

CHAPTER-1

INTRODUCTION

Generations of computer

- Explain briefly the various generations of computers.[PU:2012 fall]
- Why second generations of computer are better than first generation? Differentiate between third generation and forth generation of computer.
- Write a short notes on:
Generations of computers [PU: 2018 spring]

Generations of computer refers to the different state of advancement of computer technology.

When generations goes up the following characteristics are in effect.

Characteristics	Effects
Size	Decrease
Speed	Increase
Power consumption	Decrease
Processing capability	Increase
Storage capacity	Increase
Reliability and accuracy	Increase

Based on the period of development and the features incorporated, the computers are classified into different generations- First generation to Fifth generation. This is called the computer generation.

1) First Generation (1940-1956)

- **Technology:** Vacuum tubes were used
- **Input/output device:** Punch card was used as input/output devices.
- **Processing speed:** Slow processing speed and measured in millisecond.
- **Programming language:** Machine level language was used for programming.
- **Reliability and accuracy:** The computers were not fully reliable and accurate.
- **Size and cost:** The size of computer was very large and its cost was also expensive.
- **Power consumption and heat emission:** Computer consumed a lot of electricity power and emitted a lot of heat.
- **Examples.** UNIVAC, EDVAC , ENIAC etc.

2) Second Generation (1956-1963)

- **Technology:** Transistors were used
- **Input/output device:** Punch card was used as input/output devices.
- **Processing speed:** Faster processing speed and measured in microsecond.
- **Programming language:** Assembly and High level programming language were used such as COBOL, FORTRAN and ALGOL
- **Reliability and accuracy:** More Reliable and accurate than first generations of computers.
- **Size and cost:** Smaller in size and less expensive than first generations of computer.
- **Power consumption and heat emission:** Computer consumed a lot of electricity power and emitted a lot of heat.
- **Examples.** PDP-5, PDP-8, IBM 7090, IBM 1620

3) Third Generation (1964-1971)

- **Technology:** IC(Integrated Circuits)were used
- **Input/output device:** Keyboards and monitors were used as input/output device
- **Processing speed:** Faster than previous generation of computers and processing speed measured in nanosecond.
- **Programming language:** Further development of high level programming language for computer programming.
- **Reliability and accuracy:** Computer became fully reliable and accurate.
- **Size and cost:** Smaller in size and less expensive than Previous generations of computer.
- **Power consumption and heat emission :** Less than previous generations of computers
- **Examples.** CDC11 7600, PDP 11 and IBM 370

4) Fourth Generation (1972 onwards)

- **Technology:** VLSI(Very Large Integration Circuits)
- **Input/output device:** All different types of input/output devices available such as microphone, speaker, scanner ,printer
- **Processing speed:** Faster than previous generation of computers and processing speed increased up to picoseconds and (MIPS) Millions of instructions per second.
- **Programming Language:** Problem-oriented fourth generation language (4GL) is used to develop the program. As well database programming language were used.
- Operating system like MS DOS ,MS windows with Graphical User Interface(GUI) and User friendly applications

- **Size and cost:** Smaller in size and less expensive than Previous generations of computer.
- **Power consumption and heat emission :** Less than previous generations of computers
- Examples. Pentium II, Pentium III, Pentium IV, DEC's Alpha

5) **Fifth Generation – (present and future)**

Fifth generation computing devices, based on artificial intelligence and still are development. Computer of this generation offers Ultra Large Scale Integration (ULSI) technology.

Characteristics:

- Aims to solve highly complex problems, which require reasoning, intelligence and expert knowledge.
- Based on Parallel processing architecture.
- Will use natural language rather than high level language. Processing with quantum computation and molecular technology will radically change the computing in future.

Computer Software

- What is a software? Differentiate tailored and packaged software.
- What is computer software? Explain the different type of software used in today's life.[PU:2018 fall]
- What do you mean by Instructions and software? Explain various types of software.[PU:2019 spring]

Software is a computer program which is a sequence of instructions designed to direct a computer to perform certain task. The software enables a computer to receive input, store information, make decisions, manipulate and output data in the correct format. A program consists of instruction that tell the computer what to do and how to behave.

System software

The purpose of system software is to help run the computer system by controlling, Integrating and managing the individual hardware components of a computer system.eg. Operating system, device drivers etc. Operating systems like linux , windows and DOS (Disk operating system) control all parts of the computer system by handling I/O devices, coordinating and managing resources like memory, disk ,CPU etc. and provide a environment over which other programs(software) can run.

Application software

Software which is used for user's specific application known as application software. Application software are designed to process data and support users in an organization such as solving equations or producing bills, result processing of campuses, data processing of accounts in banks. E.g. Word, Excel, PowerPoint, Photoshop, etc.

Application software can be classified into following categories.

- **Tailored software:** These kind of software are developed for solving particular problem. eg. A software for payroll of an organization, attendance system for student, software for ticket reservation etc.
- **Packaged software:** These software that is often used together, performs similar functions, or includes similar features, and is bundled together as a set of software programs. For example, Microsoft Office is packaged software, including multiple software programs used in a home or office, such as Microsoft Excel, Microsoft Word, and Microsoft PowerPoint. Video and audio editing software may be available as packaged software as well, as they may be used together for editing music and video files used in a movie.
- **Utility software:** These are special types of application software which help us to fine tune the performance of a computer, prevent unwanted actions or perform system related tasks such as checking for virus and removing virus, system utilities which provide information about current state of the use of files, memory, users and peripherals eg disk info, check disk, debuggers for removing "bugs" from program.

Types of computers

1) On the basis of working mode

How does digital computer differ from analog computer? Define Hybrid computer.

i) Analog computer

Analog computer is one which operates on continuous data, usually of a physical nature such as length, voltage or current, etc. An analog machine is usually a special purpose device dedicated to a single task. Analog computers are based on analog signals that are continuous signals. These types of computers were widely used in scientific and industrial applications.

Presley, thermometer, speedometer, barometer, lactometer, etc are the example of an analog computer. An example of analog devices is a thermometer, barometer, speedometer and ammeter.

ii) Digital computer

The computer which works on discrete data or discontinuous data is known as a digital computer. It works on a binary system where 0 represent off and 1 represents on. It is based on digital signals i.e discrete signals.

So, the basic principle of these computers are either present or absence of an electric pulse in the signals. It is a multipurpose and programmable computer. It is fast processing, more accurate and has large memory capacity. It is usually general purpose computer.

Digital watch, digital speedometer etc are the example of digital devices Some examples of a digital computer are IBM PC, Apple/Macintosh computer, etc.

Analog computer vs Digital computer

Analog computer	Digital computer
1. Uses the continuous signal for its operation.	1. Use the discrete signal for their processes which are in the binary form (0 and 1).
2. Usually contains either no any or limited memory capacity.	2. It usually contains larger storage capacity.
3. Accuracy is less.	3. They are more reliable, accurate and less affected by noise.
4. Slower in speed.	4. Faster in speed.
5. Used for specific purpose.	5. Used for general purpose.
6. These computers use a network of resistors and capacitors.	6. Here a large number of logic gates, microprocessors and on-off switches are used.
7. Eg. Speedometer, Thermometer, Analog watch etc. are the analog devices.	7. Eg. Digital watch, Digital speedometer etc are the example of digital devices.

iii) Hybrid Computer

A computer, which has a combination best feature of both analog and digital computers is called a hybrid computer. It helps the user to process discrete and continuous data. The hybrid computer can convert the analog signal into digital signals and digital signal into analog signal. Hybrid computers are used mainly in specialized applications where both kinds of data need to be processed. Therefore, they help the user to process both continuous and discrete data.

They have usually the speed of digital computers and the accuracy of analog computers. They can perform the task of both analog and digital computer. They are usually used for special problems, as it is a special purpose computer in which input data are derived and measurement are converted into digits and processed by a computer.

It is mostly used in radar communication, rocket launching, weather forecasting and in other fields.

In weather forecasting, analog devices measure wind speed, humidity, temperature, wind direction and fed to the digital devices that compare with the past information to predict the climate changes.

2) On the basis of size and capabilities

Explain the classification of computer based on size and capabilities.

- i) **Super computers:** Supercomputers are very expensive, very fast, and the most powerful computers we have in the world. It has multiuser, multi-processing, very high efficiency and large amount of capacity. They are used in scientific research centers like NASA. These computer types are also very large in size due to the numerous parts and components involved in their design.

A good example of a Supercomputer is Tianhe-2.

- ii) **Mainframe computers:** These are large and expensive computer types capable of supporting hundreds, or even thousands, of users simultaneously. Thus, they are mostly used by governments and large organizations for bulk data processing, critical applications, transaction processing, census, industry and consumer statistics among others. They are ranked below supercomputers

Examples. IBM 4300 series, ICL 39 series, IBM-1401.

- iii) **Mini Computer**

Minicomputers are used by small businesses & firms. Minicomputers are also called as “Midrange Computers”. These are small machines and can be accommodated on a disk with not as processing and data storage capabilities as super-computers & Mainframes. These computers are not designed for a single user. Individual departments of a large company or organizations use Mini-computers for specific purposes. For example, a production department can use Mini-computers for monitoring certain production process.

Popular Minicomputers

- K-202
- Texas Instrument TI-990
- SDS-92

- iv) **Micro Computer**

Desktop computers, laptops, personal digital assistant (PDA), tablets & smartphones are all types of microcomputers. The micro-computers are widely used & the fastest growing computers. These computers are the cheapest among the other three types of computers. The Micro-computers are specially designed for general usage like entertainment, education and work purposes. Well known manufacturers of Micro-computer are Dell, Apple, Samsung, Sony & Toshiba.

Block Diagram of computer

- With the help of block diagram of digital computer explain the function of control unit and memory unit.[PU:2014 spring]
- Draw a block diagram of digital computer. Explain Each Component in brief. [PU:2018 spring]
- What is the functional difference between primary memory and secondary memory? Explain the function of control unit with the help of block diagram of digital computer.[PU:2016 fall]

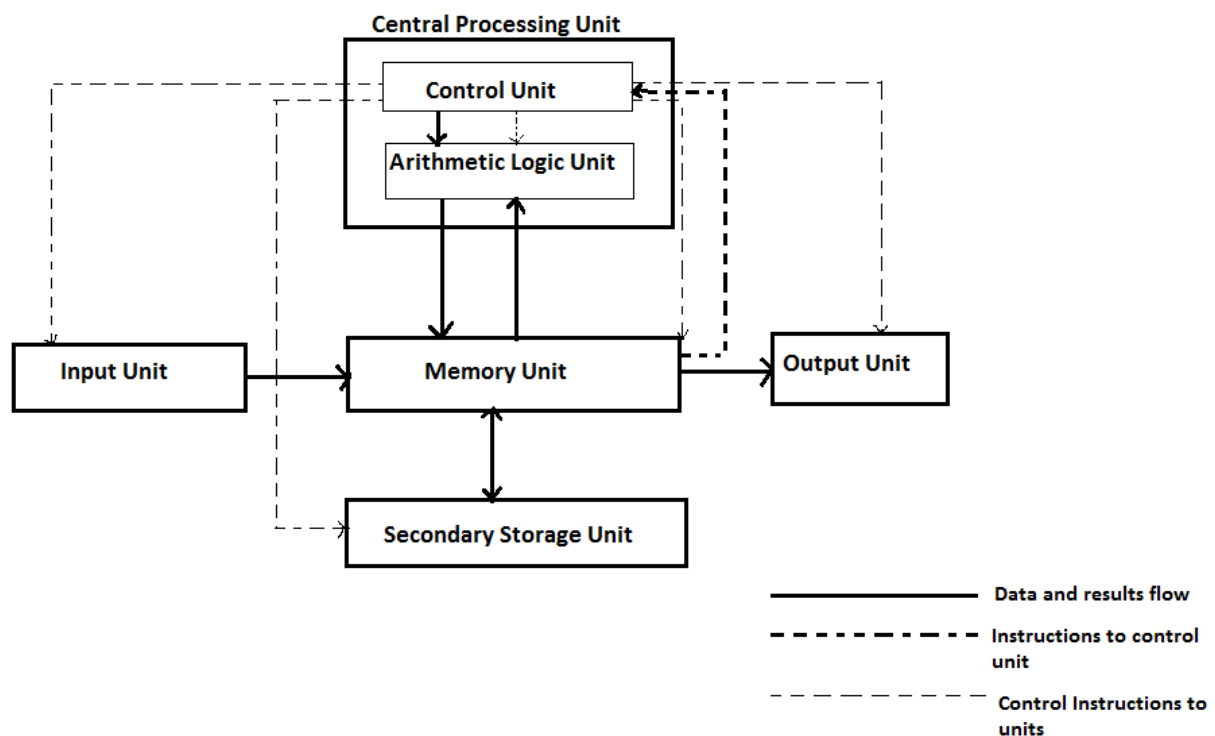


Fig. Block Diagram of Computer

Input units: They are input devices from which data and instructions entered into memory unit. The commonly used input devices are keyboard, mouse, trackball, joystick, touch panel etc.

Memory unit: It holds data and instructions that are entered through the input unit, before they processed. It preserves the intermediate and final results before they are sent to the output devices. It also saves data for later use. They are categorized as:

- **Primary storage:** They stores data and programs while the program is being executed. They are temporary in nature. The data is lost when computer is switched off. They are faster, expensive and occupy less space as compared to secondary storage unit. eg RAM
- **Secondary storage:** They stores the data and program permanently. The program that run on a computer are first transferred to primary memory before it actually run.

Whenever the results are saved they get stored in secondary memory. They are cheaper and slower than primary memory. eg. Hard disk, CD-ROM etc.

Processing Unit:

It is also known as central processing unit, used to perform computation and information processing on those data that is entered through input devices. Processing unit consist of Control Unit (CU) and Arithmetic Logic Unit (ALU).

- **Control Unit:** The control coordinates or controls all the activities performed in a computer system. It transfers data and instructions to the ALU for arithmetic operations. It tells the computer's memory, arithmetic and logic unit and input and output devices how to respond to the instructions that have been sent to the processor. As well, It directs the operation of the other units by providing timing and control signals.
- **Arithmetic and Logic unit:** They performs Arithmetic and logical operations on data. Arithmetic operations performed by them are Addition, Subtraction, Multiplication, Division etc. Similarly logical operations perform by them are AND, OR, NOT etc.

Whenever calculations are required, the control unit transfers the data from memory unit to ALU, once computations are done, the results are transferred to the Memory unit by the control unit and then it is send to the output unit for displaying data.

Output Unit

They are set of output devices used for providing the output of a program that is obtained after performing the operations specified in a program. Commonly used output devices are monitor, printer etc.

Programming Language

- What do you mean by programming language? Explain all types of programming language with examples.[PU:2013 spring][PU:2014 fall]
- What is programming language? Describe Low level programming language(LL) and High level Programming language (HLL) with examples.[PU:2012 fall]
- Define programming language .Differentiate between high level and low level programming language.[PU:2013 fall][PU:2015 spring]
- What is programming Language? Why High level programming (HLL) is preferred to low level programming Language(LL)?[PU:2016 spring]
- What do you mean by programming language? Discuss on machine language, assembly language and high level language.[PU:2017 fall]
- What is programming language? Explain about high level programming language and low level programming language.[PU:2019 fall]
- Compare and Contrast High level programming language and Low level language.[PU:2017 spring]

A programming language is a standardized communication technique for describing instructions for a computer. Each programming language has a set of syntactic and semantic rules used to define computer programs.

A programming language enables a programmer to precisely specify what data computer is act upon, how these data are to be stored/transmitted and what actions are to be taken under circumstances.

Programming language are classified mainly in two categories:

- Low level programming language
 - High level programming language
- i) **Low level programming language**

Low level language are specific to hardware. Before creating a program, it is required to have through knowledge of that hardware. low level programming language are divided into two types.

- Machine language
- Assembly language

Machine language

Machine language are lowest- level programming language. A computer understands program written only in the machine language. It is directly executable by computer without the need for translation by a compiler or an assembler.

Machine code consist entirely of the 0's and 1's of the binary system. Early computers were programmed using machine language. Programs written in machine language are faster and efficient.

Writing program in machine language is very tedious, time consuming, difficult to find bugs in longer programs.

Assembly language

In assembly language, instead of using numeric opcodes (i.e. pattern of 0 & 1),mnemonics are used eg. ADD,SUB etc. Program written in assembly language must be converted into machine language which could be done by assembler. Assembly language program written for one type of CPU won't run on another. So that assembly language is time consuming and machine dependent.

ii) High Level programming language

The syntax of high level is closer to human language. High level language were developed to make programming easier. Most of the high level language are English like languages. They use familiar English words, Special symbols (! & etc.) in their syntax .Therefore high level language are easier to read, write, understand and maintain.

Each high level language has their own set of grammar and rules to represent set of instructions. Eg. C ,C++,Java, FORTAN etc.

Program written in high level language also need to translated into machine language. This can be done either by compiler or interpreter.

Language Translator

- What do you mean by language translation? Differentiate compiler and interpreter.
- Explain the significance of compiler and interpreter.

A programmer write a program in high level language that is to be translated into machine language equivalent code. This task is achieved by using language translator.

The common language translator are:

- Compiler
- Interpreter
- Assembler

Difference between compiler and interpreter

Compiler	Interpreter
1. A compiler translates the entire source code to object code and then only object code is executed.	1. An interpreter translates one statement at a time, executes it and continues for another statement.
2. Compiler is faster than interpreter.	2. Interpreter is slower than compiler.
3. It generates the error message only after scanning the whole program. Hence debugging is comparatively hard.	3. It continuously translates the program until the first error is met, in which case it stops. Hence debugging is easy.
4. A compiler is a complex program.	4. Interpreter is less complex program than compiler.
5. As compared to an interpreter developing a compiler is difficult.	5. As compared to a compiler developing interpreter is easier.
6. Programming language like C,C++,FORTRAN use compiler.	6. Python use interpreter.

Assembler

An assembler is a program (software) which translates the program written in assembly language to machine language. It takes the basic commands and operations from assembly code and converts them into binary code that can be recognized by a specific type of processor.

Assemblers are similar to compilers in that they produce executable code. However, assemblers are more simplistic since they only convert low-level code (assembly language) to machine code. Since each assembly language is designed for a specific processor, assembling a program is performed using a simple one-to-one mapping from assembly code to machine code in that they produce executable code.

Differences between high level and low level programming language

High level programming language	Low level programming language
1. It is programmer friendly language.	1. It is machine friendly language.
2. Compiler or interpreter is required for translation.	2. Assembler is required for translation.
3. They execute slower.	3. They execute faster.
4. For writing program hardware knowledge is not required.	4. For writing program hardware knowledge is required.
5. They are easier to learn and understand by human.	5. It is difficult to learn and understand by human.

6. It can run on any platform.	6. It is machine dependent.
7. It is simple to debug and maintain.	7. It is difficult to debug and maintain as compared to high level language.
8. Example: C, C++, Java etc.	8. Example: Assembly language

Advantages and Disadvantages of High level and low level programming language

Advantages of High level language

- High level languages are programmer friendly.
- They are easy to write, debug and maintain.
- They are portable, which means same code can run on different hardware.
- It is machine independent language.
- Easy to learn.

Disadvantages of High level language

- It takes additional translation times to translate the source to machine code.
- Execution of high level programs are comparatively slower than low level programs.
- Compared to low level programs, they are generally less memory efficient.
- Cannot communicate directly with the hardware.

Advantages of low level languages

- Programs developed using low level languages are fast and memory efficient.
- There is no need of any compiler or interpreters to translate the source to machine code. Thus, cuts the compilation and interpretation time.
- It can directly communicate with hardware devices.

Disadvantages of low level languages

- Programs developed using low level languages are machine dependent and are not portable.
- It is difficult to develop, debug and maintain.
- Programmer must have additional knowledge of the computer architecture of particular machine, for programming in low level language.

Traditional and structured programming

Differentiate structured programming concept from traditional programming concept.

In traditional Programming we start with a problem to solve. We figure out how to break the problem into smaller parts, and then each part into smaller parts. At each stage we think about how to do things, then another, then yet another. So divide and conquer with an emphasize on doing things.

Structured programming is a subset of procedural programming that enforces a logical structure on the program being written to make it more efficient and easier to understand and modify.

Structured programming frequently employs a top down top-down design model, in which developers map out the overall program structure into separate subsections. A defined function or set of similar function is coded in a separate module or sub-module, which means that code can be loaded into memory more efficiently and that module can be reused in another programs. After a module has been tested individually, it is then integrated with other modules into the overall program structure.

[Pokhara University Previous Board Exam Questions](#)

1) Why higher generations of computer are better?

When generations goes up the following characteristics are in effect.

Characteristics	Effects
Size	Decrease
Speed	Increase
Power consumption	Decrease
Processing capability	Increase
Storage capacity	Increase
Reliability and accuracy	Increase

Due to this reason ,higher generations computer are better.

2) Discuss briefly about the history of computing and computers. [Assignment]

3) Why C is called Structured Programming language?[PU:2017 spring]

C is called a structured programming language because to solve a large problem, C programming language divides the problem into smaller modules called functions or procedures each of which handles a particular responsibility.

The program which solves the entire problem is a collection of such function

4) What do you mean by instructions and software?[PU:2019 spring]

An instruction is an order given to a computer processor by a computer program. At the lowest level, each instruction is a sequence of 0s and 1s that describes a physical operation the computer is to perform (such as add decimal, move, load register)

Software is a computer program which is a sequence of instructions designed to direct a computer to perform certain task. The software enables a computer to receive input, store information, make decisions, manipulate and output data in the correct format. A program consists of “instructions” that tell the computer what to do and how to behave.