Covered Topics Under UNIT-1 of "PPS-PROGRAMMING FOR PROBLEM SOLVING (BCS101 / BCS201)"

shwetatiwari08@recabn.ac.in
shwetatiwari08aug@gmail.com

Class Notes

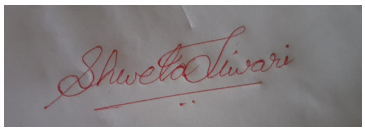
Published Date: November, 2022

PPS: UNIT-1

Introduction to Components of a Computer System

FALL SEMESTER, YEAR (I/II sem, 1st yr)

FALL SESSION (2022-23)
(PPS)
MS. SHWETA TIWARI
Published Date: November, 2022



shwetatiwari08@recabn.ac.in
shwetatiwari08aug@gmail.com

TOPIC On : UNIT-1: BASIC COMPUTER OPERATIONS

—

By SHWETA TIWARI

Under On: Introduction to Components of a Computer System

PREPARED FOR
Engineering Students
All Engineering College

PREPARED BY
SHWETA TIWARI

TOPIC On : UNIT-1: BASIC COMPUTER OPERATIONS

BASIC COMPUTER OPERATIONS

I. A Computer

Computer is an electronic device. As mentioned in lecture one, it can do arithmetic calculations faster. But as you will see later it does much more than that. It can be compared to a magic box, which serves different purposes to different people. For a common man a computer is simply a calculator, which works automatically and quite fast. For a person who knows much about it, a computer is a machine capable of solving problems and manipulating data. It accepts data, processes the data by doing some mathematical and logical operations and gives us the desired output.

Therefore, we may define a computer *as a device that transforms data*. Data can be anything like marks obtained by you in various subjects. It can also be name, age, sex, weight, height, etc. of all the students in your class or income, savings, investments, etc., of a country. Computer can be defined in terms of its functions. It can i) accept data ii) store data, iii) process data as desired, and iv) retrieve the stored data as and when required and v) print the result in desired format. You will know more about these functions as you go through the later lessons.

II. Functionalities of a Computer

If we look at it in a very broad sense, any digital computer carries out the following five functions:

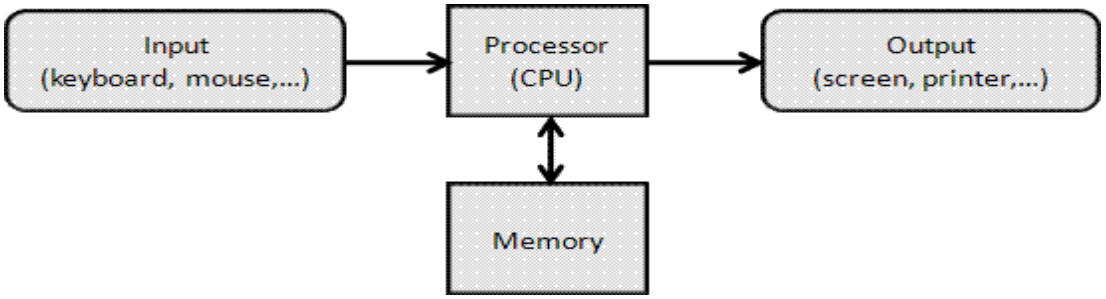
Step 1 − Take data as input.

Step 2 − Stores the data/instructions in its memory and uses them as required.

Step 3 − Processes the data and converts it into useful information.

Step 4 − Generates the output.

Step 5 − Controls all the above four steps.



III. Advantages of Computers

Following are certain advantages of computers.

High Speed

- Computers are very fast devices.
- It is capable of performing calculations of very large amounts 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 performing 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 the input is correct.

Storage Capability

- Memory is a very important characteristic of computers.
- A computer has much more storage capacity than human beings.
- It can store large amounts of data.
- It can store any type of data such as images, videos, text, audio, etc.

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 perform repeated tasks with the 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 problems related to various fields.

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 is the ability to perform a given task automatically. Once the computer receives a program i.e., the program is stored in the computer memory, then the program and instruction can control the program execution without human interaction.

Reduction in PaperWork and Cost

- The use of computers for data processing in an organization leads to reduction in paperwork and results in speeding up the process.
- As data in electronic files can be retrieved as and when required, the problem of maintenance of large numbers of paper files gets reduced.
- Though the initial investment for installing a computer is high, it substantially reduces the cost of each of its transactions.

IV. Disadvantages of Computers

Following are certain disadvantages of computers:

1. **Environments Pollution**
   Computers are not only the CPU, Monitors, Mouse and Keyboards. Heavy automatic machines, Laptops, Mobiles, Tablets and many other machines and equipment that work on command are called Computers. Therefore the manufacturing of these machines and components are causes of Environments Pollution like, Air Pollution, Water Pollution and Soil Pollution. There are also many Advantages and Disadvantages of Pollution.
2. **Data Security**
   The second drawback and demerit of a PC is data is not secure in the hard drive. In the office someone can steal your files in minimum time in your absence. Because the CPU's are very fast nowadays and transferring the data to USB takes no time.
3. **Reduce Job Opportunities**
   On the one hand computers produce job opportunities, but on another hand it also reduces the job opportunities. Because a lot of machines today's works automatically, work done before by five or ten people now that work machine does alone with one command.
4. **Viruses**
   Virus word is good in sound but it kills your Computer and can damage your files and data available in your Hard Disk. Virus is the enemy of *pc*, once it enters into the system, the quantity of virus increases automatically daily and at the end you will lose all important information and data.
5. **Need Skilled Person**
   No five points in "*Disadvantages of Computers"* is that a skilled person is needed for every special task. And a skilled person in specific software will charge a high salary. For example, for designing need Graphic Designer, for architect need person who can work in AutoCAD, for computerized accounting need person who can work in Peachtree or QuickBooks Software.

6. **Time Wastages**

   Another demerit of a PC is the wastage of time. People in offices use it for extra or personal work. Because of that other peoples are in problems.

7. **Money Waste**

   As we discussed above, misuse of computers is a waste of time, as like that it is also a waste of money. People buy it for playing games; watching movies and music are a waste of money.

8. **Short Circuit**

   In case of any problem in power cable, less or more power of electricity or heavy load on computer may cause of short circuit or blast. In that case you may lose your data and files and others may have to lose your whole system.

9. **Far from Family**

   The biggest disadvantage of the computer system is that more use of it for entertaining and playing video games or other misuse keep the people far from their families. Father cannot understand the children better; husband cannot understand wife and many other relations are going far.

10. **Automatic Operation**

    This is the last point of "advantages and disadvantages of computer technology in our life". This is the most serious and dangerous point because some automatic operations and functions of computerized software and commands sometimes stop working due to some reasons that may cause death. For example in lift, if electricity gets off or load shedding may stop lift. Many other machines that have no sense of thinking they work only command.

V. Uses of Computer

Following are certain uses of computers.

1. **Medical Departments**

   Computer is not only a combination of CPU, Monitor, Mouse and Keyboard. The Machines in Medical and Health departments and hospitals like X-Ray, Pathology Machine, Electrocardiograph Machine, Transport Monitors, Blood Gas Machine and Transport Ventilators etc. these all and thousands of other machines are computerized.

2. **Government Departments**

   In the list of advantages on second position goes to the point, uses of computers in government departments. Government of every country uses the computerized system in every department to keep the records of people for long time. This is the biggest **advantages of computer** system for the world. Because we can easily find the person in the county with the help of a national identification card issued by the government. And the second thing is that it is very difficult to keep the record of the

whole country in books and registers.

3. Education

Computers have a lot of advantages and disadvantages but we can get full benefits for computers in the education department. There are very high numbers of uses of computers in all the education sections. We can use it in schools for students, fee cards, pictures, papers, result cards etc. also used for merit lists, we can also get connected to every university and college in the world and can get online admission with the help of internet connection. Students solve their questions, create designs, create software and thousands are other *advantages of computers* in education and technology.

4. Jobs Opportunities

Another important point in the list for the jobless people. Because jobless people can easily find jobs on the internet with the help of computers. As compared to buying the newspaper from the market and searching for a job on every page in all newspapers. You can easily point out jobs according to your education and experience.

5. Computer Sports

People who like sports can easily find scores on the monitor screen or laptop screen with the help of the internet.

6. Games

You are free, no work and nothing to you are getting bored. Let's get on you (*PC*) and enjoy the fun of video games. Multiple video games like football, cricket, racing, arcade, fight and mission games are more interesting and entertaining.

7. Entertainments

Today’s the multimedia and entertainment age. Everybody likes to hear the latest new music, and want to watch the latest released movies of Hollywood and Bollywood. Not only this, there are many more entertainment ways that people can avail with the help of **PC** systems.

8. High Storage Space

You can use and get advantages from computer buy saving your thousands of old and new images. You're old memories, your project images, videos and working files. Because today's computers have the ability to save data in Terabytes.

9. Presentation

Presentations are playing a big role in every field to know more about the things. And to know something quick and easy with the help of presentation. PowerPoint software is used for creating the presentations. These presentations may be for events, products and projects etc.

10. Business Departments

Uses of computers in business departments. Every organization in the world, whether it is small or big, must need at least one or two computers for documentation, keeping records of workers, online communication etc.

VI. Basic Computer Operations

A computer as shown in Fig. 2 performs basically five major operations or functions irrespective of their size and make. These are:

1. It accepts data or instructions by way of input.
2. It stores data.
3. It can process data as required by the user.
4. It gives results in the form of output.
5. It controls all operations inside a computer.

We discuss below each of these operations.

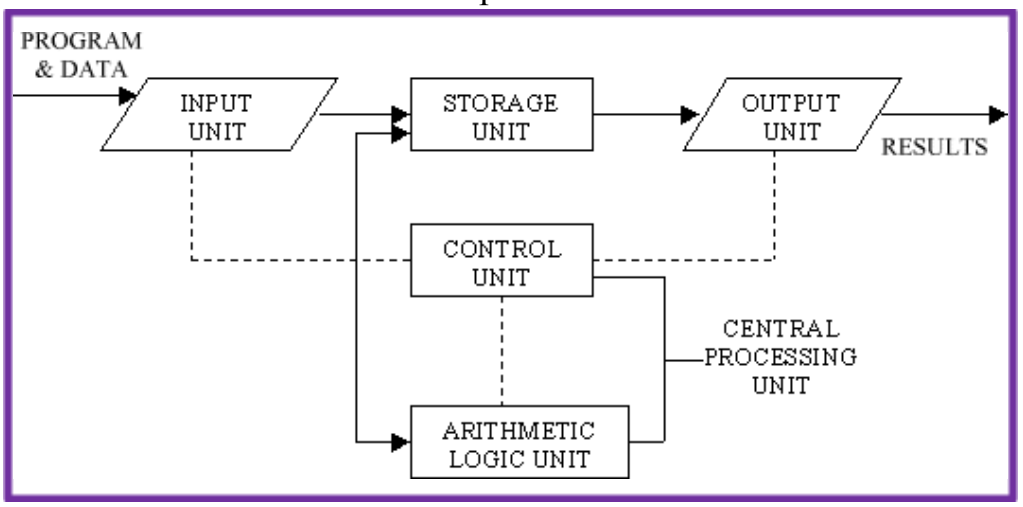


Fig. 2 Basic computer Operations

1. **Input:** This is the process of entering data and programs into the computer system. You should know that a computer is an electronic machine like any other machine which takes as inputs raw data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

2. **Storage:** The process of saving data and instructions permanently is known as *storage*. Data has to be fed into the system before the actual processing starts. It is because the processing speed of the Central Processing Unit (CPU) is so fast that the data has to be provided to the CPU with the same speed. Therefore the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions.

The storage unit performs the following major functions:

- All data and instructions are stored here before and after processing.
- Intermediate results of processing are also stored here.

3. **Processing:** The task of performing operations like arithmetic and logical operations is called **processing**. The Central Processing Unit (CPU) takes data and instructions from the storage unit and makes all sorts of calculations based on the instructions given and the type of data provided. It is then sent back to the storage unit.

4. **Output:** This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.
5. **Control:** The manner how instructions are executed and the above operations are performed. Controlling of all operations like input, processing and output are performed by the control unit. It takes care of step by step processing of all operations inside the computer.

VII. Data Representation.

The basic building block of personal computers is the transistor. A ***transistor*** is an electronic device for controlling the flow of electrons in an electrical circuit. If electrons are allowed to flow, the circuit is on; conversely, if electrons are not allowed to flow, the circuit is off. Thinking of a transistorized circuit as a switch like a light switch at a home. The switch is either **on** or **off** and stays that way until it is flipped again. When a circuit is **on**, we say it is in the marking state and assign a **1** to it. Conversely, when it is **off,** we assign a **0** to it.

A modern digital computer is often said to be a binary computer because its most basic circuits can remember either one of ***two states: 0 and 1***. The binary digits 0 and 1 are called **bits**. Both the internal and external memory of computers are nothing more than **store-houses** for bits.

VIII. Number System

When we type some letters or words, the computer translates them into numbers as computers can understand only numbers. A computer can understand the positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

The value of each digit in a number can be determined using −

- The digit

- The position of the digit in the number
- The base of the number system (where the base is defined as the total number of digits available in the number system)

1. Decimal Number System

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In the decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands, and so on.

Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position. Its value can be written as

$$(1 \times 1000) + (2 \times 100) + (3 \times 10) + (4 \times 1)$$
$$(1 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + (4 \times 10^0)$$
$$1000 + 200 + 30 + 4$$
$$1234$$

As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

S.No.	Number System and Description	
1	**Binary Number System**	
	Base 2.	Digits used : 0, 1
2	**Octal Number System**	
	Base 8.	Digits used : 0 - 7
3	**HexaDecimal Number System**	
	Base 16.	Digits used: 0 - 9, Letters used : A- F

2. Binary Number System

Characteristics of the binary number system are as follows:

- Uses two digits, 0 and 1
- Also called as base 2 number system
- Each position in a binary number represents a **0** power of the base (2). Example 2^0
- Last position in a binary number represents a **x** power of the base (2). Example 2^x where **x** represents the last position - 1.

Example

Binary Number: **10101_2**

Calculating Decimal Equivalent:

Step	Binary Number	Decimal Number
Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

Note − 10101_2 is normally written as 10101.

Binary numbers are sums of powers of two in the same way that decimal numbers are sums of powers of ten. The following table shows the decimal numbers represented by some of more important powers of two in personal computing:

$2^{-2} = 0.25$
$2^{-1} = 0.5$
$2^0 = 1$
$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^{16} = 65.536$
$2^{20} = 1.048.576$
$2^{24} = 16.777.216$

3. Octal Number System

Characteristics of the octal number system are as follows −

- Uses eight digits, 0,1,2,3,4,5,6,7
- Also called as base 8 number system
- Each position in an octal number represents a **0** power of the base (8). Example 8^0
- Last position in an octal number represents a **x** power of the base (8). Example 8^x where **x** represents the last position - 1

Example

Octal Number: **12570_8**

Calculating Decimal Equivalent:

Step	Octal Number	Decimal Number
Step 1	12570_8	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570_8	$(4096 + 1024 + 320 + 56 + 0)_{10}$
Step 3	12570_8	5496_{10}

Note − 12570_8 is normally written as 12570.

4. Hexadecimal Number System

Characteristics of hexadecimal number system are as follows −

- Uses 10 digits and 6 letters, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
- Letters represent the numbers starting from 10. A = 10. B = 11, C = 12, D = 13, E = 14, F = 15
- Also called as base 16 number system
- Each position in a hexadecimal number represents a **0** power of the base (16). Example, 16^0
- Last position in a hexadecimal number represents a **x** power of the base (16). Example 16^x where **x** represents the last position - 1

Example

Hexadecimal Number: $19FDE_{16}$

Calculating Decimal Equivalent:

Step	Binary Number	Decimal Number
Step 1	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (F \times 16^2) + (D \times 16^1) + (E \times 16^0))_{10}$
Step 2	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (15 \times 16^2) + (13 \times 16^1) + (14 \times 16^0))_{10}$
Step 3	$19FDE_{16}$	$(65536+ 36864 + 3840 + 208 + 14)_{10}$
Step 4	$19FDE_{16}$	106462_{10}

Note − $19FDE_{16}$ is normally written as 19FDE.

IX. Basic Terms and Notation.

The alphabet of computers, more precisely digital computers, consists of 0 and 1. Each is called a ***bit***, which stands for the binary digit. The term ***byte*** is used to represent a group of 8 bits. The term ***word*** is used to refer to a group of bytes that is processed simultaneously. The exact number of bytes that constitute a word depends on the system.

For example, in the Pentium, a word refers to four bytes or 32 bits. We use the abbreviation "**b**" for bits, "**B**" for bytes, and "**W**" for words. Sometimes we also use ***doublewords*** and ***quadwords***. A ***doubleword*** has twice the number of bits as the word and the ***quadword*** has four times the number of bits in a word.

2-bit 2^2 = 4 possible states (00, 01, 10, 11)

3-bit 2^3 = 8 possible states (000, - - -, 111)

8-bit 2^8 = 256 possible states (00000000, - - - , 11111111)

Bits in a word are usually ordered from right to left, as you would write digits in a decimal number. The rightmost bit is called the *least significant bit* (**LSB**), and the leftmost bit is called the *most significant bit* (**MSB**).

We use standard terms such as ***kilo*** (K), ***mega*** (M), ***giga*** (G), and so on to represent large integers. Unfortunately, we use two different versions of each, depending on the number system, decimal or binary. Table 1 summarizes the differences between the two systems.

Typically, computer-related attributes use the binary version.

For example, when we say 128 megabyte (MB) memory, we mean 128×2^{20} bytes. Usually, communication-related quantities and time units are expressed using the decimal system.

For example, when we say that the data transfer rate is 100 megabits/second (Mb/s), we mean 100×10^6 Mb/s.

Table 1 Terms to represent large integer values

Term	Decimal (base 10)	Binary (base 2)
K (kilo)	10^3	2^{10}
M (mega)	10^6	2^{20}
G (giga)	10^9	2^{30}
T (tera)	10^{12}	2^{40}
P (peta)	10^{15}	2^{50}