

Government Arts College for Women, Salem-8

Department of Physics

Skill Based Elective Course-Programming in C-II.B.Sc., Physics 2020-2021

UNIT-II

Input and Output Devices

Following are some of the important input devices which are used in a computer –

- Keyboard
- Mouse
- Joy Stick
- Light pen
- Track Ball
- Scanner
- Graphic Tablet
- Microphone
- Magnetic Ink Card Reader(MICR)
- Optical Character Reader(OCR)
- Bar Code Reader
- Optical Mark Reader(OMR)

Keyboard

Keyboard is the most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

All types of computers follow the same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows –

| S.No | Keys & Description |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Typing Keys These keys include the letter keys (A-Z) and digit keys (09) which generally give the same layout as that of typewriters. |
| 2 | Numeric Keypad |

| | |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | It is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators. |
| 3 | <p>Function Keys</p> <p>The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose.</p> |
| 4 | <p>Control keys</p> <p>These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).</p> |
| 5 | <p>Special Purpose Keys</p> <p>Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.</p> |

Mouse

Mouse is the most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed.

Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer.

Advantages

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of the keyboard.

Joystick

Joystick is also a pointing device, which is used to move the cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

The function of the joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

Light Pen

Light pen is a pointing device similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube.

When the tip of a light pen is moved over the monitor screen and the pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

Track Ball

Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on the ball, the pointer can be moved.

Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button, or a square.

Scanner

Scanner is an input device, which works more like a photocopy machine. It is used when some information is available on paper and it is to be transferred to the hard disk of the computer for further manipulation.

Scanner captures images from the source which are then converted into a digital form that can be stored on the disk. These images can be edited before they are printed.

Digitizer

Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at.

Digitizer is also known as Tablet or Graphics Tablet as it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for fine works of drawing and image manipulation applications.

Microphone

Microphone is an input device to input sound that is then stored in a digital form.

Bar Code Readers

Bar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner.

Following are some of the important **output devices** used in a computer.

- Monitors
- Graphic Plotter
- Printer

Monitors

Monitors, commonly called as **Visual Display Unit** (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)

- Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically.

There are some disadvantages of CRT –

- Large in Size
- High power consumption

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.

The flat-panel display is divided into two categories –

- **Emissive Displays** – Emissive displays are devices that convert electrical energy into light. For example, plasma panel and LED (Light-Emitting Diodes).
- **Non-Emissive Displays** – Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. For example, LCD (Liquid-Crystal Device).

Printers

Printer is an output device, which is used to print information on paper.

There are two types of printers –

- Impact Printers
- Non-Impact Printers

Impact Printers

Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.

Characteristics of Impact Printers are the following –

- Very low consumable costs
- Very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

These printers are of two types –

- Character printers
- Line printers

Character Printers

Character printers are the printers which print one character at a time.

These are further divided into two types:

- Dot Matrix Printer(DMP)
- Daisy Wheel

Dot Matrix Printer

In the market, one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in the form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character which is why it is called Dot Matrix Printer.

Advantages

- Inexpensive
- Widely Used
- Other language characters can be printed

Disadvantages

- Slow Speed
- Poor Quality

Daisy Wheel

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower) which is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices that require a few letters to be sent here and there with very nice quality.

Advantages

- More reliable than DMP
- Better quality
- Fonts of character can be easily changed

Disadvantages

- Slower than DMP
- Noisy
- More expensive than DMP

Line Printers

Line printers are the printers which print one line at a time

Non-impact Printers

Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers.

These printers are of two types –

- Laser Printers
- Inkjet Printers

Characteristics of Non-impact Printers

- Faster than impact printers
- They are not noisy
- High quality
- Supports many fonts and different character size

Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

Advantages

- Very high speed
- Very high quality output
- Good graphics quality
- Supports many fonts and different character size

Disadvantages

- Expensive
- Cannot be used to produce multiple copies of a document in a single printing

Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

They make less noise because no hammering is done and these have many styles of printing modes available. Color printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

Advantages

- High quality printing
- More reliable

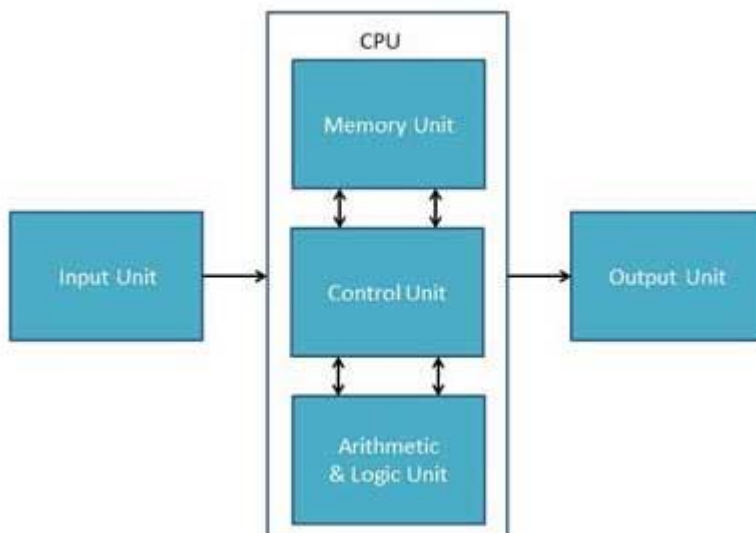
Disadvantages

- Expensive as the cost per page is high
- Slow as compared to laser printer

CPU-Central Processing Unit

All types of computers follow the same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users.

| S.No. | Operation | Description |
|-------|----------------------|------------------------------------------------------------------------------------------------------------------|
| 1 | Take Input | The process of entering data and instructions into the computer system. |
| 2 | Store Data | Saving data and instructions so that they are available for processing as and when required. |
| 3 | Processing Data | Performing arithmetic, and logical operations on data in order to convert them into useful information. |
| 4 | Output Information | The process of producing useful information or results for the user, such as a printed report or visual display. |
| 5 | Control the workflow | Directs the manner and sequence in which all of the above operations are performed. |



Input Unit

This unit contains devices with the help of which we enter data into the computer. This unit creates a link between the user and the computer. The input devices translate the information into a form understandable by the computer.

Output Unit

The output unit consists of devices with the help of which we get the information from the computer. This unit is a link between the computer and the users. Output devices translate the computer's output into a form understandable by the users.

CPU (Central Processing Unit)

Central Processing Unit (CPU) consists of the following features –

- CPU is considered as the brain of the computer.
- CPU performs all types of data processing operations.
- It stores data, intermediate results, and instructions (program).
- It controls the operation of all parts of the computer.

CPU itself has following three components.

- Memory or Storage Unit
- Control Unit
- ALU(Arithmetic Logic Unit)

Memory or Storage Unit

This unit can store instructions, data, and intermediate results. This unit supplies information to other units of the computer when needed. It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM).

Its size affects speed, power, and capability. Primary memory and secondary memory are two types of memories in the computer. Functions of the memory unit are –

- It stores all the data and the instructions required for processing.
- It stores intermediate results of processing.
- It stores the final results of processing before these results are released to an output device.
- All inputs and outputs are transmitted through the main memory.

Control Unit

This unit controls the operations of all parts of the computer but does not carry out any actual data processing operations.

Functions of this unit are –

- It is responsible for controlling the transfer of data and instructions among other units of a computer.
- It manages and coordinates all the units of the computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.

- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

ALU (Arithmetic Logic Unit)

This unit consists of two subsections namely,

- Arithmetic Section
- Logic Section

Arithmetic Section

Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication, and division. All complex operations are done by making repetitive use of the above operations.

Logic Section

Function of logic section is to perform logic operations such as comparing, selecting, matching, and merging of data.

Programming language

Computer Program

- A program is a set of instructions following the rules of the chosen language.
- Without programs, computers are useless.
- A program is like a recipe.
- It contains a list of ingredients (called variables) and a list of directions (called statements)

that tell the computer what to do with the variables.

Programming Language

- A vocabulary and set of grammatical rules (syntax) for instructing a computer to perform specific tasks.
- Programming languages can be used to create computer programs.
- The term programming language usually refers to high-level languages, such as BASIC, C, C++, COBOL, FORTRAN, Ada, and Pascal.

To convert any program into machine language so that the computer can understand it. •

There are two ways to do this: –

Compile the program

– Interpret the program

Compile is to transform a program written in a highlevel programming language from source code into object code.

- This can be done by using a tool called compiler.

• **A compiler** reads the whole source code and translates it into a complete machine code program to perform the required tasks which is output as a new file.

Interpreter is a program that executes instructions written in a high-level language.

- An interpreter reads the source code one instruction or line at a time, converts this line into machine code and executes it.

Computer Programming

- Computer programming is the process of writing, testing, debugging/troubleshooting, and maintaining the source code of computer programs.
- This source code is written in a programming language like C++, JAVA, Perl etc.

Computer Programmer

- A programmer is someone who writes computer program.
- Computer programmers write, test, and maintain programs or software that tell the computer what to do.

Generations of Programming Language

- The first generation languages, or 1GL, are low level languages that are machine language.

- The second generation languages, or 2GL, are also low-level languages that generally consist of assembly languages.

- The third generation languages, or 3GL, are highlevel languages such as C.

- The fourth generation languages, or 4GL, are languages that consist of statements similar to statements in a human language.

Fourth generation languages are commonly used in database programming and scripts.

- The fifth generation languages, or 5GL, are programming languages that contain visual tools to help develop a program. A good example of a fifth generation language is Visual Basic.

There are three types of **programming language**:

- Machine language (Low-level language)

- Assembly language (Low-level language)

- High-level language

- Low-level languages are closer to the language used by a computer, while high-level languages are closer to human languages.

Machine Language

- Machine language is a collection of binary digits or bits that the computer reads and interprets.

- Machine languages are the only languages understood by computers.

- While easily understood by computers, machine languages are almost impossible for humans to use because they consist entirely of number

Assembly Language

• A program written in assembly language consists of a series of instructions mnemonics that correspond to a stream of executable instructions, when translated by an assembler that can be loaded into memory and executed.

• Assembly languages use keywords and symbols, much like English, to form a programming language but at the same time introduce a new problem.

The problem is that the computer doesn't understand the assembly code, so we need a way to convert it to machine code, which the computer does understand.

• Assembly language programs are translated into machine language by a program called an assembler.

High Level Language

• High-level languages allow us to write computer code using instructions resembling everyday spoken language (for example: print, if, while) which are then translated into machine language to be executed.

• Programs written in a high-level language need to be translated into machine language before they can be executed.

• Some programming languages use a compiler to perform this translation and others use an interpreter.

Examples of High-level Language: • ADA • C • C++ • JAVA • BASIC • COBOL • PASCAL • PHYTON

Comparison

| | Machine Language | Assembly Language | High-level |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Time to execute | Since it is the basic language of the computer, it does not require any translation, and hence ensures better machine efficiency. This means the programs run faster.. | A program called an 'assembler' is required to convert the program into machine language. Thus, it takes longer to execute than a machine language program. | A program called a compiler or interpreter is required to convert the program into machine language. Thus, it takes more time for a computer to execute. |

| | | | |
|-----------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Time to develop | Needs a lot of skill, as instructions are very lengthy and complex. Thus, it takes more time to program. | Simpler to use than machine language, though instruction codes must be memorized. It takes less time to develop programs as compared to machine language. | Easiest to use. Takes less time to develop programs and, hence, ensures better program efficiency. |
|-----------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|