value.

Algorithm

1. Read a, b
2. big ← a
3. If b > big then
   big ← b
4. Print big
5. Stop

Flowchart



Note: There are other methods available to find the biggest value. The method discussed here is the best which can be easily extended for any number of values and is suitable for writing structured programs.

Example 5

Write the algorithm and draw the flowchart to find the biggest of the given three numbers.

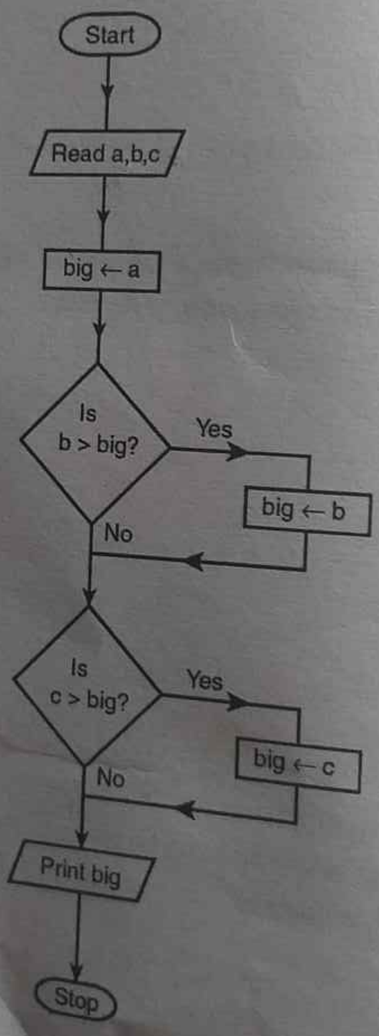
Solution

The method discussed in Example 4 is extended for three numbers:

Algorithm

1. Read a, b, c
2. big ← a
3. If b > big then
   big←b
4. If c > big then
   big ← c
5. Print big
6. Stop

Flowchart



Example 6

Draw a flowchart to solve the following series

$$s = x - x^3 + x^5 - x^7 \cdots x^n$$

Solution

For this problem, the initial values are assigned as

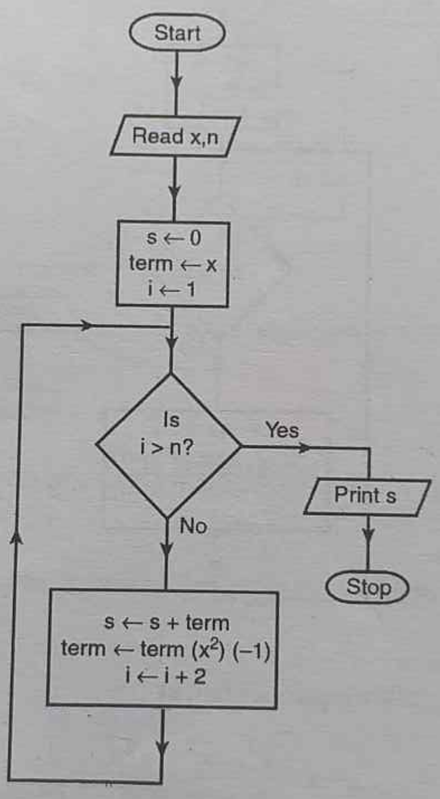
$s \leftarrow 0$

term $\leftarrow x$ – represents the first term in the series

$i \leftarrow 1$ – represents the power in x^1

Then the value of the `term` is incremented to get the next `term` and `i` is also incremented accordingly. The `term` is then added to `s` and is repeated until `i > n`.

Flowchart



Example 7

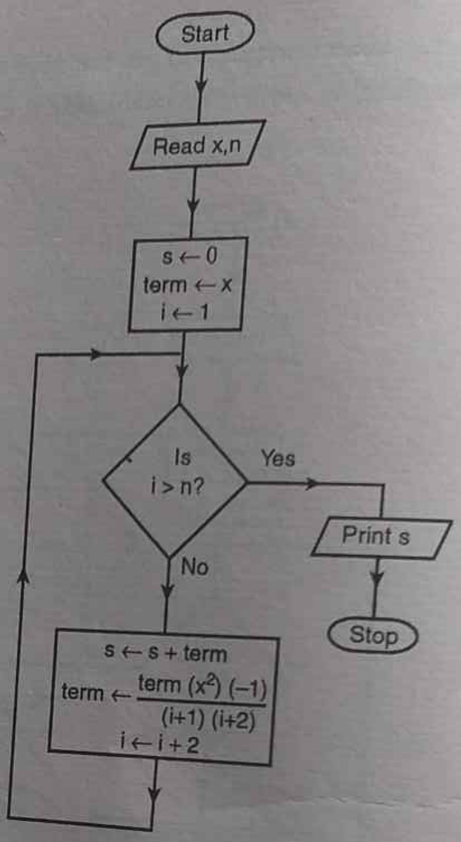
Draw a flowchart to solve the following series:

$$s = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} \cdots \frac{x^n}{n!}$$

Solution

The method discussed in Example 6 is extended by including the denominator.

Flowchart



Example 8

Draw the flowchart to solve the following series (sin x)

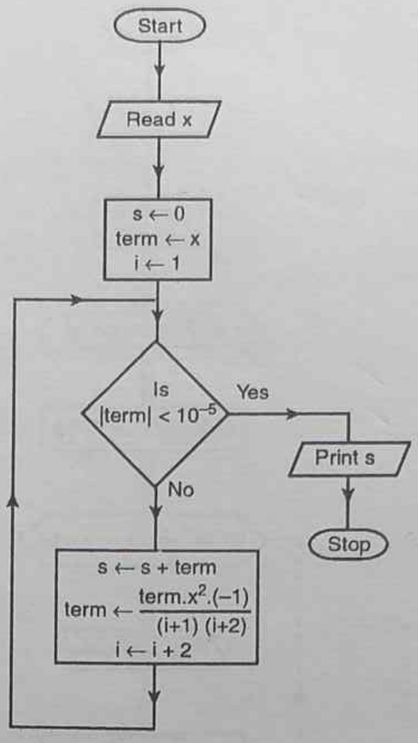
$$s = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} \cdots \infty$$

omitting those terms which are less than 10^{-5} in magnitude.

Solution

The method discussed in Example 7 is extended by considering the absolute value of the `term`.

Flowchart



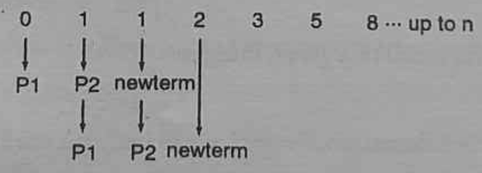
Note: The method of solving a series given in this example can be used for any other series of this kind, e.g. cos x, e^x, and so on.

Example 9

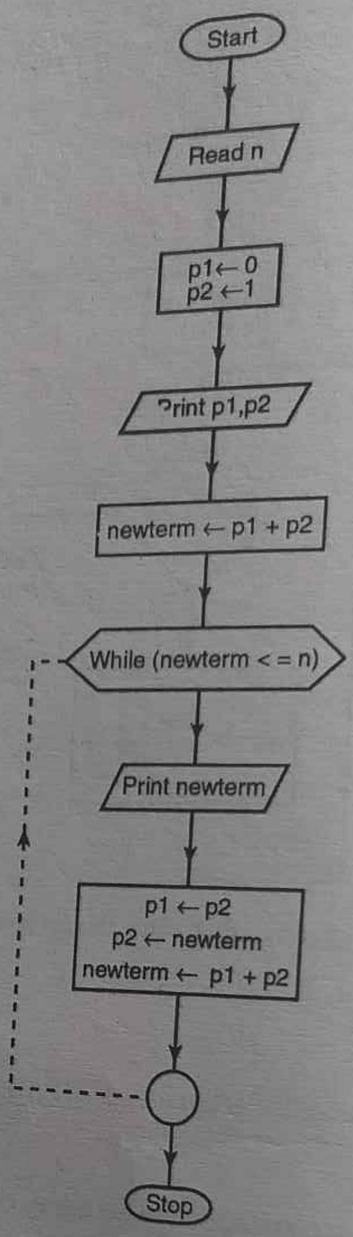
Draw a flowchart to generate and print the Fibonacci series 0 1 1 2 3 5 8 ··· n.

Solution

For this series, the preceding two terms are added to get the next term.



Flowchart



Example 10

Draw a flowchart to find the factorial of a given integer.

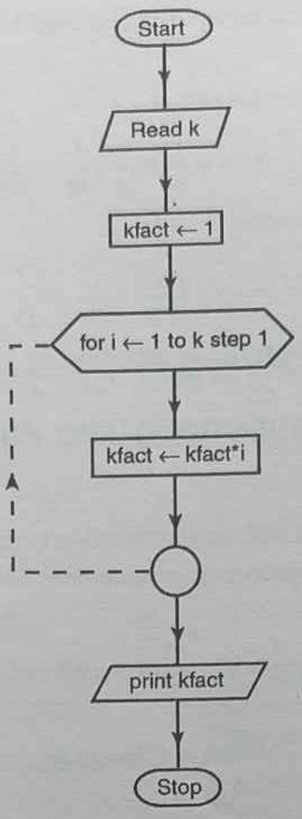
Solution

Let 'k' be the integer then

$k! = 1 \times 2 \times 3 \ldots k$

To get k!, numbers are generated from 1 to k in steps of 1 and all these numbers are multiplied.

Flowchart



Note: Factorial (!) is not available for non-integer and negative numbers. Also note that 0! is 1.

REVIEW QUESTIONS AND EXERCISES

1. Write the algorithm and draw the flowchart to find the average of given 3 values.
2. Write the algorithm and draw the flowchart to find the area and circumference of a circle of radius r.

   [**Hint :** Area = πr^2; Circumference = $2\pi r$]
3. Write the algorithm and draw the flowchart to convert the temperature given in °c to °f.

   [**Hint :** Use the relation °f = 1.8°c + 32]
4. Draw the flowchart to find the smallest of the given three numbers.
5. Draw the flowchart to solve the following series which is the summation of cosine series $s = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots \infty$ neglecting the terms which are less that 10^{-4} in magnitude.

   [**Hint :** The method discussed in Example 8 can be used to solve this series with minor changes.]

6. Draw the flowchart to find the sum of natural numbers upto N.

   [Hint : The method discussed in Example 10 can be used to solve the series, i.e. $s = 1 + 2 + 3 + \ldots + N$.]

7. Draw a flowchart to solve the following series:

$$s = 1 + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} \cdots \frac{1}{N!}$$

8. Draw a flowchart to solve the following series:

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} \cdots \infty$$

Neglect the terms which are less than 10^{-5} in magnitude.

SHORT QUESTIONS AND ANSWERS

1. What is an algorithm?

   An algorithm refers to step-by-step instructions written to solve any problem. Various steps in algorithm are written in correct sequence to produce the desired result.

2. What is a flowchart?

   A flowchart is a diagrammatic or symbolic representation of an algorithm. It uses various symbols to represent the operations to be performed.

3. _____ programming method is followed in C language.

   Procedural

4. _____ programming method is followed in C++.

   Object oriented

5. Procedural programming method is commonly used for writing small programs which produce discrete results. (True/False)

   True

6. Object oriented programming method is commonly used to develop software packages to perform a task. (True/False)

   True

7. Algorithms and flowcharts may be omitted after getting experience in writing program. (True/False)

   True