Unit 1 Introduction to Computer

1.1 The Meaning and Characteristics of Computer

1.1.1 Definition of Computer

There is no doubt that man is highly gifted and is of high capabilities and potentials. In fact, man is truly an amazing being and a master of inventions. He constantly uses the power of his imaginations and inventions to solve problem in his environment. A lot technologies have been developed, such as television, vehicle, camera, radio etc. are all human inventions. Computer is not an exemption, it is one of the inventions of this amazing being. Therefore, what is a computer? A computer is an electronic machine used in solving problem. This definition of computer that you just read is just a simple definition, it does not say enough about computer. This is because not all electronic machines are computer. You should also note that computer is not just physical equipment that you can only see or touch, it is also made up of parts you cannot easily see like the program. Now in a more encompassing manner, let us define computer. Computer therefore, is an electronic device (calculating machine) that is capable of accepting data (Input), process the data logically or arithmetically using some sets of instructions (Processing) and release result (Output).

In another way a computer can be defined as an electronic machine that solves problem by applying prescribed instructions with little or no intervention on data presented to it. To the present day generation, computer has different meaning to different group of people. The use to which it is put determines the understanding attached to it. It is common for different group to see it differently because of differences in usage. As you study along, bear it in mind that computer is not composed just a machine, but it is a collection of

interrelated parts which are able to transmit information to one another, see diagram below on functional parts of computer system showing system units and other peripherals.

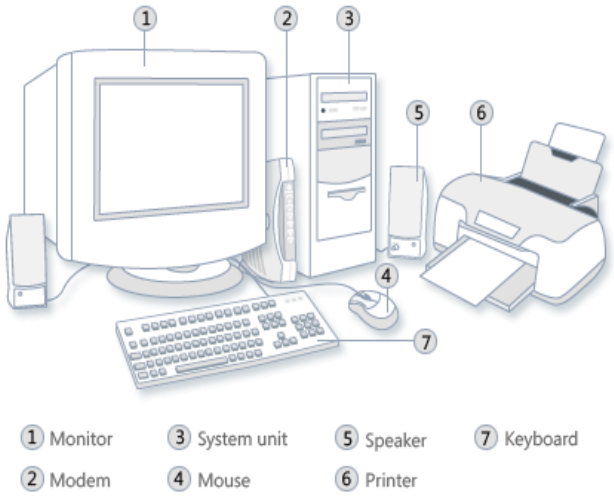


Fig 1.1: Functional Parts of Computer System.

1.2 Historical Background of Computer

1.2.1 ABACUS

Historically, computing may be considered to have begun with ABACUS, which originated about 5,000 years ago. During the Middle age, the abacus was used throughout the European and Arab Worlds as well as in Asia. The design is simply a wooden rack holding parallel wires on which beads are strung. Calculations can be performed manually by sliding (beads or blocks) along the parallel wires (rods). The counters are divided into two sections by means of a bar perpendicular

to the rods. One section has two counters, representing 0 and 5 depending upon their position along the rod. The second section has four or five counters, representing units. Each bar represents a significant digit, with the least significant digit on the right. Another computing instrument, the ASTROLABE, was also in use about 2,000 years ago for navigation.

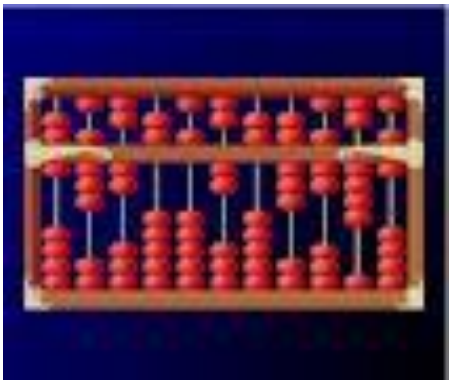


Fig 1.2: Abacus

1.2.2 BLAISE PASCAL

Going by the popular saying that “necessity is the mother of invention, a young man by name Blaise Pascal invented the first calculating machine at the age of 19 years during the 17th century, 1642 to be precise. His invention was in response to his desire to assist his father in his cumbersome business accounting works that involved a lot of calculations. Pascal’s machine was able to carry out only addition and subtraction of numbers. It utilized a mechanical gear system to add and subtract, with as many as eight columns of digits.

Between 1663 and 1666 Sir Morland in England unaware of Pascal’s machine invented three machines out of which only one was used for British currency addition, pounds and shillings, the two other machines were devices which provided access to pre–calculated tables.

1.2.3 GOTFRIED WILHELM LEIBNITZ

In 1694 the German mathematician Leibnitz developed a more advanced mechanical calculator. His calculator called Stepped Reckoner could also multiply, divide and extract square roots. This calculator's first working model was completed 100 years later in 1794 and exhibited at Royal Society in London.

1.2.4 CHARLES BABBAGE

After Leibniz's machine proved unreliable, by the 1830's Charles Babbage an English inventor developed the first automatic digital computer called Analytical Engine. The new device was able to combine arithmetic process of addition, subtraction, multiplication and division with decisions based on its own computations. Most of the basic elements of the modern digital computer was found in Babbage's engine which includes punched–card, input/output medium, arithmetic unit, memory for storage of numbers and sequential control. Charles Babbage invention marked the beginning of modern computer architectural design. Considering this great achievement, he was referred to as the father of modern computers. Although he was not able to implement his design because of level of technology as at that time.

1.2.5 GEORGE BOOLE

The essays written during the mid-19th century by Boole was of greater significance. He called attention to the analogy between the symbols of algebra and those of logic as used to represent logical forms. Boole's system with its binary logical operators (e.g. AND, OR and NOT) became the basis of what is now known as Boolean algebra on which electronic computer switching theory and procedures are based.

1.2.6 HERMAN HOLLERITH

Introduction of punched cards in 1880 by Herman Hollerith a U. S. Statistician who worked on census return was another major step in computer development. He recognised the possibility that a pattern of holes in perforated sort and manipulate electrically by a machine specially designed to sort and manipulated the numerical data represented by the holes. By the U. S. Census of 1890, Hollerith had invented a tabulating system that automated census count. As stated earlier Hollerith's system had accomplished in one year and seven months what it would have taken a hundred clerks seven years and eleven months to do. Hollerith left the census bureau in 1896 to form the tabulating Machine Company which was eventually changed to the International Business Machine Corporation (IBM), which today stands out as one of the largest computer manufacturer in the world.

Fig 1.3: punch card

1.2.7 AUTOMATIC CALCULATOR

In 1939 John V. Atanasoff, a U. S. Mathematician and Physicist built what some consider to be a prototype of an electromechanical digital computer. That same year Howard Aiken of Harvard University, in association with engineers of International Business Machine Corporation began work on a fully automatic large-scale calculator using standard business machine components. By 1944 the first calculator called Automatic Sequence Controlled Calculator, commonly known as Mark-1 was made. Later Mark-2 and Mark-3 were built on similar line.

Fig 1.4: Automatic calculator

Another machine called ENIAC (Electronic Numerical Integrator and calculator) which consists of switches and interconnecting wires was built around 1939, this was mainly for calculating trajectories and could also be used in other computations. The use of paper tape for data entry into these machines was slow and did not allow the machine to operate at full speed. Similarly there

was a need to make programs available internally along with the data, to take advantage of the high speed inherent in electronic systems. Large memory was designed in Cambridge by M. V. Wilkes. His machine called EDSAC (Electronic Delay Storage Automatic Calculator) was used for the training of a whole generation of computers oriented mathematicians at Cambridge. Between 1945 and 1950, EDVAC (Electronic Discrete Variable Computer) was designed. This machine emphasized the idea of stored program. By 1948 a prototype machines at Manchester was completed. Later, companies like IBM, Remington Co-operation, ICL and many other joined in producing computer in commercial quantities.

Fig 1.6: ENIAC

Significance of Computer

Scientific and military applications were the first areas to which the computer was put to use to aid problem solving calculations, especially during war. Presently it is also widely used for planning and as an aid to business. Because of its wide area of applications, it can be said to be a general purpose machine. It performs its data-processing operations accurately at high speed with little or no human interventions by loading it with different packages or programmes. It is also

called an automatic device and has the ability to perform calculations, sort Files, and Edit information.

It must be noted that its compatibility to solve any given problem is limited by the instruction supplied. A problem that has no solution from human point of view also has no solution in the computer realm. Hence it can be said to an extension of human mind, though in speed and accuracy, it performs better. This view is not true because it has no mind of its own, it cannot start itself, and its ability to solve problem is limited by logic or steps supplied by the programmer. There is also a high degree of reliability in its processing operations and performance of repetitive operations.

It stores vast quantities of information and also retrieves any given volume within a very short time gap. One major advantage is the ability to take some decisions by altering the flow instructions.

Due to speed and accuracy of processing, computer machine are fast more becoming more popular and there is increase in their demand n the world over. It is currently having a proud influence on science, business, government, industry, and education.Science and mathematical research have been vastly accelerated by the use of the computer. In business and government, management practices have been revolutionized by computer and also because of its ability to process data and present it in a more meaningful form. The development in the computer industry is so fast that latest developments today may be out dated within 2 years. This continuous revolution and development in the computer industry makes it challenging area to be exploded.

Today’s computers come in a variety of shapes, sizes and costs. Larger general-purpose computers are used by many large corporations, universities, hospitals and government agencies to carry out

sophisticated scientific and business calculations. These computers are generally referred to as mainframes. They are very expensive (some cost millions of dollars), and they require a carefully controlled environment (temperature, humidity, etc.). As a rule, they are not physically accessible to the scientists, engineers and corporate accountants that use them. Mainframes have been available since the early 1950s, but very few people had any opportunity to use them, particularly in the earlier years. Thus it is not surprising that computers were viewed mysteriously and with some suspicion by the general public.

The late 1960 and early 1970s saw the development of smaller, less expensive minicomputers. Many of these machines offer the performance of earlier mainframes at a fraction of the cost. Many business and educational institution that could not afford mainframe acquired minicomputers as they became increasingly available. By the md-1970s, advances in integrated circuit technology (silicon “chips”) resulted in the development of still smaller and less expensive computers called microcomputers. These machines are built entirely of integrated circuits and are therefore not much larger (or more expensive) than a conventional office typewriter. Yet they can be use for a wide variety of personal, educational, commercial and technical applications. Their use tends to complement rather than replace the use of mainframes. In fact, many large organizations utilize microcomputers as terminal or workstations that are connected to a mainframe computer (or series of mainframes) through a communication network. Particular interest is the development of the personal computer a small, inexpensive microcomputer that is intended to be used by only one person at a time. Many of these machines approach small minicomputer in power. Moreover, their performance continues to improve dramatically as their cost continues to drop. Personal computers are now used in many schools and small business, and it appears likely that they will soon become a common household item

UNIT 2: GENERATIONS OF COMPUTER

2.1 Generations of Computer

2.1.1 Overview

The history of computer development is often referred to as the different generations of computing devices. Each generation of computers is characterized by a major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, powerful, more efficient and reliable devices. Since the development of Mark-1, the digital computer has evolved at an extremely rapid pace. The succession of advances in computer hardware, most notably in logic circuitry and storage system is generally discussed in terms of the concept of generation. Each stage of development is associated with one sort of technological innovation or another. Each generation is usually better than the previous by making possible, certain which were not possible with the earlier generation. Generally, the five generations of computers are characterized by electrical current flowing through the processing mechanisms, such as the first generation within vacuum tubes, second-generation within transistors, third-generation within integrated circuits, fourth-generation within microprocessor chips and fifth-generation unveiled smart devices capable of artificial intelligence. The summary of the development of five generations of computers from its early days to the present situations are simply analyzed in Table 2.1.

Table 2.1: Analysis of the five generations of computers

Generation	Architecture	Speed	Memory Capacity	Heat generated	Power consumption	Physical Size	Cost
First	vacuum tubes	Very Low	Very small	Large	High	Very big	High

Second	Transistors	Low	Small	Large	Low	Small	High
Third	integrated circuits	Higher	Large	Low	Low	Very small	Low
Fourth	microprocessor chips	Higher	Very Large	Low	Low	Very small	Relatively Low
Fifth	artificial intelligence	Higher	Very Large	Low	Low	Very small	Relatively Low

2.1.2 FIRST GENERATION: VACUUM TUBES (1940-1956)

The first generation of modern-day computers with ENIAC (Electronic Numerical Integrator and Calculator) was ushered in by J. P. Eckert and John W. Mauchly in 1946. It was the first all-purpose, all-electronic digital computer. Figures 2.1 and 2.2 identify vacuum tubes for circuitry and magnetic drums for memory of mercury relay lines respectively used in the first computers instead of relays as its active logic element. There was a substantial increase in computational speed due to the use of electron tubes. This computer was more than 1000 times faster than its electromechanical predecessors and could execute an average of 5,000 basic arithmetic operations per second.

Figure 2.1: Vacuum Tubes[5]

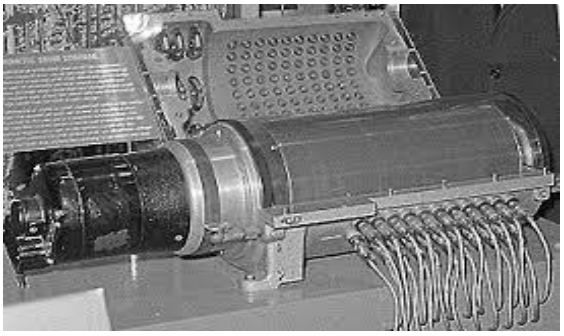


Figure 2.2: Magnetic Tapes[5]

In 1974 the Hungarian mathematician John Von Neumann devised a method of converting the ENIAC concept of an externally programmed machine to that of a stored program concept. This stored-program concept led to the development of the self – modifying computer. Other notable first generation of computers called the UNIVAC-1 (Universal Automatic Computer) built in the year 1951 was the first commercial computer delivered to a business client, the U.S. Census Bureau. The first electronic digital computers relied on machine language, the lowest-level programming language understood by computers, to perform operations, and they could only solve one problem at a time. Input was based on punched cards and paper tape, and output was displayed on printouts. UNIVAC-I was the first computer to handle both numerical and alphabetical information with equal ease and assailed the principle of the separation of input/output from computation per se.

The main problem encountered during the era of first-generation computers was that they occupied a large amount of space and large circuits as shown in figure 2.3. Generally, they were slow in operation and generated a lot of heat with the problem of unreliability which was often the cause of malfunctions compared to other generations. They were very expensive to operate and the period of this generation spanned mid-forties to mid-fifties.

Figure 2.3: First-generation Computer[4]

Examples of the first generation of computers

i. ENIAC (1946)
ii. EDSAC (1949)
iii. EDVAC (1950)
iv. UNIVAC I (1951)

Characteristics of the first generation of computers

i. Used vacuum tubes for circuitry
ii. Electron emitting metal in vacuum tubes burned out easily
iii. Used magnetic drums for memory
iv. Were huge, slow, expensive, and many times undependable
v. Generated a lot of heat
vi. Solved one problem at a time
vii. Used input based on punched cards
viii. Outputs are being displayed in print outs
ix. Used magnetic tapes
x. Used machine language
xi. Had limited primary memory

Advantages of the first generation of computers

i. Computers could calculate in milliseconds.

Disadvantages of the first generation of computers

i. Very big, weight was about 30 tones.
ii. Store only a small amount of information
iii. It requires a large cooling system
iv. Very less work efficiency
v. Limited programming capabilities
vi. Large amount of energy consumption.
vii. Not reliable and constant maintenance is required

2.1.3 **SECOND GENERATION: TRANSISTORS (1956-1963)**

Figure 2.4 introduced the second generation of computers that was invented in 1947 with a semi-conductor device known as TRANSISTORS in electronic engineering to replaced vacuum tubes but still relied on punched cards for input and printouts.

Figure 2.4: Second generation of computer[4]

The transistor was unable to see the widespread use until the late 1950s after a series of development in transistors became a viable alternative to the vacuum tube. The transistors helped

in building a series of processors operating at microsecond speed ranges with a lower level of generated heat shown in figure 2.5. By using transistors in control, arithmetic and logic circuits along with improved magnetic core memory manufacturers were able to produce more efficient, smaller, faster and cheaper computers than its predecessors. Figure 2.5 showcase the typical example of a more efficient and smaller size of the second generation of computers.

Figure 2.5: Improved Second generation of computer[4]

This generation of computers with memory to store advanced from cryptic binary machine language to symbolic which allows programmers to specify instructions in words using high-level programming languages like COBOL and FORTRAN developed at this time as early versions. The memory was also upgraded from a magnetic drum to magnetic core technology. The first products of advanced second generation of computers were developed for the atomic energy industry. There was a vast improvement in transistor over the vacuum tube, though the transistors were still subjected the computer to damage due to a great deal of heat attributed to it. The small size of the transistor as presented in figure 2.6, its greater reliability and its comparatively low power consumption of computers in the second generation made it far superior to the vacuum tube computers in the first generation. This generation was between the late fifties and early sixties.

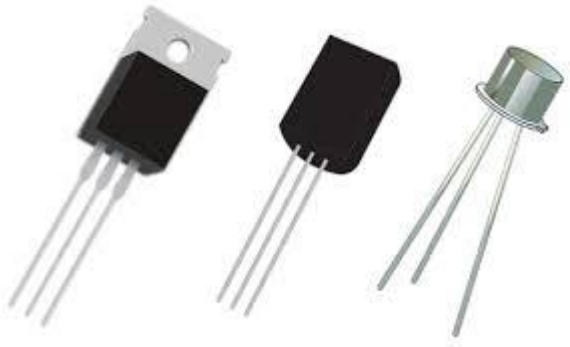


Figure 2.6: Transistors[5]

Examples of the second generation of computers

i. IBM-7000
ii. CDC 3000 series
iii. UNIVAC 1107
iv. IBM-7094
v. MARK III
vi. Honeywell 400

Characteristics of the second generation of computers

i. Used transistors
ii. Faster and more reliable
iii. Slightly smaller and cheaper
iv. Generated heat
v. Used punch cards and printouts for input/output
vi. Allowed assembly and high-level languages
vii. Stored data in magnetic media

viii. Costly and need air conditioning

ix. Introduced assembly language and operating system software

Advantages of the second generation of computers

i. It reduced the size of a computer

ii. Less energy and not produce much heat

iii. Assembly language and punch cards were used for input.

iv. Low cost

v. Calculate data in microseconds

vi. Portability

Disadvantages of the second generation of computers

i. A cooling system was required

ii. Constant maintenance was required.

iii. Only used for specific purposes

2.1.4 **THIRD GENERATION: INTEGRATED CIRCUITS (1964-1971)**

During the late 1960s and 1970s, transistors were miniaturized and placed on silicon chips, called semiconductors to develop the integrated circuit of a solid-state device. A solid-state device (integrated circuit) consists of hundreds of transistors, diodes and resistors on a tiny silicon chip which happened to be the existence of the third generation of computers. Thereafter, an improved

Integrated Circuit was able to develop a Large Scale Integration (LSI) which made it possible to pack thousands of transistors and related devices on a single integrated circuit as figured out in figure 2.7. This also led to the invention of the microprocessor that contains all the arithmetic, logic and control circuitry called the Central Processing Unit (CPU). The CPU is the part of the digital computer that interprets and executed instruction. The development of the CPU into a single integrated circuit led to the production of microcomputers.

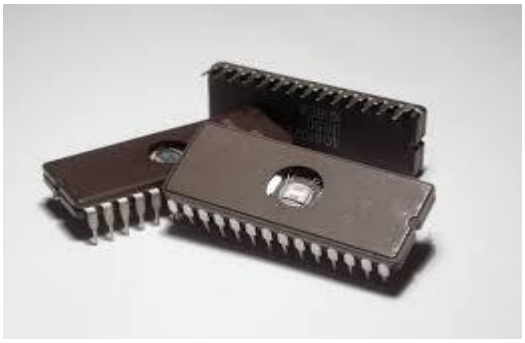


Figure 2.7: Integrated Circuits. [5]

The typical structure of the third generation showcased in figure 2.8 which was the generation that produced an important technological innovation to increase the speed and efficiency of computers instead of punched cards and printouts. Users interacted directly with computers through the use of keyboards and monitors that interfaced with an operating system and allowed the device to run many different applications at one time with a central program that monitored the memory.

Figure 2.8: Third generation computer[7]

The construction of mainframe (large-scale) computers of higher operating speed and capacity reliability at substantially lower cost was achieved based on the impact of integrated circuitry innovation which further helped the engineers to design mini computers. The third generation of computers richly helped the society by making computers to be accessible due to its smaller size and cheaper than its predecessors.

Examples of third-generation computers

i. IBM-360
ii. Personal Data Processor (PDP)
iii. IBM-370

Characteristics of the third generation of computers

i. Used integrated circuits (ICs)
ii. Used parallel processing
iii. Slightly smaller, cheaper and faster
iv. Used motherboards
v. Data was input using keyboards
vi. Output was visualized on the monitors
vii. Used operating systems
viii. Allowed multitasking
ix. Encouraged simplified programming languages

Advantages of the third generation of computers

i. ICs improves the performance of the computer
ii. It has a big storage capacity
iii. Mouse and keyboard are used for input
iv. They used an operating system
v. It encourages the concept of time-sharing and multiple programming
vi. It reduces the computational time from microseconds to nanoseconds

Disadvantages of the third generation of computers

i. IC chips are difficult to maintain
ii. The highly sophisticated technology required for the manufacturing of IC chips.
iii. Air conditioning is required

2.1.5 **FOURTH GENERATION: MICROPROCESSOR CHIPS (1971-PRESENT)**

The development of microprocessor led to the fourth generation of computers. Thousands of integrated circuits were built and packed in a single silicon chip. The first microprocessor named as Intel 4004 chip was developed in 1971, contained all the components of the computer ranged from the central processing unit, memory to input/output controls as indicated in figure 2.9. A microprocessor is a central processing unit fabricated on a chip.

Figure 2.9: Microprocessor chip[5]

The set of computer produced in the 1980's were referred to as the fourth generation computers. In 1981, IBM introduced its first computer for the home user while Apple introduced the Macintosh in the year 1984. Microprocessors were upgraded from the use of desktop computers into many areas of life as more and more everyday products began to use microprocessors as described as an example of the migration in figure 2.10. The main feature attributed to this generation is the availability of the VERY LARGE-SCALE INTEGRATED (VLSI) which has vastly increased the circuit density of the microprocessor, memory and support chips. Note that the large-scale integrated circuits contain thousands of computers on a silicon chip less than 0.2 inch (five mm) square, the very large-scale integrated circuit holds hundreds of thousands of electronic components within the same amount of space.

Figure 2.10: fourth-generation computer[4]

During this era, there is no much difference between fourth generation and the third generation of computers; but this generation witnessed the flooding of the market with a wide variety of software tools, application packages like database management systems, word processing packages, spreadsheet packages, game packages, etc and the enhancement on networking capabilities in the areas of LAN (Local Area Network). As this generation of computers became more powerful, the use of the Internet and the GUIs also became friendly and useful. The fourth generation of mainframes and supercomputers evolved to be powerful systems. This generation is an open-source and free software, examples are Ubuntu OS, Mozilla Firefox browser, Open Office, MySQL and VLC media player.

Examples of the fourth generation of computers

i. Desktops
ii. All-in-one
iii. Laptops
iv. Workstations
v. Nettops
vi. Tablets
vii. Smartphones

Characteristics of 4th Gen Computers

i. Used central processing units (CPUs)
ii. Much smaller and fitted
iii. Used a mouse

iv. Used in networks

v. Were cheap and very fast

vi. Had GUI

Advantages of the fourth generation of computers

i. Fastest in computation and reduced in size

ii. Heat generated is negligible

iii. Less maintenance is required

iv. All types of high-level language can be used in this type of computers

Disadvantages of the fourth generation of computers

i. The design of microprocessors are very complex

ii. Air conditioning is required in many cases due to the presence of ICs.

iii. Advanced technology is required to make the ICs.

2.1.6 FIFTH GENERATION: ARTIFICIAL INTELLIGENCE (PRESENT AND BEYOND)

The fifth generation of computing devices is based on artificial intelligence that is still in development. Though there are some applications like voice recognition, which are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality. Quantum computation and molecular, and nanotechnology will radically change the face of computers in the years to come. The goal of the fifth-generation of computers is to develop devices that respond to natural language input and are capable of learning, self-organization,

reasoning, recognize relationships and improving the performance based on the experience. Manufacturers are also expected to produced voice-input devices that capable of handling connected speech of larger vocabularies as described in figure 2.11.

Figure 2.11: Fifth generation of computer[4]

Note that, the fifth generation of computers is yet to be in the market because of the features expected. There is hope that simultaneous execution of several separate operations (e.g. memory, logic and control) employing numerous integrated circuits in which millions of CPU, memory, and input/output circuits are combined on a single chip.

Examples of the fifth generation of computers

i. Virtual personal assistants
ii. Smart cars
iii. Computer-Aided Diagnosis
iv. News generation tools
v. Laptop
vi. NoteBook
vii. UltraBook
viii. Chromebook

Advantages of the fifth generation of computers

i. It is more reliable and works faster

ii. It is available in different sizes and unique features

iii. It provides computers with more user-friendly interfaces with multimedia features

Disadvantages of the fifth generation of computers

i. They need very low-level languages

ii. They may make the human brains dull and doomed

iii. It is busy doing yoyo things

UNIT 3 COMPUTER SYSTEM

3.1 COMPUTER AS A SYSTEM.

Before we discuss computer in detail, there is need for us to learn what a system is. We often speak of water system, digestive system in biology, computer system and other types of system. What then is a system? A system is a collection interrelated components interacting together to achieve a goal. Most systems have input, process and output stages as illustrated with the diagram below.

fig3.1: Input-Process-Output system

Input: this is the element that enter the system for processing

Processing: This organises or arranges input into an output

Output: This is the result obtained from processing activities

To facilitate understanding of input-process-output processing in a system we shall use digestive system, and human body as an illustration

3.1.1 Digestion of food as a System

Digestion of food is the taking in of food through the mouth, breaking down the foods into soluble forms and wastes by body enzymes and releasing the wastes in form of urine and excreta. The I-P-O phase in the system involves the following:

Input: foods

Process: breaking down the foods

Output: waste inform of urine and excreter

3.1.2 Human body as a system

You can take a look at the figure 3.4 below. It shows different parts of human body. The parts can be likened to I-P-O system. That is, it has input, processing and output components

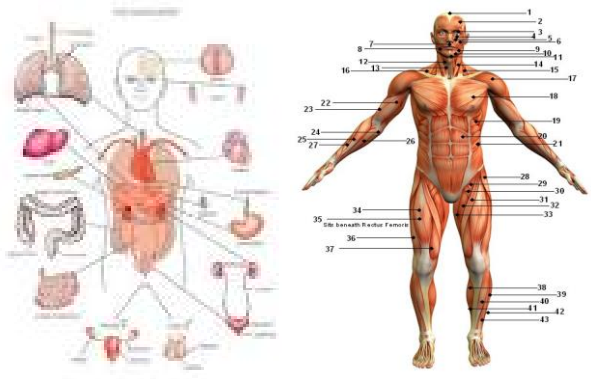


Fig3.2: Human body system

Input:

- Eyes: for sensing object
- -Ears: for hearing sound
- Mouth : for drinking and eating
- Nose : for breathing in oxygen

Processing

- Brain : for thinking, memorising and controlling the activities of the body

Output

- Hands: for writing information
- Mouth for speech
- Nose for breathing out carbondioxide

3.1.3 Computer as a system

The definition of computer you read in unit 1 of this module shows that computer is an I-P-O system. From the definition, computer accepts data (input), processes the data and gives out results(output). The I-P-O is represented in figure 3.6 below

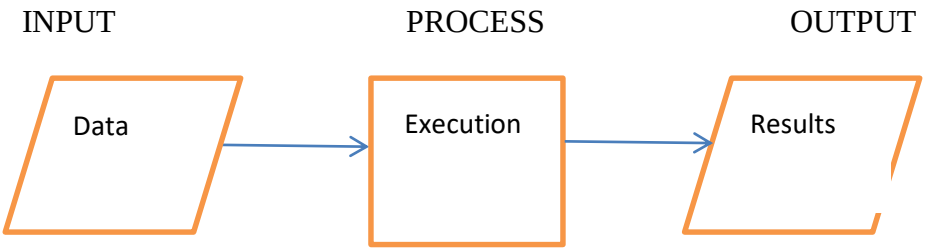


Figure 3.3: Input-Process-Output-Phase in Computer

Consider this scenario: suppose numbers 10 and 15 are supplied to a computer with an instruction to add the two numbers. Can you show the I-P-O phase of how computer will carry out this scenario. The computer will add the two numbers according to the given instruction and generate the required result which is 25. The I-P-O phase of the addition operation of the two numbers is represented in figure 3.7 below

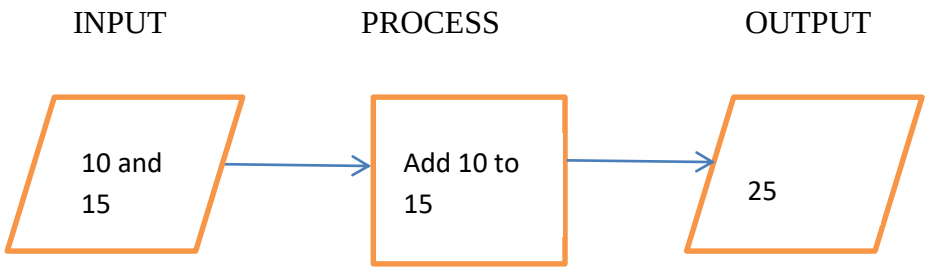


Figure 3.4: I-P-O PHASE

3.2 COMPUTER SYSTEM

In our earlier study in unit 1 we gave simple definition of computer. You have also further studied that a computer is a system. What then is a computer system? A computer system is not a single machine. It consists of a group of electronic components like monitor, system unit, keyboard, mouse, printer and other components working together to achieve a particular goal. You can see figure 1.1 for different components of a computer systems

3.2.1 Characteristics of a Computer System

Computer has some characteristics or features which distinguish them from other machine. These characteristics constitute the advantages of computer. Below are some of these characteristics

Speed: Computers process information at a very fast rate, the speed of processing is measured in nanoseconds (billionth of seconds), some also operate faster in picoseconds (trillionths of seconds). Some processing speeds are of the order of gigaflops.

Access : Computers are used mainly for information processing, but more important access to the speed stored processed information in more important. They offer the advantage of fast and easy access to store information. The speed of retrieval however depends on the capacity of the system (computer) and the peripheral device used.

Extra ordinary task: Computers have the ability to perform tasks that would otherwise not be feasible or cost effective using conventional means. A good example of this is the ability to solve tedious and long equations in space program.

Security: Computers are provided with in-built security codes that make it impossible for outsiders to manipulate the data or record in the computer files. This security helps to check unauthorized access by other insider except the user.

Storage Space: Every piece of information that is stored within the computer's memory s encoded as some unique combination of zeros and ones. These zeros and ones are called bits (binary digits). Each bit is represented by an electronic device that is, in some sense, either "off" (zero) or "on" (one). Most small computers have memories that are organized into 8-bit multiples called bytes. Normally 1 byte represents a character (i.e., a letter, a single digit or a punctuation symbol)

An instruction may occupy 1, 2, or 3 bytes, and a single numerical quantity may occupy anywhere from 2 to 8 bytes, depending on the precision and type of number. The size of a computer's

memory is usually expresses as some multiple of 2^10 = 1024 bytes. This is referred to as 1k. Small computers have memories whose sizes typically range from 64k to 1024k (1 mega) bytes.

Take a look at this explanation

If the memory of a small computer is say 64k bytes, then, as many as 64 * 1024 =65,536 characters and/or instructions can be stored in the computer memory. If the entire memory is used to represent character data, then about 800 names and address can be stored within the computer at any one time (assuming 80 characters for each name address). If the memory is used to represent numerical data rather than names and address, then about 16,00 individual quantities can be stored at any one time (assuming 4 bytes per number). Large computers have memories that are organized into words rather than bytes. Each word will consist of a relatively large number of bits, typically 32 or 36. This allows one numerical quantity, or a small group of characters (typically four or five) to be represented within a single word of memory. Large computer memories are usually expressed as some multiple of 1k (i.e.2^10 = 1024) words.

A large computer may have several millions words of memory. Some memories have ability to store 16,000 or 64,000 bits (pieces of information) and there are others that can store information in the region of gigabytes (1 gigabyte 1024 * 1024 = 1048576).

Now can you calculate the capacity of this computer in term of data storage?

- If the memory of a large general purpose computer is 2048kb, can you determine the storage capacity of the computer?
- Then this is equivalent to 2048 * 1024 = 2,097,152 words. If the entire memory is used to represent numerical data, then roughly 2 million numbers can be stored within the computer at any one time. If the memory is used to represent character rather than

numerical data, then about 8 million characters can be stored at any one time. This is more than enough memory to store the content of an entire book.

Most computers also employ auxiliary memory device (e.g. magnetic tapes, disks, solid-state memory devices) in addition to their primary memories. These devices typically range from a few hundred thousand bytes (for a small computer) to several million words (for a larger computer). Moreover, they allow for the permanent recording of information, since they can be physically mounted or dismounted from the computer and stored when not in use. However the access time (i.e. the time required to store or retrieve information) is considerably greater for these auxiliary devices than for primary memory.

SPEED AND RELIABILITY: Because of its extremely high speed, a computer can carry out calculations in just a few minutes that would require month's perhaps even years – if carried out by hand. Simple tasks, such as adding two numbers, can be carried out in fractions of a microsecond (1 us = 10-6s). On a more practical level; the end-of-semester grades for all students n a large University can typically be processed in just a few minutes of computer time. For example it was estimated that Hollerith's system had accomplished in one year and seven months what it would have taken hundred clerks seven years and eleven months to do.

This very speed is accompanied by an equally high level reliability. Thus a computer practically never makes a mistake of its own accord. Highly publicized "computer" errors such as a person receiving a monthly bill of a programming error or an error in data transmission rather than an error caused by the computer itself. In computer systems, output could be described as 100% reliable if the input is correct. Hence the saying garbage-in, garbage-out (what you send n, is what you must expect).

Activity 3.1

Take a moment to reflect on what you have read so far. Based on your learning experience, and knowing that computer has a lot characteristics which make them to be very useful for daily activities. Can you mention some of the advantages, individual, organisations and even government can derive from using computer?

Activity 3.1 Feedback:

The advantages of computer ranges from speed, accuracy, storage capacity, integrity and security. Read more from unit 3.2.1

3.3. TYPES AND CLASSIFICATIONS OF COMPUTER

3.3.1 Types Of Computers

There are two basic types of computers namely

(1) Analogue Computers and

(2) Digital Computers.

(3) Hybrid Computers

The analogue computers operate on data represented by variable physical quantities, such as voltages and are measured continuously.

Digital computer on the other hand works with numbers, words and symbols expressed as digits, which it manipulates and counts discretely.

ANALOGUE COMPUTERS

An analogue device is defined as one that operates on the principle of similarity in proportional relations to a process modelled when values are kept constant over a specified range. A computer of this type solves problems by operating on continuous variables rather than on discontinuous or discrete units as do digital computers. Analogue computers are similar to a voltmeter in the way they measure values. They translate various physical conditions such as flow, temperature, pressure, mechanical motion, and angular position into mechanical or electrical analogue values. These types of computer use various types of amplifiers to perform arithmetic operations as summation and multiplication.

Fig 3.5: Analogue computer

DIGITAL COMPUTERS

A digital computer processes all kinds of data in discrete form i.e numbers expressed directly as the two digits 0 and 1 of the binary code. Using various techniques, these two binary digits called "BIT' can be made to represent numbers, letters, and symbols. Binary 0110 for example, represent the decimal number 6. By operating in binary codes, a computer is able to indicate two possible states or conditions. The state is said to be either ON or OFF, ON stands for 1 and OFF stands for 0. Groups of binary digits are called BYTES or WORDS.

In computer programming these sets of bytes is what is used to develop both complex and simple sets of instructions called SUBROUNTINE, ROUTINES and PROGRAMS.These sets of instruction called programs assist a computer to generate solution for scientific, business and machine control problems.

A digital computer also has the ability to compare, it also has capacity to make decisions, by using or employing prescribed criteria.

Examples of typical decision-making instruction to a computer two of such reads thus:

If A multiplied by B is less than X perform program P or if the result of A multiply by B is less than X perform process Y and add 1 to counter. All the computer will do is to assess the value of the manipulation and make conclusion without human interference but still following strictly the program or instruction earlier given.

Fig3.6: Digital computer

HYBRID COMPUTERS

In some cases, the user may wish to obtain the output from an analog computer as processed by a digital computer or vice versa. To achieve this, he set up a hybrid machine where the two are connected and the analog computer may be regarded as a peripheral of the digital computer. In such a situation, a hybrid system attempts to gain the advantage of both the digital and the analog elements in the same machine. This kind of machine is usually a special-purpose device which is built for a specific task. It needs a conversion element which accepts analog inputs, and output

digital value. Such converters are called digitizers. There is need for a converter from analog to digital also. It has the advantage of giving real-time response on a continuous basis. Complex calculations can be dealt with by the digital elements, thereby requiring a large memory, and giving accurate results after programming. They are mainly used in aerospace and process control applications.

3.3.2 CLASSIFICATION

Classification of digital computers depends on the same factors like size, complexity, cost, computation, retrieval speed, and transmission capability. It must be noted that they all follow certain fundamental concepts and operational principles.

The principal factor for classifying computers is the processing power.

Using these factors, computer can be classified into three broad categories namely:

(1) Mainframe Computers

(2) Mini Computers

(3) Micro Computers

It must be noted that recent development has made the classification difficult. Recently, some mini computers and microcomputers produced are more powerful than traditional mainframes.

MAINFRAME COMPUTERS

The first and second generation computers commonly referred to as the earliest computers were all mainframes:

Mainframe computers have the following characteristics;

(i) They are mostly large occupying large floor space.

(ii) Their functional units being physically separated.

(iii) They are general purpose processors capable of handling multiple simultaneous functions such as batch processing interactive and transaction processing under the control of an operating system.

(iv) They support a wide range of peripheral equipment', such as printers, including high speed devices and communication lines.

(v) They are normally housed in air-conditioned rooms surrounded by security measures, run by team of professional operators.

(vi) They have large memories of say 4 Megabytes with several disk units, each holding 3-6 hundred megabytes of information.

Mainframe computers are normally used by large organizations such as University and Research establishments where they supply general-purpose computing facilities.

Banks where large amount of information has to be collected, sorted and distributed also make use of Mainframe Computers.

Fig 3.7: Mainframe computer

MINI COMPUTERS

The third generation of computers ushered in Mini computers.

A minicomputer is structurally a small version of a mainframe computer.

It is used for low volume applications which require relatively sophisticated computational capability.

The earliest developed mini computers were used for aerospace applications and they appeared in the market between 1961 – 1962.

Generally when an organization decides to decentralize its operation or distribute its computer power to various stations or locations within user departments, mini computers were the first choice before the arrival of microcomputers.

General characteristics of mini computers:

(i) Easier to install

(ii) Have smaller memory size and word lengths

(iii) Are best suited for dedicated purposes

(iv) Need no complex management structures

(v) Typical word length of 12 -18bits

(vi) The main memory ranges from 256K to 512K. It has ability to expand to several megabytes (MBs).

Fig. 3.8: Mini computer

MICRO COMPUTERS

Technological advancement that led to the production of LSI made it possible to develop micro computers. Micro computer is a small computer consisting of processors on a single silicon chip mounted on a circuit board together with memory chips, ROMs and RAM chips etc.

Major characteristics are as follows:

(i) A keyboard for the entry of data and instructions

(ii) A screen for display purpose

(iii) Interface for connecting peripherals such as plotters, disc drive, light pen, a mouse e.t.c.

(iv) It has five basic components which include Random Access Memory (RAM), Read Only Memory (ROM), Input and Output devices, Interface components.

(v) They have word length of 4, 8, 16 bits (some are 32 bits, and they are referred to as super micro computers)

(vi) They can operate under normal office conditions

(vii) Their main memory range's from 4K to 256K

(viii) They have facility for add-on memory of up to 1MB

(ix) They are commonly found in homes, schools business, offices etc.

Fig 3.9: Micro computer

HYBRID COMPUTER

A hybrid computer system consists of a combination of analogue and digital computers.

The earliest hybrid computers were introduced in late 1950's. The principle here was the 'employment of digital machines as a support device for the analogue unit. Most recent hybrid computers, by contrast are digitally based

The basic components are; -

(i) A digital processor

(ii) A memory for the internal storage of a master digital program and data.

(iii) Primary Input/Output hardware which are video display terminals.

(iv) An electronic keyboards

(v) Interactive graphic devices

(vi) Several analogue units used to provide continuous parallel computational capability

(vii) Provision of converters called Digital to Analogue Converters (ADC) for proper interfacing (This translates data from the analogue processors into digits of the binary codes) and

(viii) Provision of devices that convert digitally processed information into analogue representation called Digital to Analogue converters (DAC)

Fig 3.10: Hybrid computer

One major advantage of hybrid system is the offer of greater precision than do analogue computers and more control capability than provided by digital machines.

3.4 **USES OF COMPUTER SYSTEM**

Computer system can be used to do the following

1. Type and print documents

2. Used to send information

3. use to play music

4. can be used to do calculation

5. used to store and process data

6. used to television and listen to radio programme over the internet

3.5 AREAS OF APPLICATION OF COMPUTER

Computer is applied in almost every aspect of human life and operation. In other word computer has made their presence felt in almost every speck of life today. Some of the areas where computer has become very common are:

3.5.1 Commercial application

- Banking sector
- Super markets
- Electricity bill generation
- Transportation
- Alarm system
- Paperless money through credit cards.

3.5.1 Educational Institutions:

- Online examination
- Open distance learning format
- Processing examination result
- Computer aided learning

3.5.2 Broadcasting Services

- Use of computer in receiving urgent news
- Runtime reporting as done during parliament elections or sports events

3.5.3 other Applications include

- space technology
- field of medicine
- applied science and technology
- in industrial research

UNIT 4 HARDWARE COMPONENTS OF COMPUTER

4.1. COMPUTER HARDWARE

Computer hardware is divided into two main categories: the system unit and peripherals. The system unit contains the electronic components used to process and temporarily store data and instructions. These components include the central processing unit, primary memory, and the system board. Peripheral devices are hardware used for input, auxiliary storage, display, and communication. These are attached to the system unit through a hardware interface that carries digital data to and from main memory and processors.

Fig. 4.1: Hardware Components

Central Processing Unit (CPU)

The CPU is commonly referred to as the heart of the system without it no system can function. It is the minimum hardware a subsystem can use. The CPU has three essential sets of transistors that work together in processing digital data: a control unit, an arithmetic logic unit, and registers.

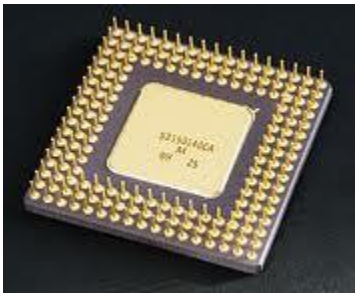


Fig 4.2: Central Processing Unit

Control Unit

The control unit directs the flow of data and instructions within the processor and electronic memory.

This unit co-ordinate's the activities of the units of the system and ensures that the instructions contain in its programs are executed in proper sequence; it also controls the activities of various input/output devices.

Fig 4.3: Control unit

The operations carried out by the control unit while executing a single instruction may be summarized as follows:

i. Obtain the ‘address of memory for the current instruction to be obeyed from the Program counter
ii. Copy the instruction from its location in memory into the Instruction Register.
iii. Increment the Program Counter so that it now contains the address of the next instruction to be obeyed.
iv. Decode the instruction from its pattern of binary digit to determine what operation is to be carried out, using the Instruction Decoder.
v. Execute the Instruction using the ALU.
vi. Go back to step (A).

Arithmetic Logic Unit

The arithmetic logic unit (ALU) contains programmed transistors that perform mathematical and logical calculations on the data. The Arithmetic and Logic Units (ALU) consists of two units,

i. The Arithmetic Unit: This unit performs arithmetic operations such as addition, subtraction, multiplication, division etc.
ii. The Logic Unit: This unit performs logical operations such as the comparison between numbers, shifting of values from one area to another. It is sometimes called the “mill” for the computer data processing

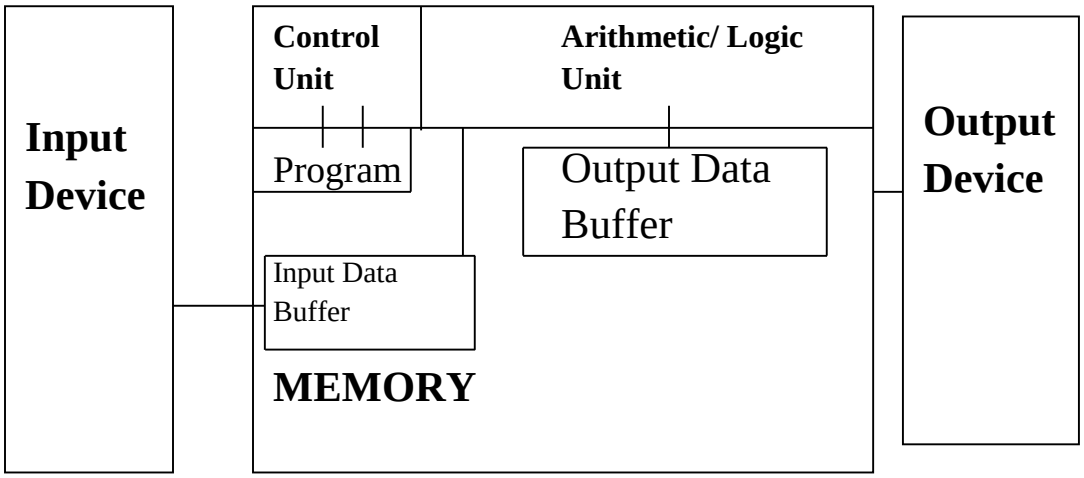


Fig. 4.4: Data flow in a computer system

Registers

The registers are special transistors that store data and instructions as they are being manipulated by the control unit and ALU. New microprocessors also have additional high-speed memory called cache, on the chip to store frequently used data and instructions.

Fir 4.5: Main memory

The Peripheral Devices

Peripheral devices are hardware used for input, auxiliary storage, display, and communication. These are attached to the system unit through a hardware interface that carries digital data to and from main memory and processors.

Input/Output (I/O) Devices

These are used as means of communication between computer and the outside and include keyboard, mouse, modems, scanners, digital camera, network interface cards, and ports. They allow you to send information to the computer or get information from the computer.




Mouse Keyboard Scanner Monitor Printer Digital Camera

Input Devices

An input device can be any piece of equipment that transfers information into a computer. This includes mouse, keyboard, scanner, camera etc.

i. Mouse

A computer mouse is an input device that is used with a computer. Moving a mouse along a flat surface can move the cursor to different items on the screen. Items can be moved or selected by pressing the mouse buttons (called clicking). Today's mice have two buttons, the left button and

right button, with a scroll wheel in between the two. Today, many computer mouse use wireless technology and have no wire.

There are many types of mouse; Optical mouse, wireless mouse, mechanical mouse, trackball mouse. A computer mouse is a handheld hardware input device that controls a cursor in a Graphical user Interface (GUI) and can move and select text, icons, files, and folders. For desktop computers, the mouse is placed on a flat surface such as a mouse pad or a desk and is placed in front of your computer. The picture to the right is an example of a desktop computer mouse with two buttons and a wheel. The mouse was originally known as the X-Y position Indicator for a display system and was invented by Douglas Engelbart in 1963 while working at Xerox PARC. However, due to Alto's lack of success, the first widely used application of the mouse was with the Apple Lisa computer ("mouse from FOLDOC". *foldoc.org.*).

ii. Keyboard

A computer keyboard is a typewriter-style device which uses an arrangement of buttons or keys to act as mechanical levers or electronic switches. Following the decline of punch cards and paper tape, interaction via teleprinter-style keyboards became the main input method for computers. Keyboard keys (buttons) typically have characters engraved or printed on them, and each press of a key typically corresponds to a single written symbol. However, producing some symbols may require pressing and holding several keys simultaneously or in sequence. While most keyboard keys produce letters, numbers or signs (characters), other keys or simultaneous key presses can produce actions or execute computer commands.

In normal usage, the keyboard is used as a text entry interface for typing text and numbers into a word processor, text editor or any other program. In a modern computer, the interpretation of key presses is generally left to the software. A computer keyboard distinguishes each physical key

from every other key and reports all key presses to the controlling software. Keyboards are also used for computer gaming either regular keyboards or keyboards with special gaming features, which can expedite frequently used keystroke combinations.

iii. Scanner

Scanners capture text or images using a light-sensing device. Popular types of scanners include flatbed, sheet fed, and handheld, all of which operate in a similar fashion: a light passes over the text or image, and the light reflects back to a CCD (charge-coupled device). A CCD is an electronic device that captures images as a set of analog voltages. The analog readings are then converted to a digital code by another device called an ADC (analog-to-digital converter) and transferred through the interface connection (usually USB) to RAM. The quality of a scan depends on two main performance factors. The first is spatial resolution. This measures the number of dots per inch (dpi) captured by the CCD. The second performance factor is colour resolution, or the amount of colour information about each captured pixel. Colour resolution is determined by bit depth, the number of bits used to record the colour of a pixel.

iv. Camera

Digital cameras are a popular input source for multimedia developers. These cameras eliminate the need to develop or scan a photo or slide. Camera images are immediately available to review and reshoot if necessary, and the quality of the digital image is as good as a scanned image. Digital capture is similar to the scanning process. When the camera shutter is opened to capture an image, light passes through the camera lens. The image is focused onto a CCD, which generates an analog signal. This analog signal is converted to digital form by an ADC and then sent to a digital signal processor (DSP) chip that adjusts the quality of the image and stores it in the camera's built-in memory or on a memory card . The memory card or stick has limited storage capacity. Images can

be previewed on the card, and if not suitable, deleted to make space for additional images. Digital camera image quality, like scanning, is based on spatial resolution and color resolution.

Output Devices

An output device transfers information to the outside of the computer. It includes; Printer, Speaker, Display monitor, Projector etc.

i. Printer

Printers remain an important multimedia peripheral device, despite the fact that multimedia applications are primarily designed for display. Storyboards, system plans, schematics, budgets, contracts, and proposals are just a few common documents that are frequently printed during multimedia production. End users print images and web pages, as well as the standard text documents associated with most computer applications.

There are two basic printing technologies: impact and nonimpact. Impact printers form images and text by striking paper. Dot-matrix printers use a series of pins that strike the paper through an inked ribbon. These printers are used for applications that require multiform output or high-speed printing. They are easy to maintain and relatively inexpensive to operate. However, limited colour and graphics capability, combined with high noise levels, make impact printers undesirable for most printing needs. Nonimpact printers form printed output without physically contacting the page. These devices include inkjet, photo, and laser printers.

ii. Speaker

Speaker systems are essential components of modern computers. Most early microcomputers restricted sound output to warning sounds such as a loud beep when there was an error message. Macintosh computers raised the bar on sound output when the first Mac introduced itself to the

world in 1984. A computer that could speak changed the prevailing belief that all computer information needed to be in visual form. Sound capability soon became a requirement for a multimedia computer. Sound output devices are speakers or headsets. They are plugged into the soundboard where digital data is converted to analog sound waves. Soundboards can be a part of the system board or added to a computer's expansion slots. Soundboard circuitry performs four basic processes: it converts digital sound data into analog form using a digital-to-analog converter, or DAC; records sound in digital form using an ADC; amplifies the signal for delivery through speakers; and creates digital sounds using a synthesizer.

- Display monitor
- Projector

Computer Memory

Mainly computer have two types of memory namely;

1. Primary or Main Memory (Volatile Memory.
2. Secondary Memory / Non Volatile Memory.

1. Primary Memory / Volatile Memory

Primary memory is internal memory of the computer. It is also known as main memory and temporary memory. Primary Memory holds the data and instruction on which computer is currently working. Primary Memory is nature volatile. It means when power is switched off it lost all data.

Types of Primary Memory

Primary memory is generally of two types.

1. RAM (Random Access Memory)
2. ROM (Read Only Memory)

1. RAM

It stands for Random Access Memory.RAM is known as read /writes memory. It generally refereed as main memory of the computer system. It is a temporary memory. The information stored in this memory is lost as the power supply to the computer is switched off. That's why RAM is also called "**Volatile Memory"**

Types of RAM

RAM is also of two types:

a) Static RAM

Static RAM also known as SRAM ,retain stored information as long as the power supply is ON. SRAM are of higher coast and consume more power .They have higher speed than Dynamic RAM

b) **Dynamic RAM**

Dynamic RAM also known as DRAM, its stored information in a very short time (a few milliseconds) even though the power supply is ON. The Dynamic RAM are cheaper and moderate speed and also they consume less power.

2. ROM

It stands for Read Only Memory.ROM is a Permanent Type memory. Its content are not lost when power supply is switched off. Content of ROM is decided by the computer manufacturer and

permanently stored at the time of manufacturing. ROM cannot be overwritten by the computer. It is also called **"Non-Volatile Memory".**

Type of ROM

ROM memory is three types names are following-

1. **PROM(Programmable Read Only Memory**)-PROM chip is programmable ROM.it is PROM chips to write data once and read many once chip has been programmed ,the recorded information cannot be changed. PROM is also non-volatile memory.
2. **EPROM (Erasable Programmable Read Only Memory)-** EPROM chip can be programmed time and again by erasing the information stored earlier in it. Information stored in EPROM exposing the chip for some time ultraviolet light.
3. **EEPROM (Electrically Erasable Programmable Read Only Memory)**-The EEPROM is programmed and erased by special electrical waves in millisecond. A single byte of a data or the entire contents of device can be erased.

2. Secondary or auxiliary Memory (Non-Volatile Memory)

Secondary Memory is external memory of the computer. It is also known as auxiliary memory and permanent memory. It is used to store the different programs and the information permanently. Secondary memory is nature non volatile. It means data is stored permanently even if power is switched off.

The secondary storage devices are:

1. Floppy Disks
2. Magnetic (Hard) Disk
3. Magnetic Tapes
4. Pen Drive
5. Winchester Disk
6. Optical Disk(CD,DVD)

Differences between Primary and Secondary Memory

S/n.	Primary Memory	Secondary Memory
1	Primary memory is temporary	Secondary memory is permanent
2	Primary memory is directly accessible by Processor/CPU	Secondary memory is not directly accessible by CPU
3	Nature of Parts of Primary memory varies. RAM-volatile in nature. ROM- Non-volatile	It's always Non-volatile in nature
4	Primary memory devices are more expensive than secondary storage devices	Secondary memory devices are less expensive when compare to primary memory devices
5	The memory devices used for primary memory are semiconductor memories	The secondary memory devices are magnetic and optical memories
6	Primary memory is also known as Main memory or Internal memory	Secondary memory is also known as External memory or Auxiliary memory
7	Examples: RAM, ROM, Cache memory, PROM, EPROM, Registers etc	Examples: Hard Disk, Floppy Disk, Magnetic Tapes etc

UNIT 5 SOFTWARE COMPONENTS OF COMPUTER

5.1 COMPUTER SOFTWARE

A computer software is a generic term for all sorts of programs that run on the hardware system. The hardware system on its own is just a bunch of electrical gadgets that do not perform any form of task because the software drives and directs the hardware. A computer software can generally be defined as a collection of instructions (programs/codes) and documents that allows a computer to perform specific simple to complex tasks. Since the first program was written by Augusta Ada for Charles Babbage's proposed analytical engine, software has evolved into being sophisticated over the years to cater for changing individual and organizational needs while providing improved interface and user interactions.

5.2 SOFTWARE CLASSIFICATION

Software is classified into two major types which are the system and application programs which are further classified into specific tools and functions. System softwares are machine and software centered while application softwares are user centred. Figure 1 shows the classification where the system software comprises the operating system, utility software and language translators and application software comprises general purpose, special purpose and bespoke applications.

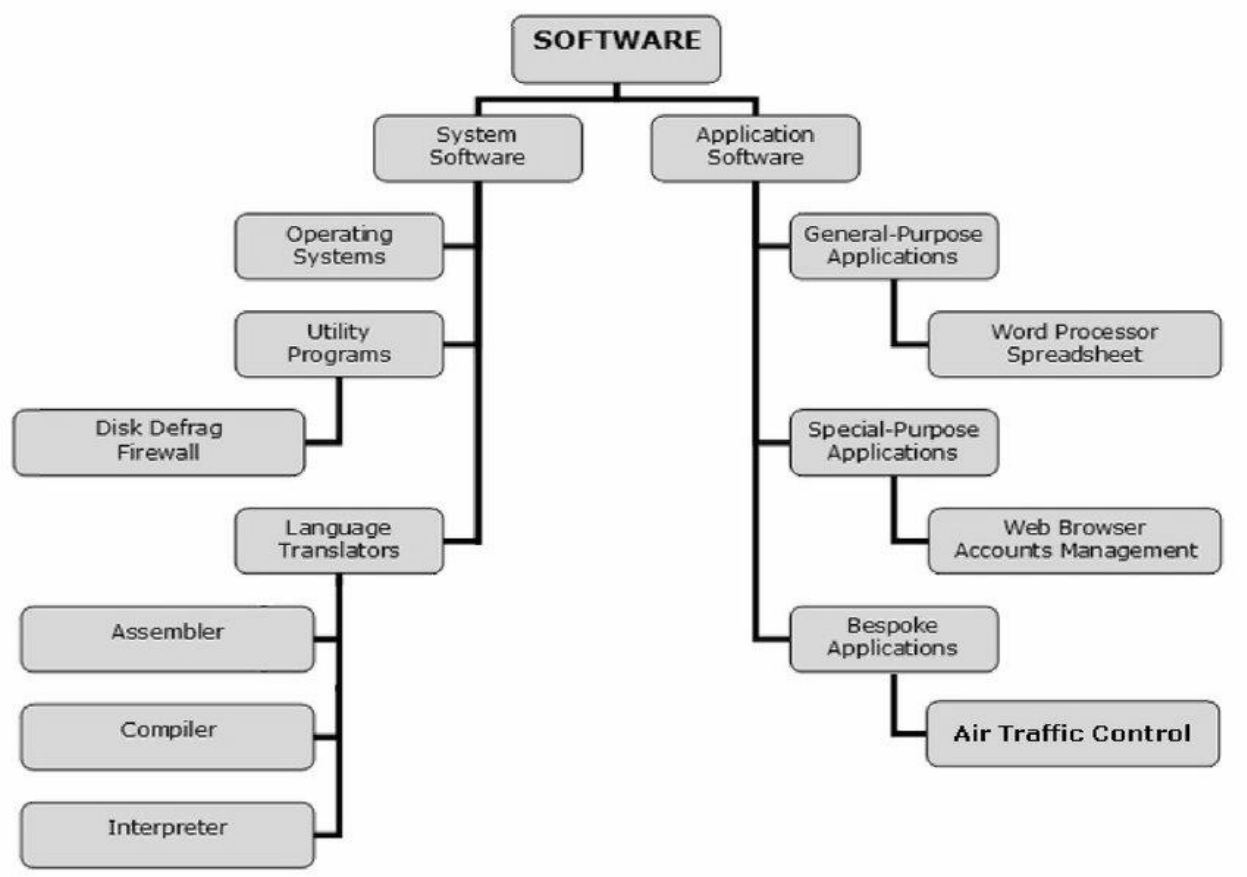


Figure5.1: Classification of Computer Software

5.2.1 SYSTEM SOFTWARE

These refer to the suite of programs that facilitate the optimal use of the hardware systems and/or provide a suitable environment for the writing, editing, debugging, testing and running of user programs. Usually every computer system comes with a collection of these suites of programs which are provided by the hardware manufacturers. They constitute an essential part of any computer system. Examples of system software are: The operating system, the language processor/translators, loaders, compilers etc.

5.2.1.1 OPERATING SYSTEM (OS)

An Operating System (OS) is a suite of programs acting as an interface between the users of a computer on one hand and the hardware on the other. It provides the users with features that make it easier for him to code, test, and execute, debug and maintain his program while efficiently managing the hardware resources. It is responsible for managing a computer's software and hardware. An OS typically is installed on the computer by the manufacturer before it is sold out. The OS oversees computer boot operations, and tasks as simple as pressing a key on the keyboard, to installing and running other softwares. If a computer system has no OS installed, it follows that most of these tasks will be carried out by the operator. In essence, the processor will be idle most of the time which again will affect the through output of the system. The OS precludes this by reducing the operator's intervention. Functions of OS includes:

Resource (hardware, software) sharing

Provision of virtual machine

Input/output handling

Memory management

File management

Protection and error handling

Program interaction and control

Accounting of computing resources

Operating systems can be found in devices ranging from mobile phones to automobiles to personal and mainframe devices. There are so many operating systems developed and in use presently which can be categorized into proprietary, non-proprietary, most popular ones include windows, mac, android, iOS and Linux (see table 1 for classification by devices).

Figure 5.2: Examples of Operating Systems.

Table 5.1: Top Operating Systems by Devices

Mobile	**Desktop**
Android	Windows
iOS	Unix
Windows	Mac OS
Blackberry	Solaris
Symbian	MS DOS
Bada	Ubuntu

TYPES OF OPERATING SYSTEM

1. **BATCH OPERATING SYSTEM:** This type of operating system does not allow interactions with the computer directly. There is an operator which takes similar jobs having the same requirement and groups them into batches. The operator will then be responsible for sorting the jobs with similar needs. Getting the right priorities for jobs is one major problem of this type of system.

2. **SINGLE-USER OPERATING SYSTEM:** Provide machines for only one user at a time. Examples are OS in microcomputer or PC like CIVIP, PC-DOS AND MS-DOS.

3. **MULTI-USER OPERATING SYSTEM:** This system allows multiple users on different computers to access a single OS resource simultaneously.

4. **TIME SHARING OPERATING SYSTEM:** Time-sharing is a method that enables many users at various points, to use a particular computer system at the same time. Also referred to as multitasking, in time-sharing, each task is allotted some time to execute, so that all the tasks run smoothly.

5. **DISTRIBUTED OPERATING SYSTEM:** Various independent interconnected computers communicate with each other using a shared communication network. Distributed systems use multiple central processors to serve multiple real-time applications and multiple users. One advantage of this system is a failure of one of the computers connected will not result in failure of every other computer.

6. **NETWORK OPERATING SYSTEM:** A Network Operating System runs on a server where the server is responsible for managing data, users, groups, security and applications. The

primary purpose of the network operating system is to allow shared file and printer access among multiple computers in a network. Examples of network operating systems include, Microsoft Windows Server 2003, Microsoft Windows Server 2008, UNIX, Linux, Mac OS X, Novell NetWare, and BSD.

7. **PROCESS CONTROL:** The main function of such an OS is to provide maximum reliability with minimum operator intervention and to 'Fail Safe' in case of a hardware malfunction.

8. **FILE INTERROGATION SYSTEM:** Here there is a large set of data which is interrogated for information and answers provided without involving the users in the details of implementation. Area of application includes Management Information System(MIS).

9. **TRANSACTION PROCESSING:** Large amount of data that is frequently being modified e.g. airline seat reservation and banking. There can be several users accessing a data item simultaneously; the operating system gives each user the impression that he is the sole user of the data item.

10. **GENERAL PURPOSE SYSTEM**: Use by computers having a large number of users performing a wide range of tasks. They operate in batch or multi-access mode. In batch mode you do not interact with your program when it is running while on multi-access you can interact with your program while running. Examples include XENIX,VAX, MVS and VM operating systems.

5.2.1.2 LANGUAGE TRANSLATORS

A language is a set of notations used for communication. A programming language is a set notation in which we express our computer programs. At the initial state of computer development

programs were hard to write, read, debug and maintain. In an attempt to solve these problems other computer languages were developed which are english like and user-friendly. However, computers can run programs written into machine language. There is therefore the need to translate programs written in these other languages into machine language. The suite of the programs that translates programs written in these other languages to machine language is called LANGUAGE TRANSLATORS. The initial program written in a language different from machine language is called the SOURCE PROGRAM and its equivalent in machine language is called the OBJECT PROGRAM. The three examples of classes of language translators are Assemblers, Interpreters, and Compilers.

ASSEMBLERS

An assembly language is a set of notations using symbols or mnemonics that are easily readable, and is used to write computer programs. An assembler is a computer program that accepts a source program in assembly language and produces an equivalent machine language program called the object program or object code. Each machine has its own assembly language. Machine language of one machine cannot run on another machine.

INTERPRETERS

An interpreter is a program that accepts a program in a source language, reads, translates and executes it one line at a time. An interpreter, directly executes instructions written in a programming language, without requiring compilation into a machine language program.

COMPILERS

A compiler is a computer program that accepts a source program in one high-level language, reads and translates the entire user's program into an equivalent program in machine language called the object program or object code. Some examples of high level languages are FORTRAN, COBOL, C, Java, Python, etc.

The stages required for a high-level source code includes:

Lexical analysis: where the syntax is broken into tokens, removing comments and whitespaces.

Syntax analysis: where the given input is checked if it is in the correct syntax of the programming language in which the input has been written.

Semantic analysis: where declarations and statements of a program are checked so that their meaning is clear and consistent with defined semantic and control structures.

Code generation: where equivalent target codes are generated from intermediate code representation.

For each high-level language there is a different compiler. We can therefore talk of COBOL compiler, FORTRAN compiler, C compiler, etc. A compiler also detects syntax errors, errors that arise from the use of the language. Compilers are portable e.g. a COBOL compiler on one machine can run on a different machine with minimum changes.

5.2.1.3 UTILITY SOFTWARE

This is a set of commonly used programs that provides general computer optimization services, e.g. anti-virus, registry cleaners, disk formatters, data generators, etc. Utility software perform the following operations:

FILE CONVERSION

This covers data transfer from any medium to another making an exact copy or simultaneously editing and validating. For example, a copy from a magnetic tape to a disk.

FILE COPY

It makes an exact copy of a file from one medium to another lot or the same medium e.g copy from one area of the disk pack to another area.

FILE REORGANIZATION

It involves cleaning the computer memory by reorganizing cylinder and bucket indexes which transferred and placed records back into their home buckets.

FILE MAINTENANCE

It enables users to insert and delete records into or from sequential files. It also allow user to rename files and amend standing data

SORTING

It provides certain parameters and requests the machine to arrange a set of records into a certain order (ascending or descending) using some keys.

5.2.2 APPLICATION PROGRAMS

Application programs often called packages or applications consist of programs designed to assist users with specific tasks like word editing and publishing, browsing, designing, etc. Application software may be general purpose (web browsers, word processing, etc.), special purpose (CAD, Business Management Software, etc.) and bespoke(e-commerce softwares, content management systems, etc.)

Application programs classified by tasks include:

1. Accounting Packages: These applications cover sales ledger, invoicing, inventory control payroll, fixed assets, purchased ledger, other financial and accounting processing. Examples include; SAGE, Freshbooks, NETSuite ERP, etc.
2. Word Processing Packages: These packages help to edit and format text documents. Examples include; Word Perfect, WordStar, Display writer, Professional writer, LOTUS manuscript, MS-word, etc.
3. Spreadsheet Packages: A spreadsheet is a sheet of paper ruled into a grid of rows and columns on which you can store and analyse data. . Examples include; LOTUS 1-2-3, MS Excel, google sheets and VP Planner.
4. Utilities: They do the same job as the utility software, which was discussed earlier. Some of their functions include, undeleting and compressing a file, reading and writing a file sector by sector such that it would not work successfully if copied. Examples include; NORTON, PC Tools, Copywriter, LOTUS Magellan, etc..

5. Integrated Packages: They are programs or packages that perform a variety of different processing operations that are compatible with whatever operation is being carried out. They perform a number of operations like word processing, database management and spread sheet processes. Examples are: Office writer, Logistics symphony, Framework, Enable, Ability, Smart ware II, Microsoft works V2.

6. Graphic Packages: These are packages that enable you to create and manipulate images.. Examples include; CorelDraw, Adobe Photoshop, Adobe Illustrator, Blender, 3D Paint, etc.

7. Database Packages: These are packages used for designing, setting up and subsequently managing a database. (A database is an organized collection of data that allows for modification taking care of different user views). Examples include; MySQL, MS Access, Dbase IV, FoxBASE, Revelation Advanced, etc

UNIT 6 INTRODUCTION TO DATA PROCESSING

6.1 WHAT IS DATA PROCESSING?

Data processing is the manipulation of data into usable information. In computer terms, this is done on databases and includes data entry and data mining. Data are raw facts and figures collected from events or other sources. Data need to be processed or organized, so that they become meaningful and useful. The processed data is referred to as information

6.2 DATA PROCESSING CYCLE

The data processing cycle is the order in which data is processed. There are four stages;

Data collection

Data input

Data processing and storage

Data output

6.3 METHOD OF DATA PROCESSING

The stages or activities of converting organizing data into information may be done in the following ways

Manual method: this involves human efforts. The operations are performed using brain to think, it could be using calculator for calculation. It also involves using writing material to write, using drawing material to draw. It is suitable for volume of data.

Mechanical Method: It involves the use mechanical machines to process data. The use of adding machine to update ledger is a good example

Electronic Method: This method involves the use of electronic devices like computer system. This method is suitable for processing large volume of data. The advantages of this method lies in its speed, accuracy and large storage.

6.4 COMPUTER MODE OF PROCESSING DATA

Real time processing: In real-time processing data entered into computer are processed and the result is generated immediately. This time of processing is common in banking operation

Time-Sharing: In time sharing the system is interactive, it allows users to process data independently on a single computer at the same time. This method allows a user to share resources of computer with other user

Batch Processing: This type of processing allow user to submit data or job to be processed over a given period of time before the processing takes place. The type of technique is suitable for large volume of data.

Distributed Processing: In this method some of the processing devices and procedure are situated in different locations. The processing devices are connected together by transmission facilities

UNIT 7 NUMBER SYSTEMS

NUMBER SYSTEMS

There are four common number systems namely: binary, octal, decimal and hexadecimal systems. The number of digits used in the number system is referred to as the *base.* Thus, decimal number system has a base often because it uses ten digits. Similarly, binary number system has a base of two. The table below shows the common number systems with their digits and bases.

Table 7.1 Common Number Systems with their digits and bases.

Number System	Digits	Number of digits (Base)
Binary	0 1	Two
Octal	0 1 2 3 4 5 6 7	Eight
Decimal	0 1 2 3 4 5 6 789	Ten
Hexadecimal	0 1 2 3 4 5 6 789 A B C D E F	Sixteen

7.1.1 Binary number System

Binary number system has only two digits: 0, 1. It has a base of 2. Examples are: 101, 1001 and 1011. These binary numbers are written as 101_2, $l00l_2$ and 1011_2 (or 101_{lwo}, 1001 two and 1011_{two}) respectively. The subscript 2 indicates the base number.

7.1.2 Octal number System

Octal number system has eight digits: 0, 1, 2, 3, 4, 5, 6, 7. It has a base of 8. Examples of octal number are 176, 405, 260 and 737. They are written as 176s, 405_8, 260_8 and 737_8 (or 176_{eight}, 405_{eight} 260_{eight} and 737_{eight}) respectively. The subscript 8 indicates the base number.

7.1.3 Decimal number System

Decimal number system uses ten digits: 0, 1, 2, 3,4, 5,.6, 7, 8, 9 and has a base of 10. Example of decimal number is 4958. This number may be written as 4756_{10}. 4756 means 4 thousands, 7hundreds, 5 ten and 6 units.

= 4x1000 7x100 5x10 6x1

= $4xl0^3$ + $7xl0^2$ + $5xlO^1$ + $6x10°$

= 4756.

7.1.4 Hexadecimal Number System

Hexadecimal number system uses sixteen digits namely:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.

It has a base of 16. The first ten digits are equivalent to the decimal digits. The alphabets A, B, C, D, H and F represent 10, 11, 12, 13, 14 and 15 respectively.

Thus, A=10, B = H, O12, 11=13, 1-14 and F=15. Examples of hexadecimal number system are $8F_{16}$ $35B_{16}$ $10E_{16}$ and $C9_{16}$

7.2 Conversion From Decimal System To other Number System

The following procedure is used to convert from decimal system to another number system.

Divide the decimal number by the new base,

Continue dividing until you reach»zero (0).

Write down the remainder each time you divide; and

List the remainder figures starting from the last to the first in successive order to arrive at the required answer.

Example

Convert (i) 25.

Solution

(i) 25 to binary (base 2)

25-2=12 Rem. 1

12÷2= 6 Rem. 0

6÷2=3 Rem. 0

3÷2 = 1 Rem. 1

1÷2=0 Rem. 1

25_{10} to binary = 11001_2

Now that you have been able to work through the examples above. Can you try this? Convert 737_{10} octal numbers

The solution to the question is $1341_{8.}$

Now cross check your answer with solution below.

Solution

737 to octal (base 8)

737 ÷8 = 92 Rem.

92÷8 = 11 Rem. 4

11÷8= 1 Rem. 3

1 ÷8 = 0 Rem. 1

737_{10} to octal = 1341_8

More examples

Convert the following decimal numbers to hexadecimal numbers,

(i) 1046 (ii) 268

Solution

(i) 1046 to Hex (base 16)

1046÷16 = 65 Rem. 6

65÷16= 4 Rem. 1

4÷16= 0 Rem. 4

1046_{10} to Hex = 416_{16}

(ii) 268 to Hex (base 16)

268÷16 = 16 Rem.l2=C

16÷16 = 1 Rem. 0

1÷16 = 0 Rem. 1

268_{10} to Hex = $10C_{16}$

7.3 CONVERSION FROM ANY NUMBER SYSTEM TO DECIMAL NUMBER SYSTEM

It is possible to convert from any number system to decimal system. Each digit in the number system is multiplied by the base number raised to various powers as you will see in the examples The results of the multiplication are added up to arrive at the required answer.

Examples

Convert the following binary numbers to decimal numbers.

(i) 1101_2 (ii) $I1011_2$

Solution

1101_2 to decimal numbers

$1 \times 2^3 = 8$

$1 \times 2^2 = 4$

$0 \times 2^1 = 0$

$1 X 2^0 = 1$

$1101_2 = 13$

0110_2 to decimal numbers

$0 x2^3 = 0$

$1 \times 2^2 = 4$

$1 \times 2^1 = 2$

$0 \times 2^0 = 0$

$0110_2 = 6$

Convert 105_8 to decimal numbers.

Solution

(i) 105s to decimal number.

$1 \times 8^2 = 64$

$0 \times 8^1 = 0$

$5 \times 8^1 = 5$.

$105_8 = 69$

Now, let us test how far you have understood the subject again. Convert 260_8 to number in base ten. If you have worked it correctly, your answer should be 176. Compare your working steps with the one below

$2 \times 8^2 = 128$

$6 \times 8^1 = 48$

$0 \times 8^0 = 0$

$260_8 = 176$

Example

Convert the following hexadecimal numbers to decimal numbers.

416_{16} (ii) $35F_{16}$

(i) $4l6_{16}$ to decimal number

$4x\ 16^2 =$ 1024

$1\ x\ 16^1 =$ 16

$6\ X\ 16^0 =$ 6

$416_{16} = 1046$

(ii) $35F_{16}$ to decimal number

$3\ x\ 16^2 = 768$

$5\ x\ 16^1 = 80$

$F\ x\ 16^0 = 15=F$

$35F_{16} = 863$

UNIT 8 DATA REPRESENTATION AND ITS MEASUREMENT IN COMPUTER

8.1 DATA REPRESENTATION IN COMPUTER

Data in a computer is represented in a series of bits (binary digits) or ones and zeroes. Since the birth of computers, bits have been the language that control the processes that take place inside that mysterious black box called your computer.

Data and instructions are entered into the computer in alphabetic and number forms. These entries are converted to binary digits before the computer uses them. For convenience, computer uses coding schemes to represent numbers, alphabets, special characters and symbols in bits. The common coding schemes are binary coded decimal, extended binary coded decimal interchange code and American standard code for information interchange, (i) Binary Coded Decimal (BCD) uses 4 bits (2^2 bits) to represent numbers, (ii) Extended Binary Coded Decimal Interchange Code (EBCDIC) is an~8-bit coding scheme. It uses 8 bits (2^3 bits) to represent numbers 0-9, letters and special characters. For instance, 1111 0101 represents 5 and 1100 0010 represents uppercase letter B. (iii) American Standard Code for Information Interchange (ASCII) uses 256 bits (2^8 bits) to represent numbers 0-9, letters, special characters, mathematical symbols and keyboard characters.

ASCII (American Standard Code for Information Interchange) ASCII uses 8 bit binary numbers to represent text characters. An 8 bit code allows 256 different characters to be stored:

A-Z - 26 characters

a-z - 26 characters

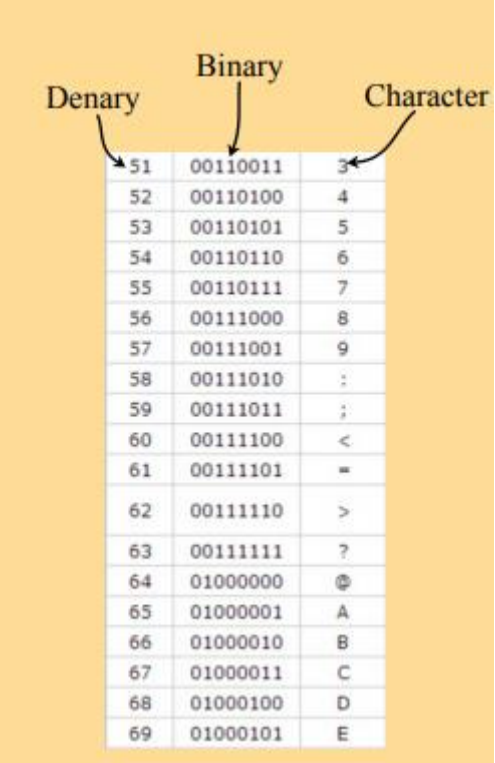
Control Characters (return, tab etc) - 32 characters

0-9 - 10 characters

Punctuation - approximately 20 characters

Mathematical Symbols - approximately 50 characters

The remaining spaces in the 256 characters code are used to store foreign alphabet letters. Figure 1 shows forms in which data can be represented.



Denary	Binary	Character
51	00110011	3
52	00110100	4
53	00110101	5
54	00110110	6
55	00110111	7
56	00111000	8
57	00111001	9
58	00111010	:
59	00111011	;
60	00111100	<
61	00111101	=
62	00111110	>
63	00111111	?
64	01000000	@
65	01000001	A
66	01000010	B
67	01000011	C
68	01000100	D
69	01000101	E

Figure 1: Data Representation

Binary to Denary

To convert a binary number to a denary number, simply add up the columns where a 1 appears.

Example 1: Convert the binary number 01100100 into a denary value.

128	64	32	16	8	4	2	U
0	1	1	0	0	1	0	0

64 32 4 64+32+4 = 100

Denary to Binary

To convert a number from denary to binary we reverse the process and place 1s into the columns ensuring that they add up to the number we are looking for.

Example 1: Convert 94 into a binary number

128	64	32	16	8	4	2	U
	1		1	1	1	1	

=94

Finally place zeros in all the columns you have not filled. Answer = 01011110

128	64	32	16	8	4	2	U
0	1	0	1	1	1	1	0

=94

Using Binary to Store Real Numbers

Real number, or numbers with decimal places are stored using scientific notation. For example, the number 345.765 would be stored as:

3.45765×10^2

The computer then stores two separate integers with a set number of bits.

The mantissa **3.45765** **X 10^2**

1010001100101010

&

The Exponent **3.45765×10^2** 00000010

The complete number is then stored as one long integer - 101000110010101000000010

Note that the number of bits that a computer uses to store the mantissa and exponent has an effect on the number stored.

8.2 BASIC UNIT OF MEASUREMENT

Bit and Byte are basic unit of measurement. These two units are discussed as follows:

BITS

All information in the computer is handled using electrical components like the integrated circuits, semiconductors, all of which can recognize only two states – presence or absence of an electrical signal. Two symbols used to represent these two states are 0 and 1, and are known as BITS (an abbreviation for BInary DigiTS). 0 represents the absence of a signal, 1 represents the presence of a signal. A BIT is, therefore, the smallest unit of data in a computer and can either store a 0 or 1. Since a single bit can store only one of the two values, there can possibly be only four unique combinations:

00 01 10 11

Bits are, therefore, combined together into larger units in order to hold greater range of values.

BYTES

BYTES are typically a sequence of eight bits put together to create a single computer alphabetical or numerical character. More often referred to in larger multiples, bytes may appear as Kilobytes (1,024 bytes), Megabytes (1,048,576 bytes), GigaBytes (1,073,741,824), TeraBytes (approx. 1,099,511,000,000 bytes), or PetaBytes (approx. 1,125,899,900,000,000 bytes). Bytes are used to quantify the amount of data digitally stored (on disks, tapes) or transmitted (over the internet), and are also used to measure the memory and document size.

Sn	Unit	Description
1.	Bit	Short for Binary digIT. It is the smallest unit which can be defined in a computer. Bits (1s or 0s) correspond to simple switches being on or off.
2.	Byte	A byte is a group of 8 bits. Early computer worked with groups of 8 bits or a byte. Today's computers typically process groups of 64 bits (8 bytes) at a time.
3.	KiloByte (KB) 1024	2^{10} Exactly 1024 bytes. Kilo usually means 1000 of something but in binary is a round number. Text files and small graphic files are usually quoted in KB.
4.	MegaByte (MB)	2^{20} Exactly 1024 Kilobytes. Mega usually means 1 million of something and in this case it is approximately 1 million bytes. Photos and music files are usually measured in MB.
5.	GigaByte (GB)	2^{30} Exactly 1024 Megabytes. The capacity of some storage devices (DVDs, USB Flash Drives) are measured in GB.
6.	TeraByte (TB)	2^{40} Exactly 1024 Gigabytes. This measurement is now commonly used with newer hard disk drives, mainframe memory and server hard drives.

7. Petabyte (PB) A petabyte is a unit of information or computer storage equal to one quadrillion

   bytes (10245).

Character

Character is an alphabet, a number or a symbol.

Alphabets: a through z or A through Z.

Numbers: 01234 56789

Symbols: @ (%, - +? #)

Blank spaces are regarded as characters. The table below shows number of bytes required to store characters and numeric values

Type of Value	**Number of bytes used for storage**
1 character	1 byte
1 integer	2 bytes
1 single precision	4 bytes
1 double precision	8 bytes

Word

One unit of information is usually made up of 8, 16 or 32 bits. This unit of information is referred to as a word. Thus, a 16-bit word is equal to 2 bytes while a 32-bit word is equal to 4 bytes. Different computers use different word-lengths. A word-length of 32 bits is commonly used.

Exercise

How many bytes are required to store the following information?

(i) A single precision value 5462. (ii) An integer value 68.

Solution

(i) 5462 is one single precision value.

One single precision value requires 4 bytes for storage,

(ii) 68 is an integer value.

One integer value requires 2 bytes for storage.

Complete this Table

1024 bytes	? kilobytes
? kilobyte	1 megabyte
32- bit word	? byte

- Check this table to see if you are right

1024 bytes	1 kilobyte
1024 kilobytes	I mega byte
32-bit word	4 bytes

8.3 MEASUREMENT OF STORAGE CAPACITY

The storage capacity of RAM, hard drives or any other storage device is usually quoted in Megabytes (MB) or Gigabytes (GB). Table 8.1 shows Volume capacity of common storage media.

Storage Medium	Volume Capacity
Diskette	A diskette stores 1.44 millions characters(outdated) characters characters. Its volume capacity is 1.44Mb.
Compact disc (CD)	CD stores 650 or 700 millions of characters. It has volume capacity of 650Mb or 700Mb. CD can record music for a period of 74 minutes.
Hard disk	The volume capacity of hard disk varies. It may have capacity of 4.3Gb, 10Gb, 20Gb, 40Gb or more.
Flash disk	The volume capacity of flash disk varies. Its capacity ranges from 64Mb to 1Gb or more.
Digital video disk (DVD)	DVD has volume capacity of 4.7Gb.

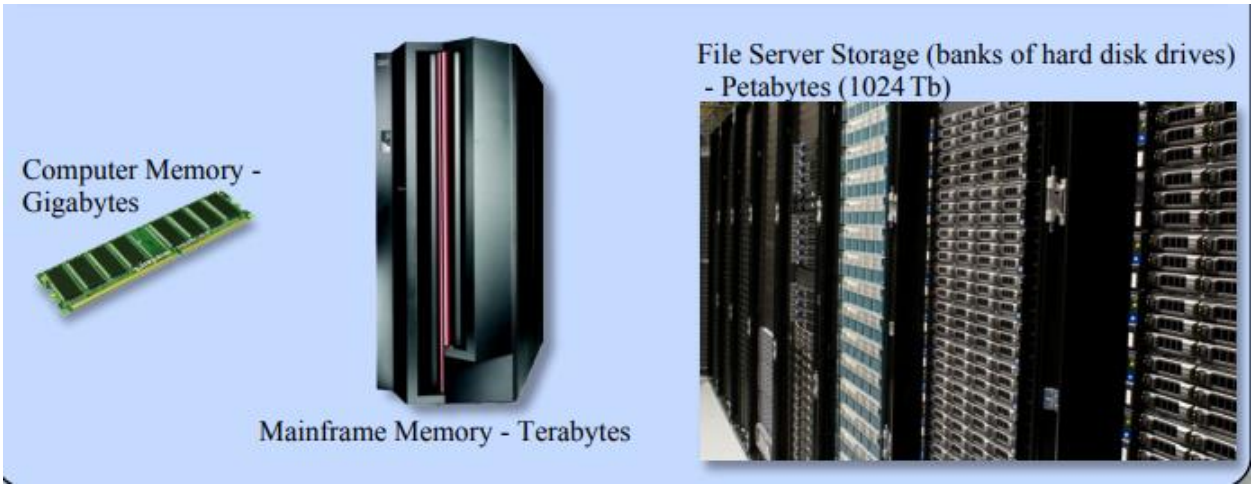


Figure 2: Example of Storage Capacity of Physical Quantities

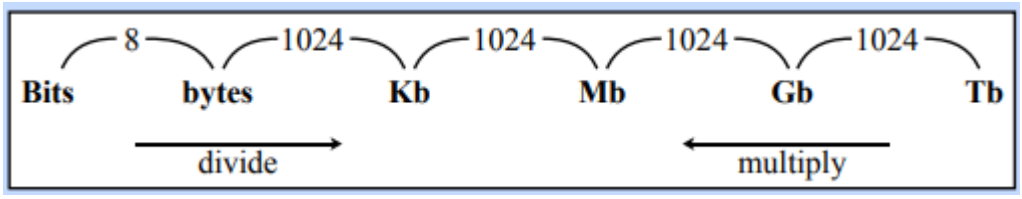
8.4 CHANGING FROM ONE UNIT TO ANOTHER

As well as knowing the order of the units (bits, Bytes, KB, MB, GB, TB, PB) it is important, when doing calculations in computing, to be able to change from one unit to another. For example: A high definition movie might require 1,717,986,918 bytes of storage space. If you were telling your friend that you had downloaded the above movie last night. You would be far more likely to say that the movie you downloaded was 1.6Gb in size. The following manipulations assist in changing from one form of unit to another:

i. To covert a small unit to a larger one we divide (for example changing bytes to Mb).

ii. To convert a large unit to a smaller one we multiply (for example Tb to Mb)

What you multiply and divide by, depends on the number of places you are moving up or down. Use the chart below.



Note:

Kb to Gb would be two places to the right so you would divide by 1024 twice.

Example 1: Convert 4Mb into bytes We are moving two steps to the left 4 x 1024 x 1024 =

4,194,304 bytes

Example 2: Convert 4096Gb in Tb We are moving one step to the right 4096 / 1024 = 4Tb

Example 3: Convert 3.5Mb into bits We are moving three steps to the left 3.5 x 1024 x 1024

x 8 = 29,360,128 bits

Example 4: Convert 68,719,476,736 bits into Gb We are moving four steps to the right 68,719,476,736 / 8 / 1024 / 1024 / 1024 = 8 Gb

UNIT 9 COMPUTER NETWORK

9.1 COMPUTER NETWORKS

Definition

Computer network is a collection of computer systems linked together by means of communication line in order to share resources. The communication line may be ordinary cables, telephone lines or broadcast channels. Each computer system in the network is referred to as a *node. The figure 1 below is an example of a computer network.*

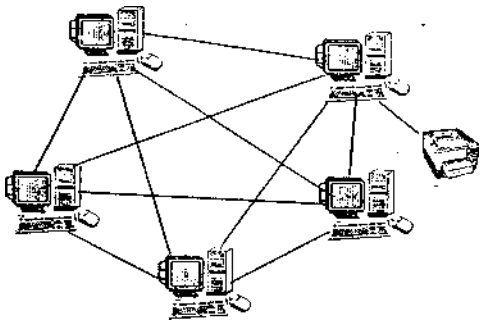


Figure 1: Typical Computer Network

9.2 TYPES OF NETWORK

There are three major types of network. They are local area network (LAN), metropolitan area network (MAN), and wide area network (WAN)

9.2.1 Local Area Network

In a LAN, the computer systems are situated in the same locality or premises within few meters away from each other. The computers are usually linked with ordinary cables.

9.2.2 Metropolitan Area Network

Computers in metropolitan area network (MAN) are few kilometres away from each other. They are usually situated within the metropolis, community or city. The computers in this network are connected to each other with communication equipment.

9.2.3 Wide Area Network

Computers in WAN are spread over a wide area. They may be several kilometres away from each other. Because of the distance, computers in this type of network are linked with telephone lines or broadcast channels.

9.3 NETWORK TOPOLOGY

Computers in a network are connected or linked together in different ways. The structure of physical connections in the network is called topology. Now let us have a look and discuss some of these typologies.

9.3.1 Star Connection Method

In star topology every computer is connected to the central computer. The computer in the network also communicate with each other through the central placed computer. Figure 2 is an example of Star topology structure

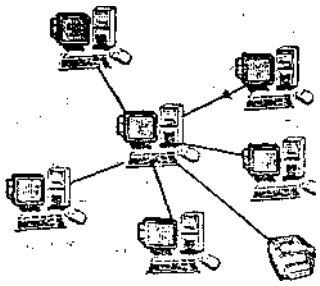


Figure 2: Star topology structure

Take a look at this explanation

Activity 9.1

Take a critical look at the above star topology structure, can you explain what happen to the network if the central computer is down

Activity 1.1 Feedback:

Of course communication among the computer becomes difficult

Read more from unit 9.3.1

9.3.2 Ring Connection Method

Computers in the network are connected together in a ring form as shown in figure 3 below. Information sent by any of the computers is passed round the network until it is received by the owner of the information.

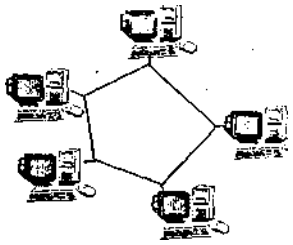


Figure 3: A Ring Connection.

Activity 9.1

How can you describe the level of security of information in this network (Ring topology).

Activity 9.1 Feedback:

The topology may not suitable for application requiring high level of confidentiality.

Read more from unit 4.3.2

9.3.3 Bus Connection Method

A **bus topology** consists of a single cable with the terminator at each end. All present nodes are connected to the single cable. There is no limit to the number of nodes that can be attached to this network, but the number of connected nodes can actually affect the performance of the network. All the computers in the network share the same bus. Figure 4 shows a bus topology

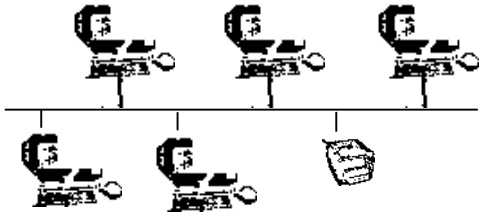


Figure 4: A Bus Connection.

9.3.4 Hierarchical Connection Methods

A Hierarchical network topology interconnects multiple groups that are located on the separate layers to form a larger network. Each layer concentrates on the specified functions, this allows to choose the right equipment for the layer.

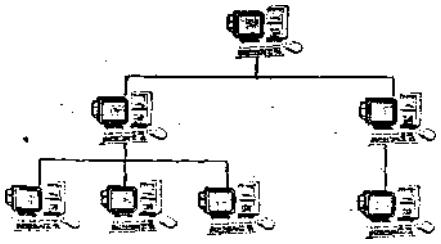


Figure 5: A Hierarchical Connection

9.4 ADVANTAGES OF NETWORK

The main advantages of computer networks are:

(i) Exchange of information.

(ii) Sharing of the same resources.

(i) Passing messages from one computer in one location to the computer situated in another location.

(iv) providing access to wide variety of data and information,

(v) reducing cost of running hardware and software for computers within the same locality.

Unit 10 The Internet

10.1 THE INTERNET

10.1.1 Introduction

The Internet, sometimes called simply *"the Net'* is a world-wide system of computer networks through which sharing of information is possible *INTERNETS is defined as* network of networks. Just as *interstate highway system* links one city to another, similarly the *Internet* links thousands of computer networks. Similarly Internet too is a *pool of information* on matters ranging from books, education, movies, current affairs, sports, arts etc.

10.2 APPLICATION AREAS OF INTERNET

The Internet is very useful, It has its application in different areas of human endeavour. The following are the areas of applications of the Internet:

Banking has replaced the conventional way of banking. Now we are not required to stand in the long queues for depositing, withdrawing or updating our account, with just a ***click of a*** mouse we can get the required information, about our bank account.

Online *education* system no more requires a student to go to the institute and register to attend the classes, and in fact a student can now not only register and attend the classes but also give examination for that particular class at the ***click of a mouse***

On line employment system with which job seeker can register and obtain information for use vacancies with various, companies.

Participating in a discussion about your favourite TV show with like minded people across the globe.

Sending and receiving greetings for various occasions across globe.

Find out which computer programming languages are ruling industries.

Visit an electronic zoo or a museum.

Download (obtain) some interesting software and try it out.

Publish your portfolio over the net.

10.3 THE WORLD-WIDE WEB

The *World Wide Web (WWW)* is a large-scale, on-line repository of information that users can search using an interactive application program called a *browser.* The *World Wide Web is* an Internet-based network of *Web servers.* A *Web Server* is the host computer that publishes information for users to view. In other words, we can define *World Wide Web* as a universal database of knowledge.

When we connect to a *Web Server* we get information in the form of a *PAGE.* A *PAGE* displays information in the-'form of text, graphics or both. These pages are user-friendly and may contain a link to other pages that contain more in-depth information about the specific page. The links on these pages leads you to another page, which may reside on the same or different server.

The Web gets its name because of the complex navigation that a user has to carry out without even realizing it. The connected text is called *'hypertext"* and the page on which it is contained is called a *'Web Page'* These web pages are files, similar to those created with a word processor. The difference is that word processor files have extensions like .DOC *[document] or . TXT [text]* whereas these web documents have, a *HTML [Hypertext Mark-up Language] extension.* These

web documents are stored on computers connected to a network. Many such networks join together to form the Internet. Let us briefly explain some terminologies related to the internet.

Hypertext :Hypertext is text that 'has *connections".* This special text contains the address of another computer that is part of the WWW. When we click on this text, the browser [a gateway in *INTERNET]* understands it as an instruction to get that page from that computer and display it.

Link : A link is the connection from one web page to another using hypertext. These Web Pages are not physically connected but just contain the address of the page that should be displayed.

HTTP : stands for HyperText Transfer Protocol. It is a" *a set of* rut *and regulations"* that is used to send a page or pages contain hypertext from one computer to another.

Browser: A browser is an interactive program that permits a user to view information from the *World Wide Web.* The information contains selectable items that allow the user to view other information. Typically a browser is used for the following services.

- Connecting to the source computer whose address is specified in the hyper-link
- Requesting the new page from the source
- Receiving the page
- Closing the connection
- Displaying it to the user after formatting it

Some popular Web Browsers are Internet Explorer, Mozilla, Netscape Navigator and crazy browser

- *Now let take a look at this, when you go to a restaurant, you will sit down and go through the menu list. Normally you will always place your order through the waiter. The Waiter will take your order to the kitchen for the cook to prepare the dishes. The waiter himself*

does not prepare the food he only convey the customer order to the kitchen. After the cook has prepare the food, the waiter will in turn bring the food to the customer who has placed the order waiting for the arrival of his order. Can you relate this to how the internet works

- *The customer is the user of the Internet in this regard requesting for service, The waiter is likened to the browser who takes the request of the of the user to the server.The Cook is the server who actually produced the request of the customer. The waiter will bring it back to the customer who is the user*

Address: Each computer on the Internet has a unique address of its own. This address is contained in the hyperlink Text of a document. The browser software uses this address to connect to the server over the network.

Client: The computer that is requesting for some service from another computer is called the-client.

Server: A server is the computer that actually services the requests of Other Computers. Another name that is sometimes used for a server is a 'host'. The server is usually a powerful computer with a large memory and hard disk containing many thousands of documents. The documents can be HTM files, they could be sound files, picture files and others).