

UNIT STRUCTURE

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2.0 Learning Objectives :

In this unit, we will discuss about the basics of computer organization and Data processing :

After working through this unit, you should be able to :

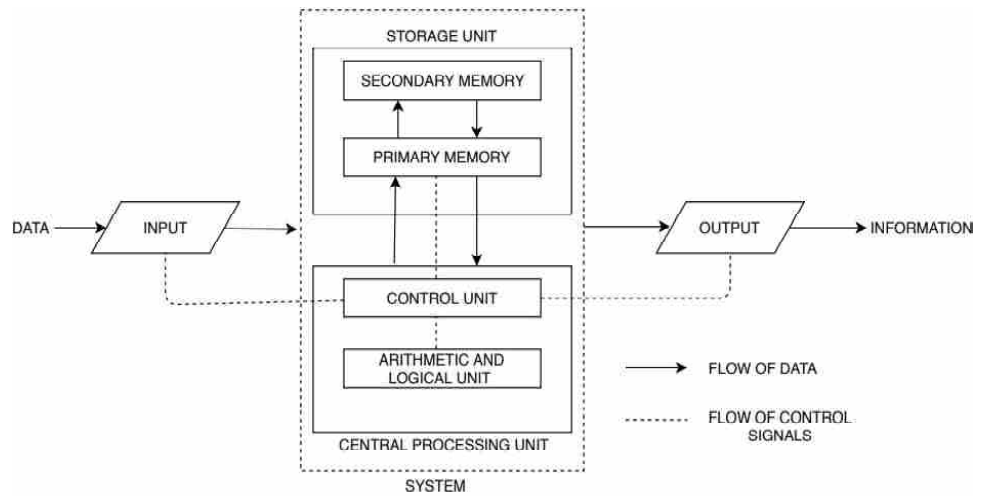
- Understand Block–diagram of computer.
- Know, advantages and disadvantages of computer system
- Understand programming languages and its features
- Know computer data processing

2.1 Introduction :

Computer is an electronics machine, which is made by various electronic and mechanical components. In this unit we will focus on various components used in computer, their attributes, uses etc. We will also see the advantages and disadvantages of computer and area of its applications. We will see types of software's and data processing.

2.2 Block-Diagram of Computer :

As we have discussed that the computer is a data processor which takes data from the user, using input devices. It processes the data using Central Processing Unit (CPU) and Memories and produces information. User can get the information produces by a System using various output devices.



2.2.1 Input :

To input the data to the computer system, user might have to use input devices. These input devices can be a Keyboard or Mouse. With the help of these input devices user can entered the data to the computer system for processing purpose.

2.2.2 System :

The computer system will accept the data from the user using input devices like Keyboard, Mouse etc. and stored it into the memory. Computer system consists of [1] Storage Unit and [2] Central Processing Unit.

[1] Storage Unit :

Storage Unit consists of memory of the computer system. Which is used to store data entered by the user. After processing of data, system will produce information. This information will also be stored in the storage unit. Storage unit mainly divided into two type : [1] Primary Memory and [2] Secondary Memory.

Computer system has a memory called Random Access Memory (RAM), which provides temporary storage to the computer system. This memory is volatile memory, that mease it is not be able to store the data and information permanently. RAM needs continuous power supply and if we switch off the system, content within this memory will be erased. Therefore, RAM provides temporary storage to store data, information and intermediate results for CPU.

Secondary memory is a permanent memory (non-volatile). It can store the data and information permanently even if we switch off the machine or discontinue the power supply. Generally, computer system has a Hard-disk drive, which is a secondary storage of the computer system. Data and Information stored in the Hard-disk drive will be permeant and can be retrieve back even after we restart the machine. Because of secondary memory is much slower than of primary memory, CPU always use primary memory to process the data. CPU do not interact with the Primary Memories directly. The data stored on the secondary memory will be loaded in to the primary memory first and then CPU will process it.

[2] Central Processing Unit :

Central Processing Unit is responsible to process the data and convert it to information with the help of storage unit. The CPU consists of the 3 units : [1] Memory Unit [2] Control Unit and [3] Arithmetic and Logical Unit.

Central Processing Unit of the computer system have a memory unit. Which consists of several registers. Registers are very high-speed memory among all memories resided in the chip of the CPU itself. It is a very costly memory and available in very small size (Bytes). Registers are made from the special circuitry called Flip-Flops.

Central processing unit also have a control unit, which is basically used to control all hardware peripherals such and Input / Output devices, Storage unit and ALU (Arithmetic and Logical Unit which is another unit of the CPU). In the Block-diagram controls lines are represented by a dotted line, which means Control Unit of the CPU controls the various hardware using special control lines available in the computer system.

Central Processing Unit also consists of Arithmetic and Logical Unit (ALU), which is responsible to execute all the instructions. ALU made of various small circuitries which executes all instruction written by a programmer into a computer program. For example, when programmer has written instruction 'a+b' at that time Control Unit of the system will decode the instruction and send a control signal to the circuitry called 'Adder' available in the ALU. Once the signal from CU is received by 'Adder', it executes the instruction and produces result of the instruction 'a+b'. During this moment other circuitry of the ALU will be in inactive state.

2.2.3 Output :

After processing the data which is entered by the user, by the CPU, information will be obtained. Information will be stored initially in the Primary Memory. Based on the user request information can be stored in the secondary memory for future use. User can retain this information using output devices such as monitor or printer.

❑ Check Your Progress – 1 :

1. _____ is a volatile memory.
[A] RAM [B] Hard-disk
[C] Flash memory [D] All of the above
2. CPU consists of _____.
[A] Memory unit [B] Arithmetic and Logical Unit
[C] Control unit [D] All of the above
3. _____ is an output device.
[A] Mouse [B] Keyboard [C] Printer [D] Scanner

2.3 Advantages and Limitations of Computer :

Compared to traditional systems, computers offer lots of significant features. That's why the traditional systems are being replaced speedily by computer-based systems.

In traditional system human performs the task of writing data in the registers or books and used to perform calculations or making a report apart from

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this preserving the data in hard copies, files and folders with all human errors. This used to take lot of space to store. Many times, records get destroyed due to natural calamity and theft. The main advantages offered by the computers are as follows :

1. Computer provides access to more information using Internet
2. Computers can complete tasks that might be impossible for humans to complete
3. Computer saves lots of time of human
4. Computer automates lots of repetitive tasks
5. It also allows for greater productivity
6. Computers can be used for better communication and connections
7. It can also be used for entertainment
8. Computer provides large storage, can able to store huge amount of data.

The limitations of the computer system are as follows :

1. Excessive use of computer can result in several medical problems. For example, more use of computer put more strain on eyes.
2. Computer has to be protected from malwares and viruses. If proper precaution is not taken then viruses can destroy data and important files from the computer. Hacker can access your data, without your knowledge if the system is not protected properly.
3. Computers are expensive and you need to pay for proper hardware and software.

2.4 Characteristics of Computer :

- **Automatic :** A machine is said to be automatic, if it works by itself without human intervention.
- **Speed :** A computer is a very fast device. It can perform in a few seconds, the amount of work than a human being can do in an entire year. While talking about the speed of the computer, we do not talk in terms of seconds or even milliseconds (10^{-3}). Our units of speed are the microseconds (10^{-6}), the nanoseconds (10^{-9}), and even the picoseconds (10^{-12}).
- **Accuracy :** In addition to being very fast, computers are very accurate. The accuracy of a computer is consistently high, and the degree of accuracy of a particular computer depends upon its design.
- **Diligence :** Unlike human beings, a computer is free from monotony, tiredness and lack of concentration. It can continuously work for hours, without creating any errors.
- **Versatility :** Versatility is one of the most wonderful things about the computer. One moment, it is preparing the result of an examination, the next moment; it is busy preparing electricity bills.
- **Power of Remembering :** A computer can store and recall any amount of information because of its secondary storage capability. Every piece of information can be retained as long as desired by the user, and can be recalled, as when required.
- **No I.Q. :** A Computer is not magical device. It possesses no intelligence of its own. Its I.Q. is zero at least until today.

- **No Feelings** : Computers are devoid of emotions. They have no feelings and instincts because they are machine.

☐ **Check Your Progress – 2 :**

1. Identify the attribute of the computer, which explains that computer can never tired or boarded to do repetitive tasks.
[A] Versatility [B] Diligence [C] Accuracy [D] No I.Q.
2. Identify the attribute of the computer, which explains that computer can easily switched from one task to another task.
[A] Versatility [B] Diligence [C] Accuracy [D] No I.Q.
3. Identify the limitation of the computer system from given below :
[A] Accuracy [B] Versatility
[C] High cost [D] Better communication

2.5 Applications of Computer :

Today's age is described as computer age. The computer-based applications are being widely used in almost all fields. Some of the fields are mentioned below where computers are invariably used.

1. Health care and Insurance sectors
2. Research and Development
3. Defence and Security sectors
4. Air lines and aviation sector
5. Education – schools, colleges, universities
6. Media and Film sector
7. Government – population, taxes, Police, defence
8. Medicine – Manufacturing of medicines, surgery
9. Agriculture– composition of fertilizers.
10. Industry – Design, shipping, process control
11. Home – communication, business work at home, schoolwork, entertainment, Finances
12. Business – Decision Support, Business information systems.

2.6 Programming Lanaguages :

To communicate with the Computer, we need programming languages. It is specifically design to give instructions to the Computer system to perform I/O operations, computations and logical operations that control behavior of the system. Programming languages consist of syntax (refers to grammatical rules) and semantics (refers to the meaning of the vocabularies) which provides meaningful instruction to the system. Programming languages provide platform to developer to write the program, which expressed in the algorithm which can be executed on system. Depends on the enhancement and advances done in the programming language it can be classified by following generations.

1. Machine language
2. Assembly language

3. High-level language (3rd generation languages)
4. Very high-level languages (4th generation languages)

2.6.1 Machine Language :

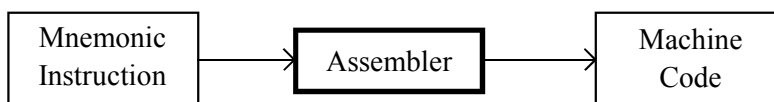
Machine language is a language, which machine can understand directly. To understand the instruction written in this language, machine do not need any kind of translator.

As we know machine is an electronic device and made by number of electronic components which can be in 2 states (charged means 1 or discharged means 0). So, it is a language of only two symbols 1 and 0. This language is also known as binary language. Here the program has number of instructions, and each instruction has unique binary pattern string. Because of each instruction directly written in machine language, translation is not needed. So, it is faster language than all other languages as they don't need translation. It is also known as Low-level language.

It is difficult for the programmer to memorize all instructions of the system in the form of binary strings. Hence, it is difficult to learn machine language. Another drawback of the machine language is, it is machine dependent language. So, program written for one machine cannot be executed on another machine having different architecture.

2.6.2 Assembly Language :

Rather writing instruction into the string of binary as in machine language, Assembly language use mnemonic symbols such as to add two number instruction 'ADD' is used. Similarly, 'MOV', 'SUB', 'MUL' kind of mnemonic instruction (instead of Binary) make this programming language easier and more readable, than machine language. Here programmer will write the program using mnemonic codes. After writing the program all instructions will translated into machine language using assembler.



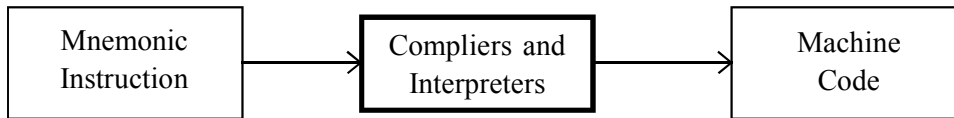
Assembler is a simple translator, which takes one assembly instruction and convert it into one corresponding machine code(instruction). So, it not reducing the length of the program. Furthermore, assembly programs are also machine dependent (as Machine language).

❑ Check Your Progress – 3 :

1. _____ is a machine language.
[A] Binary [B] Assembly
[C] C-Language [D] None of the Above
2. Machine language is also known as _____ language.
[A] High-Level [B] 4th Generation
[C] Assembly [D] Low-Level
3. _____ language use mnemonic code for instructions rather than strings of Binary patterns.
[A] Machine [B] Assembly [C] High-Level [D] All of the above

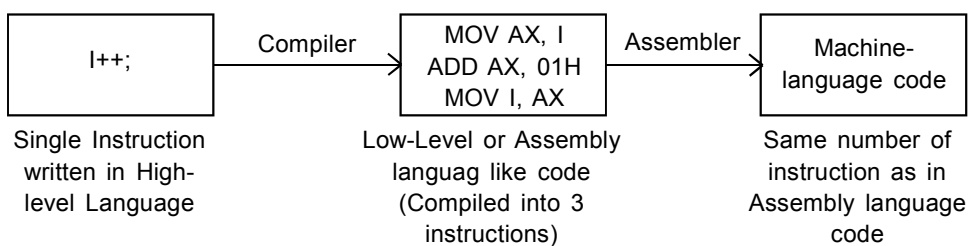
2.6.3 High-Level Languages :

Procedural and Object-Oriented languages are high-level languages. C, C++, Java, Visual Basic .NET, C#.NET are High-level languages. Basically, it is easier for the programmer to write the program in the high-level languages. High-level programs are more readable compare to assembly language code. To translate the instruction written in the high-level languages, compilers and interpreters are used. Compilers and Interpreters translates the High-level instruction to the machine understandable code, before the execution starts.



Compare to the assembler, compilers are doing its work in more efficient way. Compilers can take a single high-level instruction and can convert it into one or more instructions in the low-level language. So, compiler reduces number of instructions that programmer needs to write. Hence compiler makes high-level programs more compact. High-level languages are portable and platform independent. So, program written for a computer can be executed in other machines even they have different architecture or operating systems.

In the following figure we have tried to show how one line of high-level code is compiled and translated into 3 lines. In the C-language we have instruction 'I++', which will increment the value of variable 'I' by one. Now variables are declared in the random-access memory, and do not allow to change the value of any variable stored in RAM. It allows only two operations read and write. When programmer writes 'I++' instruction in the C-language, compilers generates 3 line of codes as shown in the figure. Computer will read the value of variable 'I' from the RAM and copy it to some register AX. The 1 will be added to the register AX. Finally, the incremented value of the AX register will be written back to RAM (i.e. variable I will be overwritten by incremented value). Thus, compiler save efforts of the higher-level language programmer, as well as allow programmers to do programming even if they do not have prior knowledge of the computer hardware or architecture.



It is clear that High-level languages reduces programming efforts by reducing number of lines, more readable and platform independent but it takes much time to translate it into machine code and these languages are slower compare to the Machine language and Assembly language.

2.6.4 4th Generation Language :

4th Generation languages like SQL (Structured Query Language) is much simpler and easy to understand. It uses syntax nearer to English like language. For example, to fetch the name of the Employees from the Emp table having salary more than 25000, we can write "SELECT NAME FROM EMP WHERE SALARY > 25000". To perform the same task into the procedural (3rd GL) requires number of instructions like declaration of number of variables, running of the loop for each record, if condition to verify salary > 25000 and so on.

❑ **Check Your Progress – 4 :**

1. Procedural languages are known as _____ language.
 [A] Low-Level [B] High-Level
 [C] Machine [D] None of the above
2. SQL stands for _____.
 [A] Systematic Query Language [B] System Quantified Language
 [C] Structured Query Language [D] System Quality Language
3. SQL is _____ Language.
 [A] 4th GL [B] Procedural [C] Object oriented [D] Binary

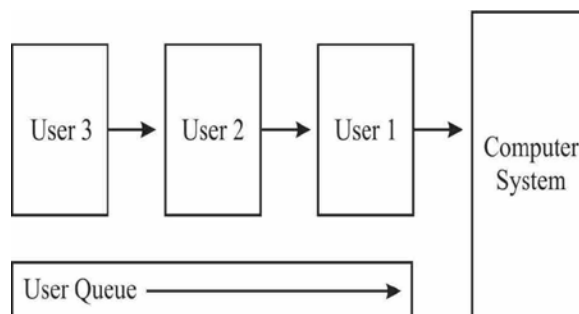
2.7 Computer Data Processing :

As we have learnt earlier that computer is a machine which takes data as input, process and gives out put in a user required form. Now we will learn about data processing. Computer data processing referred to the tasks like sort, search, merge, copy, transfer, collate, compare, store, create, enter, perform, compare, display and compute etc. are carried out time to time as per the requirement of the users of the computer. All these tasks are carried out by using different technologies.

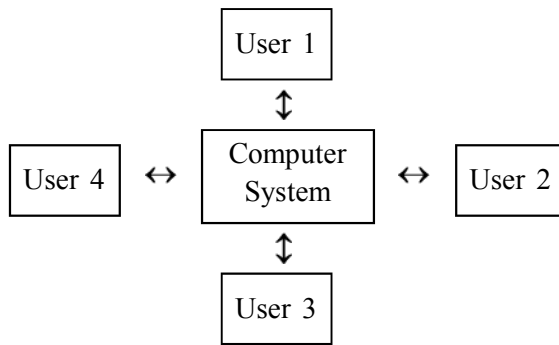
There are mainly three types of data processing technologies available such as :

1. Batch Processing (Off-Line)
2. Time Sharing (Simple On-Line)
3. Real time (quick response, On-Line)

1. **Batch Processing and Time Sharing :** The computer works on basis of either batch processing or time sharing. **Batch Processing :** In batch processing, the computer acts as a standalone unit. As such, it is available for a single user. Therefore, number of tasks can be done one after the other. In a small business unit, only one computer doing the entire task collecting batch wise data accordingly.



2. **Time sharing :** Unlike batch processing, the time sharing offers simultaneous usage of computer. The computer is provided with multiple terminals from which the system can be accessed simultaneously by number of users. User has time slot to process their tasks one after the other.



3. **Real time** : This method of processing done without delay because there are various processors in the main machine available which take the request of the users from various corners and allocate the processor to process the task immediately without delay. Hence processing done quickly. Examples like Radar System in Defence organization, online railway booking, airline booking and online examination and result declaration system etc.

❑ **Check Your Progress – 4 :**

1. Online railway reservation system is a kind of _____ processing.
 [A] Batch [B] Time-sharing
 [C] Real-time [D] None of the above
2. Multi-user system is a good example of _____ processing.
 [A] Batch [B] Time-sharing
 [C] Real-time [D] None of the above
3. In _____ processing number of tasks are given to computer system to process it as a single unit.
 [A] Batch [B] Time-sharing
 [C] Real-time [D] None of the above.
4. _____ processing is interactive data processing system.
 [A] Batch [B] Time-sharing
 [C] Real-time [D] None of the above.

2.8 Let Us Sum Up :

In this unit, we have :

- Discussed Block-diagram of computer system
- Elaborated Advantages and Limitations of computer system
- Described characteristics of computer system
- Talked about different types of programming languages
- Discussed about various data processing techniques

2.9 Suggested Answers For Check Your Progress :

❑ **Check Your Progress 1 :**

1. [A] 2. [D] 3. [C]

❑ **Check Your Progress 2 :**

1. [B] 2. [A] 3. [C]

❑ **Check Your Progress 3 :**

1. [A] 2. [D] 3. [B]

❑ **Check Your Progress 4 :**

1. [B] 2. [C] 3. [A]

❑ **Check Your Progress 5 :**

1. [C] 2. [B] 3. [A] 4. [B]

2.10 Glossary :

ALU : Arithmetic and Logical Unit. It is a part of CPU which is responsible to execute all the instructions of a program.

CU : Control Unit. It is a part of CPU which decode the instructions and instruct to the various hardware to perform.

RAM : Random Access Memory. It is a main memory of computer system. It is made from semi-conductor material. Therefore, it is also known as primary memory of the system. It is volatile memory that means content stored within RAM will be erased when we turn off the machine.

2.11 Assignment :

1. Draw and Explain Block-diagram of the computer system.
2. List and explain data processing techniques in brief.
3. List and explain different types of programming language in details.

2.12 Activity :

We know that the computer system uses RAM as a main memory and store its data into this memory. RAM is a semi-conductor memory and can store only binary data, which uses only two symbols those are '0' and '1'. Explain how the characters (alphabets) are stored in the RAM ?

2.13 Further Reading :

1. Computer Fundamentals by P.K.Sinha and Priti Sinha.
2. Discovering Computers 2016 by Shelly Cashman Series. CENGAGE publications.
3. Computer Fundamentals by Pearl Software, Khanna Book Publishing.