Functionalities of a computer

Any digital computer carries out five functions in gross terms:

 Takes data as input.

 Stores the data/instructions in its memory and use them when required.

 Processes the data and converts it into useful information.

 Generates the output

 Controls all the above four steps.



Definition

Computer is an electronic data processing device which

 accepts and stores data input,

 processes the data input, and

 generates the output in a required format.

Advantages

Following list demonstrates the advantages of computers in today's arena.

**High Speed**

 Computer is a very fast device.

 It is capable of performing calculation of very large amount of data.

 The computer has units of speed in microsecond, nanosecond, and even the picosecond.

 It can perform millions of calculations in a few seconds as compared to man who will spend many months for doing the same task.

**Accuracy**

 In addition to being very fast, computers are very accurate.

 The calculations are 100% error free.

 Computers perform all jobs with 100% accuracy provided that correct input has been given.

**Storage Capability**

 Memory is a very important characteristic of computers.

 A computer has much more storage capacity than human beings.

 It can store large amount of data.

 It can store any type of data such as images, videos, text, audio and many others.

**Diligence**

 Unlike human beings, a computer is free from monotony, tiredness and lack of concentration.

 It can work continuously without any error and boredom.

 It can do repeated work with same speed and accuracy.

**Versatility**

 A computer is a very versatile machine.

 A computer is very flexible in performing the jobs to be done.

 This machine can be used to solve the problems related to various fields.

 At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

**Reliability**

 A computer is a reliable machine.

 Modern electronic components have long lives.

 Computers are designed to make maintenance easy.

**Automation**

 Computer is an automatic machine.

 Automation means ability to perform the given task automatically.

 Once a program is given to computer i.e. stored in computer memory, the program and instruction can control the program execution without human interaction.

**Reduction in Paper Work**

 The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up a process.

 As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.

**Reduction in Cost**

 Though the initial investment for installing a computer is high but it substantially reduces the cost of each of its transaction.

Disadvantages

Following list demonstrates the disadvantages of computers in today's arena.

NoI.Q

 A computer is a machine that has no intelligence to perform any task.

 Each instruction has to be given to computer.

 A computer cannot take any decision on its own

**Dependency**

 It functions as per a user’s instruction, so it is fully dependent on human being.

**Environment**

 The operating environment of computer should be dust free and suitable.

**No Feeling**

 Computers have no feelings or emotions.

 It cannot make judgment based on feeling, taste, experience, and knowledge unlike a human being.

**Applications**

Following list demonstrates various applications of computers in today's arena.

Business

A computer has high speed of calculation, diligence, accuracy, reliability, or versatility which made it an integrated part in all business organisations.

Computer is used in business organisations for:

 Payroll calculations

 Budgeting

 Sales analysis

 Financial forecasting

 Managing employees database

 Maintenance of stocks etc.

Banking

Today banking is almost totally dependent on computer.

Banks provide following facilities:

 Banks provide online accounting facility, which includes current balances, deposits, overdrafts, interest charges, shares, and trustee records.

 ATM machines are making it even easier for customers to deal with banks.

Insurance

Insurance companies are keeping all records up-to-date with the help of computers. The insurance companies, finance houses and stock broking firms are widely using computers for their concerns.

Insurance companies are maintaining a database of all clients with information showing

 procedure to continue with policies

 starting date of the policies

 next due installment of a policy

 maturity date

 interests due

 survival benefits

 bonus

Education

The computer has provided a lot of facilities in the education system.

 The computer provides a tool in the education system known as CBE (Computer Based Education).

 CBE involves control, delivery, and evaluation of learning.

 The computer education is rapidly increasing the graph of number of computer students.

There are number of methods in which educational institutions can use computer to educate the students.

 It is used to prepare a database about performance of a student and analysis is carried out on this basis.

Marketing

In marketing, uses of computer are following:

 **Advertising -** With computers, advertising professionals create art and graphics, write and revise copy, and print and disseminate ads with the goal of selling more products.

 **At Home Shopping -** Home shopping has been made possible through use of computerised catalogues that provide access to product information and permit direct entry of orders to be filled by the customers.

Health Care

Computers have become important part in hospitals, labs, and dispensaries. The computers are being used in hospitals to keep the record of patients and medicines. It is also used in scanning and diagnosing different diseases. ECG, EEG, Ultrasounds and CT Scans etc. are also done by computerised machines.

Some major fields of health care in which computers are used are:

 **Diagnostic System -** Computers are used to collect data and identify cause of illness.

 **Lab-diagnostic System -** All tests can be done and reports are prepared by computer.

 **Patient Monitoring System -** These are used to check patient's signs for abnormality such as in Cardiac Arrest, ECG etc.

 **Pharma Information System -** Computer checks Drug-Labels, Expiry dates, harmful drug’s side effects etc.

 **Surgery:** Nowadays, computers are also used in performing surgery.

Engineering Design

Computers are widely used in Engineering purpose.

One of major areas is CAD (Computer aided design).that provides creation and modification of images. Some fields are:

 **Structural Engineering -** Requires stress and strain analysis for design of Ships, Buildings, Budgets, Airplanes etc.

 **Industrial Engineering -** Computers deal with design, implementation and improvement of integrated systems of people, materials and equipments.

 **Architectural Engineering -** Computers help in planning towns, designing buildings, determining a range of buildings on a site using both 2D and 3D drawings.

Military

Computers are largely used in defence. modern tanks, missiles, weapons etc. Military also employs computerised control systems. Some military areas where a computer has been used are:

 Missile Control

 Military Communication

 Military Operation and Planning

 Smart Weapons

Communication

Communication means to convey a message, an idea, a picture or speech that is received and understood clearly and correctly by the person for whom it is meant for. Some main areas in this category are:

 E-mail

 Chatting

 Usenet

 FTP

 Telnet

 Video-conferencing

Government

Computers play an important role in government. Some major fields in this category are:

 Budgets

 Sales tax department

 Income tax department

 Male/Female ratio

 Computerization of voters lists

 Computerization of driving licensing system

 Computerization of PAN card

 Weather forecasting

**Generations**

Computer Generations

Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. But nowadays, generation includes both hardware and software, which together make up an entire computer system.

There are totally five computer generations known till date. Each generation has been discussed in detail along with their time period and characteristics. Here approximate dates against each generations have been mentioned which are normally accepted.

Following are the main five *generations* of computers **S.N.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Generation and Description** | |
| 1 | **First Generation** The period of first generation: 1946-1959. Vacuum tube based. | |
| 2 | **Second Generation** The period of second generation: 1959-1965. Transistor based. | |
| 3 | **Third Generation** The period of third generation: 1965-1971. Integrated Circuit based. | |
| 4 | **Fourth Generation** The period of fourth generation: 1971-1980. VLSI microprocessor based. | |
| 5 | **Fifth Generation** The period of fifth generation: 1980-onwards.ULSI microprocessor based | |

First Generation

The period of first generation was 1946-1959. The computers of first generation used vacuum tubes as the basic components for memory and circuitry for CPU (Central Processing Unit). These tubes, like electric bulbs, produced a lot of heat and were prone to frequent fusing of the installations, therefore, were very expensive and could be afforded only by very large organisations. In this generation mainly batch processing operating system were used. Punched cards, paper tape, and magnetic tape were used as input and output devices. The computers in this generation used machine code as programming language.

The main features of first generation are:

1. Vacuum tube technology
2. Unreliable
3. Supported machine language only
4. Very costly
5. Generated lot of heat
6. Slow input and output devices
7. Huge size
8. Need of A.C.
9. Non-portable
10. Consumed lot of electricity

**Some computers of this generation were:**

1. ENIAC
2. EDVAC
3. UNIVAC
4. IBM-701
5. IBM-650

Second Generation

The period of second generation was 1959-1965. In this generation transistors were used that were cheaper, consumed less power, more compact in size, more reliable and faster than the first generation machines made of vacuum tubes. In this generation, magnetic cores were used as primary memory and magnetic tape and magnetic disks as secondary storage devices. In this generation assembly language and high-level programming languages like FORTRAN, COBOL were used. The computers used batch processing and multiprogramming operating system.

* 1. **The main features of second generation are:** 
     1. Use of transistors
     2. Reliable in comparison to first generation computers
     3. Smaller size as compared to first generation computers
     4. Generated less heat as compared to first generation computers
     5. Consumed less electricity as compared to first generation computers
     6. Faster than first generation computers
     7. Still very costly
     8. A.C. needed
     9. Supported machine and assembly languages

**Some computers of this generation were:**

1. IBM 1620
2. IBM 7094
3. CDC 1604
4. CDC 3600
5. UNIVAC 1108

Third Generation

The period of third generation was 1965-1971. The computers of third generation used integrated circuits (IC's) in place of transistors. A single IC has many transistors, resistors and capacitors along with the associated circuitry. The IC was invented by Jack Kilby. This development made computers smaller in size, reliable and efficient. In this generation remote processing, time-sharing, multi-programming operating system were used. High-level languages (FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC, ALGOL-68 etc.) were used during this generation.

**The main features of third generation are:**

* 1. IC used
  2. More reliable in comparison to previous two generations
  3. Smaller size
  4. Generated less heat
  5. Faster
  6. Lesser maintenance
  7. Still costly
  8. A.C needed
  9. Consumed lesser electricity
  10. Supported high-level language

**Some computers of this generation were:**

1. IBM-360 series
2. Honeywell-6000 series
3. PDP(Personal Data Processor)
4. IBM-370/168
5. TDC-316

Fourth Generation

The period of fourth generation was 1971-1980. The computers of fourth generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors and other circuit elements and their associated circuits on a single chip made it possible to have microcomputers of fourth generation. Fourth generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to personal computer (PC) revolution. In this generation time sharing, real time, networks, distributed operating system were used. All the high-level languages like C, C++, DBASE etc. were used in this generation.

**The main features of fourth generation are:**

1. VLSI technology used
2. Very cheap
3. Portable and reliable
4. Use as PC's
5. Very small size
6. Pipeline processing
7. No A.C. needed
8. Concept of internet was introduced
9. Great developments in the fields of networks
10. Computers became easily available

**Some computers of this generation were:**

* 1. DEC 10
  2. STAR 1000
  3. PDP 11
  4. CRAY-1(Super Computer)
  5. CRAY-X-MP(Super Computer)

Fifth Generation

The period of fifth generation is 1980-till date. In the fifth generation, the VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components. This generation is based on parallel processing hardware and AI (Artificial Intelligence) software. AI is an emerging branch in computer science, which interprets means and method of making computers think like human beings. All the high-level languages like C and C++, Java, .Net etc. are used in this generation.

**AI includes:**

1. Robotics
2. Neural networks
3. Game Playing
4. Development of expert systems to make decisions in real life situations.
5. Natural language understanding and generation.

**The main features of fifth generation are:**

1. **ULSI technology**
2. Development of true artificial intelligence
3. Development of Natural language processing
4. Advancement in Parallel Processing
5. Advancement in Superconductor technology
6. More user friendly interfaces with multimedia features
7. Availability of very powerful and compact computers at cheaper rates

**Some computer types of this generation are:**

1. Desktop
2. Laptop
3. NoteBook
4. UltraBook
5. ChromeBook

**Types of computers**

|  |  |  |
| --- | --- | --- |
| Computers can be broadly classified by their speed and computing power.    **Sr. No.** | **Type** | **Specifications** |
| 1 | PC (Personal Computer) | It is a single user computer system having moderately powerful microprocessor |
| 2 | WorkStation | It is also a single user computer system which is similar to personal computer but have more powerful microprocessor. |
| 3 | Mini Computer | It is a multi-user computer system which is capable of supporting hundreds of users simultaneously. |
| 4 | Main Frame | It is a multi-user computer system which is capable of supporting hundreds of users simultaneously. Software technology is different from minicomputer. |
| 5 | Supercomputer | It is an extremely fast computer which can execute hundreds of millions of instructions per second. |

PC (Personal Computer)

A PC can be defined as a small, relatively inexpensive computer designed for an individual user. PCs are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers is playing games and surfing Internet.

Although personal computers are designed as single-user systems, these systems are normally linked together to form a network. In terms of power, now-a-days High-end models of the Macintosh and PC offer the same computing power and graphics capability as low-end workstations by Sun Microsystems, Hewlett-Packard, and Dell.



Workstation

Workstation is a computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other such types of applications which require a moderate amount of computing power and relatively high quality graphics capabilities.

Workstations generally come with a large, high-resolution graphics screen, large amount of RAM, inbuilt network support, and a graphical user interface. Most workstations also have a mass storage device such as a disk drive, but a special type of workstation, called a diskless workstation, comes without a disk drive.

Common operating systems for workstations are UNIX and Windows NT. Like PC, Workstations are also single-user computers like PC but are typically linked together to form a local-area network, although they can also be used as stand-alone systems.



Minicomputer

It is a midsize multi-processing system capable of supporting up to 250 users simultaneously



Mainframe

Mainframe is very large in size and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously. Mainframe executes many programs concurrently and supports many simultaneous execution of programs.

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Supercomputer

SupercomputerSupercomputerSupercomputerSupercomputerSupercomputerSupercomputerSupercomputerSupercomputerSupercomputerSupercompuerSupercomputerSupercomputerSupercomputer Supercomputers are one of the fastest computers currently available. Supercomputers are very expensive and are employed for specialized applications that require immense amount of mathematical calculations (number crunching). For example, weather forecasting, scientific simulations, (animated) graphics, fluid dynamic calculations, nuclear energy research, electronic design, and analysis of geological data (e.g. in petrochemical prospecting)



**Components**

|  |  |  |
| --- | --- | --- |
| **All types of computers follow a same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users** | | |
| **Sr. 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 computer. This unit makes link between user and computer. The input devices translate the information into the form understandable by computer.

CPU (Central Processing Unit)

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 computer.

CPU itself has following three components

 ALU(Arithmetic Logic Unit)

 Memory Unit

 Control Unit

Output Unit

Output unit consists of devices with the help of which we get the information from computer. This unit is a link between computer and users. Output devices translate the computer's output into the form understandable by users. **35**

**CPU –Central Processing Unit**

**CPU consists of the following features:**

* + - 1. **CPU is considered as the brain of the computer.**
      2. **CPU performs all types of data processing operations.**
      3. **It stores data, intermediate results and instructions(program).**
      4. **It controls the operation of all parts of computer.**

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**CPU itself has following three components.**

* + - * 1. **Memory or Storage Unit:**
        2. **Control Unit**
        3. **ALU(Arithmetic Logic Unit)**

Memory or Storage Unit:

**This unit can store instructions, data and intermediate results. This unit supplies information to the other units of the computer when needed. It is also known as internal storage unit or main memory or 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 memory unit are:**

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

Control Unit

**This unit controls the operations of all parts of 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 above operations.**

**Logic Section**

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

**Input Devices**

**Following are few 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 in inputting 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.**

**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:**

**39**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Keys** | **Description** |
| **1** | **Typing Keys** | **These keys include the letter keys (A-Z) and digit keys (0-9) which generally give same layout as that of typewriters.** |
| **2** | **Numeric Keypad** | **It is used to enter 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** | **Function Keys** | **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 unique meaning and is used for some specific purpose.** |
| **4** | **Control keys** | **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).** |
| **5** | **Special Purpose Keys** | **Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.** |

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**Mouse**

**Mouse is 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 mouse and sends corresponding signals to CPU when the mouse buttons are pressed.**

**Generally it has two buttons called left and right button and a wheel is present between the buttons. Mouse can be used to control the position of cursor on 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 keyboard.**

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Joystick

**Joystick is also a pointing device which is used to move 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 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 which is 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 pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.**

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**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 ball, 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 and a square.**

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**Scanner**

**Scanner is an input device which works more like a photocopy machine. It is used when some information is available on a paper and it is to be transferred to the hard disc of the computer for further manipulation. Scanner captures images from the source which are then converted into the digital form that can be stored on the disc. These images can be edited before they are printed**

