

**COURSE  
GUIDE**

**HED 326  
COMPUTER IN HEALTH EDUCATION**

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## INTRODUCTION

In the Educational industries, computer is seen as an important facilitator of learning; the knowledge obtained in learning computer will enhance the ability to teach Health Education. Also, it will make health instruction easier for the teachers, as well as richer and more meaningful for the students.

## COURSE COMPETENCIES

This course aims at providing you with relevant historical information on computer technology, and teaching you skills in the application of computer to solve Health, Physical Education and Sports problems; as well as for mastery of design of computer in Education research.

## COURSE OBJECTIVES

By the end of this course, you will be able to:

- narrate essential historical information on the development of computers
- explain the concept of computer and its classification
- identify functional components of a computer system
- state some advantages and disadvantages of computers
- mention some common computer application packages and their uses
- explain methods of application of computer in solving Health, Physical Education and Sports problems
- explain the concept of computer virus
- mention symptoms of computer virus
- identify the different types of computer virus
- explain infection targets and replication techniques of computer viruses.

You need to read each unit of this course material with good understanding, and be able to execute the self-assessment exercises in each of the units correctly.

## STUDY UNITS

There are four modules of 14 Study Units in this course, they are presented as follows:

### Module 1

- |        |   |
|--------|---|
| Unit 1 | History and Concept of Computer                       |
| Unit 2 | Concept of Computer and Classification by Generations |

- Unit 3            Classification of Computers  
Unit 4            The Computer System

## **Module 2**

- Unit 1            The Memory Unit  
Unit 2            The Central Processing Unit  
Unit 3            The Output Unit

## **Module 3**

- Unit 1            Computer Technical Language  
Unit 2            Computer Application Packages  
Unit 3            Microsoft Excel and Microsoft PowerPoint

## **Module 4**

- Unit 1            Application of Computer Technology in Health Education  
Unit 2            Application of Computer in Physical Education and Sports  
Unit 3            Meaning of Computer Virus  
Unit 4            Virus Operations and Functions

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## ASSESSMENT

There are three components of assessment for this course: In-Text Questions and Self-Assessment Exercises at the end of each study Unit; the Tutor-Marked Assignment; and a Written Examination.

## HOW TO GET THE MOST FROM THE COURSE

This course material provides you the opportunity of reading and learning at your own pace, time and location. To get the best of experience, you will need to work with the material in the following ways:

1. Read each Unit step by step as arranged.
2. As you read each Unit, note the key points in the Unit.
3. Attempt the In-Text Questions and Self-Assessment Exercises in each Unit.
4. You should follow all guiding instructions.

**COURSE INFORMATION**

Course Code: HED339

Course Title: Computer in Health Education.

Credit unit: 2

Course Status: Elective.

Course Writer: Dr. Sunday Omachi.

Course Editor: Prof. Umaru Musa.

**MAIN  
COURSE**

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## **MODULE 1**

### **MODULE INTRODUCTION**

As the human quest for better life continues to grow, so also the place of technology continues to unfold. Computer is one of the greatest inventions of the 20th century that has contributed tremendously to the service of humanity. In both developed and developing economies of the world, computer has been recognised as a dependable means of meeting most activities. In the educational industries for example, computer is seen as important facilitator of learning, and indeed a vehicle to the life of the school's information systems. The computer is seen as an interconnection of related subsystem that work harmoniously together in accepting inputs, processing them and relinquishing the outputs as solutions to man's problems at a fantastic speed.

### **UNIT 1 HISTORY AND CONCEPT OF COMPUTER**

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- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 History of Computers
  - 3.2 The Concept of Computer
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 Reference/Further Reading

#### **1.0 INTRODUCTION**

Computer in health education involves the knowledge of computer, its applications, learning and teaching. It embraces learning and teaching in classrooms, E-learning (within and distant), and information and communications technology education to mention but a few. The learning and teaching of computer in health education could be seen at different levels of education, and can also take place at any other place outside the classroom. It involves acquisition of the knowledge of computer (hardware and software) as well as the method of imparting the knowledge to others. It is also the teaching and learning of computer, its uses and usage.

## **2.0 OBJECTIVES**

By the end of this unit, you will be able to:

- narrate the history of computers
- explain the concept of computer

## **3.0 MAIN CONTENT**

### **3.1 History of Computers**

The concepts of number and counting are believed to have been developed first by the herdsmen of ancient times, who sought methods to avoid animal losses. It would be recalled that the fingers and toes which nature endowed man with had long become grossly inadequate for most of man's computational needs following the changes that have taken place in humans' needs and lifestyle. To overcome this problem, the early men used the pebbles, sticks or scratches on stone to keep records of animals. Every morning as the sheep left the fold the herdsman would drop one pebble into his pocket as each sheep passed out of the fold gate. On the animals' return in the evening they could all be accounted for by reversing the process until no pebbles were left in the pocket. Each pebble left in the pocket represented a lost sheep and action could be taken to find the animal.

These simple methods were later used to count other possessions, and eventually led to the development of a mechanised pebble counter called the ABACUS. ABACUS was a calculating device which consisted of several rows of beads which slide on sticks or wires mounted in a rectangular frame. This device provided an efficient means for computation. With growth in human development over time, mankind's computational needs became more complex making ABACUS obsolete. In response to the needs of the moment, in 1614, John Napier - a Scottish mathematician did a considerable amount of work on aids to calculation, the most notable of which was the invention of LOGARITHMS in 1614. Then in 1620, six years after the invention of Logarithms, William Oughtred invented the SLIDE RULE which is a calculating device that used the principles of Logarithms. The Slide Rule was used for solving numerical problems such as Multiplication, Division, Squares, Square roots, etc. The use of Slide Rule and Logarithms for mathematical computations was still in use and taught in schools until recently.

In 1623, Francis Bacon invented the BINARY NOTATION for number representations. Binary coding is used extensively in modern computer design. In 1642 Blaise Pascal, a French mathematician devised the first "true calculating machine" purposely to help his father who was a tax collector. This machine was called PASCAL'S ARITHMETIC

MACHINE. In 1671, Gottfried Von Leibnize, a German mathematician invented a calculating machine which was able to perform True Multiplication and Division Operations. This machine was called LEIBNIZ Calculating Machine and incorporated an important new feature - a series of sliders forming a SHIFT Mechanism. The shift mechanism mimics the actions in manual multiplication and division where one works in stages moving from column to column or left to right.

In 1801, Joseph Jacquard, a French textile manufacturer invented the Punch Cards to provide for the storage of results. The cards could contain series of holes and no-hole on both rows and columns to represent series of binary digits of 1's and 0's respectively. Apart from providing for the storage of results, JACQUARD CARD and LOOM provided a mechanized means of controlling weaving looms leading to woven fabric such that complex patterns can be woven to the cloth. Thanks to Joseph Jacquard, information storage methods started to move forward early in the nineteenth century.

In 1822 Charles Babbage, a Professor of mathematics at Cambridge University invented a mechanical computer called DIFFERENCE ENGINE. The Difference Engine was funded by the British Government and was partially completed when C. Babbage conceived the idea of using punch cards already invented by Joseph Jacquard, to provide the input and storage of results. In 1834 Babbage proposed that instructions could be read from one set of cards and data from another set, with the results stored on still another set. The proposed machine, which he called the ANALYTIC ENGINE, even had a primitive decision capability and was essentially a general purpose automatic calculator. Unfortunately, this machine could not be fully realised then due to non discovery yet of electronic switching system. Babbage died in 1871 and could not realise his dream because his ideas were very much ahead of the technology of his time.

By 1854 George Boole, an English logician devised an algebraic system or theory called BOOLEAN ALGEBRA. The Boolean Algebra provided a means for representing and manipulating logical expressions on binary variables. In 1890 Dr. Hermann Hollerith, an American statistician at the United States Census Bureau invented a calculating device called the TABULATORS. The propelling force behind him was because the Census Bureau ran into problems of being able to put together the American 1880 census figure before a subsequent one scheduled for 1890. Hollerith proposed a mechanised solution to the problem which was based upon equipment handling punched cards. His idea was to 'code the data' by representing it with punched hole combinations on the cards. Some equipment was used to punch holes in the cards. Another was used to process the data by detecting holes in the cards. Eventually,

the invention of the Tabulator facilitated the American Census of 1890. For example, whereas the census of 1880 on 50 million citizens took over 7 years to complete, the census of 1890 on 63 million citizens took only 3 years to complete.

In 1900 Valdemar Paulson developed 'Recording devices' which used media of tapes and drums coated with thin films of magnetic material. These paved ways for modern computer data storage devices. In 1906 Lee De Forest of the United States invented the THERMIONIC VALVE. This invention was rated by many as one of the greatest engineering breakthroughs of modern times, the one that gave rise to the field of electronics. He observed that current flow in a diode could be controlled by the field produced by a grid of fine wires placed as a third electrode between the cathode and the anode (or plate). De Forest's invention was the forerunner of the modern VACUUM TRIODE.

In 1907, B. Rosing of Russia proposed to use a cathode-ray tube (CRT) for image reception. The CRT was later adopted as the Video Display Unit (VDU), which now formed the main output unit of the modern computer. In 1937 Alan Turing, an English Mathematician invented the TURING MACHINE. The invention of Turing Machine marked a special turning point in the evolution of our present day computer, because the design was an abstract model of a Real Computer showing how any problem having a logical solution can be reduced to a solution based upon a set of simple instructions (known as program). Also in the same year (1937) Professor Howard Aiken of Harvard University USA, proposed the AUTOMATIC SEQUENCE CONTROLLED CALCULATOR (ASCC) based on a combination of Babbage's ideas and the technology of the Electro-mechanical calculators then being produced by IBM (the International Business Machines). The ASCC was an electrical equivalent of Babbage's Analytical Engine. The construction of this machine, more generally known as HARVARD MARK I, was started in 1939, and sponsored jointly by HARVARD and IBM. The completed machine was dedicated in August 7, 1944 - a date considered by many to mark the start of the Computer Era.

MARK I was successfully realised as a result of the Electronic Switching Circuits already been invented as of this time by Claude Shannon in 1938. Another machine called COLOSSUS was developed in 1941 by the British Intelligence Establishment at Bletchley Park - a machine that facilitated the unlocking of a top secret German code known as ENIGMA during the Second World War in 1943. Scientists who were testing the US' newly designed weapons at the Aberdeen Proving Ground quickly recognised the need for a faster computer than MARK I. As a result, a contract was awarded in 1943 to the University of Pennsylvania to develop a digital computer using VACUUM TUBES instead of Electro-mechanical relays. The result was a machine called

ENIAC (Electronic Numerical Integrator and Calculator) - the world's first electronic digital computer. ENIAC was developed in 1946 by J. Presper Eckert and John Mauchly. The mathematical consultant to the development team was John Von Neumann.

ENIAC contained over 18,000 vacuum tubes (or valves), weighed more than 30 tons and required 15,000 square feet of floor space. It was programmed by setting up to 6000 switches and connecting wires between the various units of the computer. While ENIAC was still under construction, John Von Neumann proposed a totally new computer structure now called the "STORED PROGRAM COMPUTER." Von Neumann suggested that storing the program in memory in much the same manner as data are stored, would make it possible to branch to alternate sequences of instructions, rather than being tied to a fixed sequence. The computer would then be permanently wired to fetch its instructions from memory instead of being rewired for each new program. These concepts together with some new developments in electronics led to the proposal of a new machine called EDVAC (Electronic Discrete Variable Automatic Computer).

In his first draft for a report of EDVAC issued June 1945, Von Neumann set forth a summary of the design requirements for the modern computer as follows:

- a) Binary codes should be used for the representation of Data and Instructions in a way which would make no distinction between them and allows them to be stored together and share the same storage space within the computer.
- b) The computer should be able to process both data and instructions including its modifications.

These two principles formed the basis for the design of stored program computer and the modern computers. As the development of the digital computer involved the efforts of many brilliant individuals, no one person can be said to have invented the computer. Nevertheless, many people consider John Von Neumann to be the single most important figure in the history of the computer.

### **In-Text Questions**

1. What was the first mechanised pebble counter?
2. What was the most notable aid to calculation in the early history of computer?

### 3.2 The Concept of Computer

Generally speaking, a computer can be described as an electronic machine for information processing. However, there are certain characteristics that distinguish the computer from other information processing system. Taking these characteristics into consideration, the computer may be defined as an electronic machine that can accept data, store data, process data and produce information. In other words, computer is an electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program. It can be described as a programmable electronic device designed to accept data, perform prescribed mathematical and logical operations at high speed, and display the results of these operations. Mainframes, Desktop and Laptop computers, Tablets, and Smartphone are some of the different types of computers.

**Program** and **data** are two important terms that are commonly used as computer language. In computing, **a program** is a specific set of ordered operations for a computer to perform. In other words, **a computer program** is a list of instructions that tell a computer what to do. On the other hand, **computer data** is information processed or stored by a computer. This information may be in the form of text documents, images, audio clips, or software programs. It refers to raw facts and figures, concepts or instructions. In other words, **data** can be defined as a representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing, by electronic machine.



1) Monitor. 2) Speaker. 3) Keyboard. 4) Mouse. 5) CPU (Central Processing Unit 6) - Floppy Drive

**Fig. 1: Diagram of a Computer System Unit and the Components**

#### In-Text Questions

1. From the above definition, the computer can be said to perform how many major functions?

2. What are the two important terms commonly used as computer language?

#### **4.0 CONCLUSION**

Haven read this unit and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of the introductory knowledge to computer.

#### **5.0 SUMMARY**

In this Unit, you have learnt the history and development of computers. Also, you have been introduced to the concept of computer, and some important terms that are commonly used as computer language. The assessment and self-assessment exercise have been provided to enable you understand your own rating of the learning and understanding you achieved reading this material in this unit.

#### **6.0 TUTOR-MARKED ASSIGNMENT**

1. What was the Binary Notation invented for?
2. The calculating machine which was able to perform true multiplication and division operation was called....
3. The Punched Card was invented for what purpose?
4. Who devised the first true calculating machine?

#### **7.0 REFERENCES/FURTHER READING**

Bakpo, F. S. (2002). *Introduction to Computer Science*. Unpublished Material, University of Nigeria Nsukka.

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## **UNIT 2 THE CONCEPT OF COMPUTER AND CLASSIFICATION BY GENERATION**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 The Concept of Computer
  - 3.2 Computer Generations
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### **1.0 INTRODUCTION**

There are various definitions of computer. These are given from various perspectives depending upon the author's viewpoint. In this unit, you will learn about the concept of computer, and computer generations.

### **2.0 OBJECTIVES**

By the end of this unit, you will be able to:

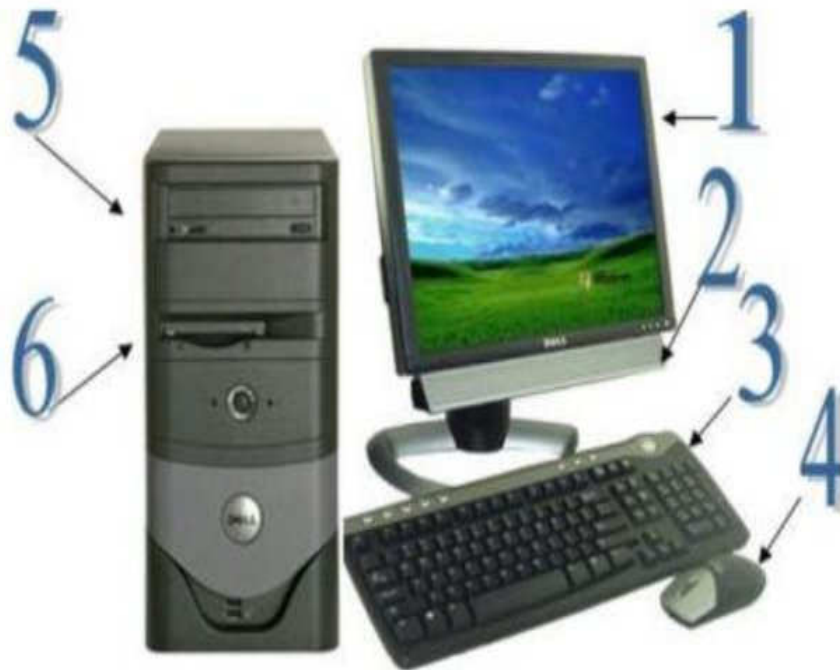
- explain the concept of computer
- state computer generations.

### **3.0 MAIN CONTENT**

#### **3.1 The Concept of Computer**

Generally speaking, a computer can be described as an electronic machine for information processing. However, there are certain characteristics that distinguish the computer from other information processing system. Taking these characteristics into consideration, the computer may be defined as an electronic machine that can accept data, store data, process data and produce information. In other words, computer is an electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program. It can be described as a programmable electronic device designed to accept data, perform prescribed mathematical and logical operations at high speed, and display the results of these operations. Mainframes, Desktop and Laptop computers, Tablets, and Smartphone are some of the different types of computers.

**Program** and **data** are two important terms that are commonly used as computer language. In computing, a **program** is a specific set of ordered operations for a computer to perform. In other words, a **computer program** is a list of instructions that tell a computer what to do. On the other hand, **computer data** is information processed or stored by a computer. This information may be in the form of text documents, images, audio clips, or software programs. It refers to raw facts and figures, concepts or instructions. In other words, **data** can be defined as a representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing, by electronic machine.



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1) Monitor. 2) Speaker. 3) Keyboard. 4) Mouse. 5) CPU (Central Processing Unit)  
6 - Floppy Drive

**Fig. 1.2: Diagram of a Computer System Unit and the Components**

### **In-Text Questions**

1. From the above definition, the computer can be said to perform how many major functions?
2. What are the two important terms commonly used as computer language?

### 3.2 Computer Generations

Generally, computers may be classified according to the following criteria:

- i) Classification by Generations of Computers.
- ii) Classification by Type of Signals or Data Processed.
- iii) Classification by Sizes and Volume of Data Processed.
- iv) Classification by Type of Tasks Performed.

**Computer Generations:** This refers to the classification of computers into the successive stages of development based on major technological improvement. Altogether, five generations of computers can be identified from 1946 to date. The propelling force behind these generations of computers was the fast changing technological advancement of the world particularly the advanced nations of USA, Japan, Britain and so on. These generations with changing technologies are discussed below.

#### 1. The First Generation (1946 - 1954)

First generation computers were large devices that utilised vacuum tubes in their circuitries. Starting with the first they include:

- a) Electronic Delay Storage Automatic Computer (EDSAC): This machine was built at Cambridge University by M.V. Wilkins and first ran in May 1949. EDSAC was the first stored program computer that was actually operational.
- b) Electronic Discrete Variable Automatic Computer (EDVAC): This machine was built at Pennsylvania University, the home of ENIAC and was completed in 1950.
- c) Automatic Computer Engine (ACE): This was built at the National Physics Laboratory in 1951.
- d) Lyons Electronic Office (LEO): This was the 'first commercial computer' produced in 1951 by M.V. Wilkins.
- e) UNIVACI: This machine was produced by UNIVAC (Universal Accounting Company) in 1951. The company was set up by Eckert and Mauchly.
- f) The IAS Machine and a copy of it - the ORDVAC built at the University Illinois, were both completed in 1952.

**In-Text Questions**

1. Basically, how many generations of computer can be identified from 1946 to date?
2. What was the principal memory element of the first generation computers?

**2. The Second Generation (1955 - 1964)**

Second generation computers used 'transistor' instead of vacuum tubes. The transistor was invented in 1948 by a team of scientists headed by William Shockley at the Bell Laboratories in America. Transistors are made from materials called semi-conductor elements, principally silicon and germanium. A transistor is produced by 'doping' layers of crystal with impurities which drastically alter the electrical properties of each layer. They (transistors) are able to perform similar operations to valves, e.g. amplification or switching, but they are simpler to manufacture and less prone to failure, cheaper, smaller, consume less power and have a longer life. For these reasons transistor devices are often called SOLID-STATE devices. The use of transistors in building computers reduced size, manufacturing costs and running cost and improved reliability and processing power. Thus, the second generation computers were smaller, faster and cheaper than first generation machines.

Early second generation models were the IBM 7000 series. In 1962 Manchester University completed what was probably the best known second generation machine, the ATLAS. ATLAS used magnetic disc storage. Magnetic discs resemble gramophone records. Data are recorded on their surfaces magnetically in invisible concentric rings called tracks. Magnetic disks and magnetic cores were the primary internal storage media, while magnetic tapes were secondary storage widely used for input/output of data.

**In-Text Questions**

1. What was the main distinction between second generation and first generation computers?
2. What is the best known second generation machine?

### **3. The Third Generation (1964 - 1970)**

Third generation computers used IC (Integrated Circuits) instead of transistors. After the invention of the transistor it was realised that the properties of semiconductors would allow the production of entire electronic circuits within single crystal. The first IC was patented by Harwick Johnson of RCA in 1953. An entire IC consists of an equivalent of several transistors (or switching circuits). The number of transistors or logic gates embedded in one silicon chip is known as its SCALE OF INTEGRATION. The development of ICs allowed further advances in miniaturization, reliability and the reduction of manufacturing costs of electronic devices. Time sharing, data communications, operating systems, high-level programming languages, and minicomputers were other features of the third generation. The third generation computers using ICs were first released into the market in 1964. Examples are IBM 360 series and the ICL 1900 series.

### **4. The Fourth Generation (1971 - 1980s)**

In the early 1970s two developments led to what many people called the 4th generation computers. First of all, many companies started to use Large Scale Integration (LSI). ICs with the equivalent of more than 100 components are called LSI. Similarly, computer main memory elements emerged in form of Integrated Circuits (IC Memory Chips) instead of magnetic cores, and input/output ports also in form of LSI instead of punched cards, tapes, etc. The second was the development and use of microprocessors. The first microprocessor was the model 4004 produced by the Intel Corporation in 1972. Model 4004 or Intel 4004 was a 4-bit microprocessor system. The 4-bit system implies that it can process four binary digits in parallel at a time. This development led to the design of microcomputers or personal computers (PCs). One of the first microcomputers was the ALTAIR.

Other features of the fourth generation computers include distributed processing, data base management system (DBMS), and enhanced man-machine interactions. The development of microcomputers in the fourth computer generation has been acclaimed as a second computer revolution (an expression which describes the fact that the computer has significantly magnified our ability in all areas of life), because it is bringing computer power to both people and products.

**In-Text Questions**

1. What was the main memory element of the third generation computers?
2. What two major developments led to the fourth generation computers?

**5. The Fifth Generation**

The fifth generation of computers depends on major advances with Very Large Scale Integration (VLSI) and Supper Very Large Scale Integration (SVLSI). ICs consisting of several thousands of logic gates in one chip are called VLSI, while those consisting of tens of thousands of logic gates are called SVLSI. This era may be considered as the state-of-the art today. In this generation both the hardware and software components of the computer are designed to function as Artificial Intelligence (AI) and Expert Systems (ESs). Fifth generation computers are characterised by their large memory capacity and very high processing speed. In fact, computer processing capability is being brought to the users in an organisation through distributed processing and to everyone in society through personal computing and smart products. **Pentium** is an example.

**In-Text Questions**

1. In the fifth generation computers the hardware and software components functioned as what?
2. What are the two main characteristics of the fifth generation computers?

**4.0 CONCLUSION**

Haven completed reading through this Unit, it is assumed that you have learned and acquired the knowledge you are required to have in the unit. The number of questions you answered correctly would indicate to you the amount of learning you have achieved in the unit.

**5.0 SUMMARY**

In this Unit, you have learnt the concept of computer. Also, you have learnt about computer generations.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Which of the following is an example of fifth generation
2. What was the first stored program computer that was actually
3. The first commercial computer produced in 1951 was called.....
4. What is another name for transistors?
5. ICs with the equivalent of more than 100 components are called.....

## 7.0 REFERENCES/FURTHER READING

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## UNIT 3 CLASSIFICATION OF COMPUTERS

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- 2.0 Objectives
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  - 3.1 Classification of Computers
  - 3.2 Computer Generations
  - 3.3 Classification by Type of Signal/Data
  - 3.4 Classification by Size and Volume of Data
  - 3.5 Classification by Task
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### 1.0 INTRODUCTION

Computers differ based on their data processing abilities. They are classified according to purpose, data handling and functionality. According to purpose, computers are either general purpose or specific purpose. General purpose computers are designed to perform a range of tasks. They have the ability to store numerous programs, but lack in speed and efficiency. Specific purpose computers are designed to handle a specific problem or to perform a specific task. According to data handling, computers are analog, digital or hybrid. Analog computers work on the principle of measuring, in which the measurements obtained are translated into data. Digital computers are those that operate with **information**, numerical or otherwise, represented in a digital form. Such computers process data into digital value; they give the results with more accuracy and at a faster rate. Hybrid computers incorporate the measuring feature of an analog computer and counting feature of a digital computer. For computational purposes, these computers use analog components and for storage, digital memories are used.

### 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the criteria by which computers may be classified
- describe the three types of computer
- state computer generations.

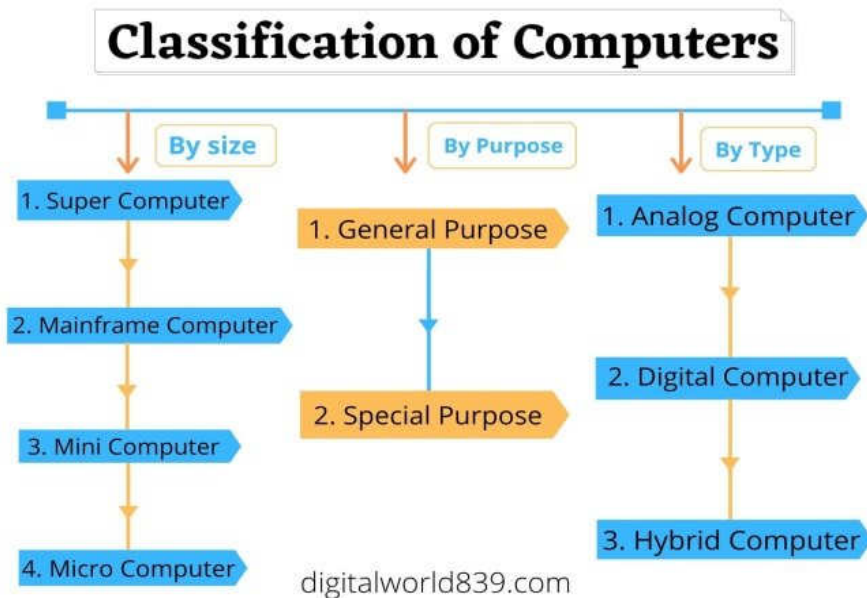


### 3.0 MAIN CONTENT

#### 3.1 Classification of Computers

Generally, computers may be classified according to the following criteria:

- i) Classification by Generations of Computers
- ii) Classification by Type of Signals or Data Processed
- iii) Classification by Sizes and Volume of Data Processed
- iv) Classification by Type of Tasks Performed



#### 3.2 Computer Generations

This refers to the classification of computers into the successive stages of development based on major technological improvement. Altogether, five generations of computers can be identified from 1946 to date. The propelling force behind these generations of computers was the fast changing technological advancement of the world particularly the advanced nations of USA, Japan, Britain and so on. These generations with changing technologies are discussed below.

##### 1. The First Generation (1946 - 1954)

First generation computers were large devices that utilised vacuum tubes in their circuitries. Starting with the first they include:

- a) Electronic Delay Storage Automatic Computer (EDSAC): This machine was built at Cambridge University by M.V. Wilkins and first ran in May 1949. EDSAC was the first stored program computer that was actually operational.

- b) Electronic Discrete Variable Automatic Computer (EDVAC): This machine was built at Pennsylvania University, the home of ENIAC and was completed in 1950.
- c) Automatic Computer Engine (ACE): This was built at the National Physics Laboratory in 1951.
- d) Lyons Electronic Office (LEO): This was the 'first commercial computer' produced in 1951 by M.V. Wilkins.
- e) UNIVACI: This machine was produced by UNIVAC (Universal Accounting Company) in 1951. The company was set up by Eckert and Mauchly.
- f) The IAS Machine and a copy of it - the ORDVAC built at the University Illinois, were both completed in 1952.

### **In-Text Questions**

1. Basically, how many generations of computer can be identified from 1946 to date?
2. What was the principal memory element of the first generation computers?

### **2. The Second Generation (1955 - 1964)**

Second generation computers used 'transistor' instead of vacuum tubes. The transistor was invented in 1948 by a team of scientists headed by William Shockley at the Bell Laboratories in America. Transistors are made from materials called semi-conductor elements, principally silicon and germanium. A transistor is produced by 'doping' layers of crystal with impurities which drastically alter the electrical properties of each layer. They (transistors) are able to perform similar operations to valves, e.g. amplification or switching, but they are simpler to manufacture and less prone to failure, cheaper, smaller, consume less power and have a longer life. For these reasons transistor devices are often called SOLID-STATE devices. The use of transistors in building computers reduced size, manufacturing costs and running cost and improved reliability and processing power. Thus, the second generation computers were smaller, faster and cheaper than first generation machines.

Early second generation models were the IBM 7000 series. In 1962 Manchester University completed what was probably the best known second generation machine, the ATLAS. ATLAS used magnetic disc storage. Magnetic discs resemble gramophone records. Data are recorded on their surfaces magnetically in invisible concentric rings called tracks. Magnetic disks and magnetic cores were the primary

internal storage media, while magnetic tapes were secondary storage widely used for input/output of data.

### **In-Text Questions**

1. What was the main distinction between second generation and first generation computers?
2. What is the best known second generation machine?

### **3. The Third Generation (1964 - 1970)**

Third generation computers used IC (Integrated circuits) instead of transistors. After the invention of the transistor it was realised that the properties of semiconductors would allow the production of entire electronic circuits within single crystal. The first IC was patented by Harwick Johnson of RCA in 1953. An entire IC consists of an equivalent of several transistors (or switching circuits). The number of transistors or logic gates embedded in one silicon chip is known as its SCALE OF INTEGRATION. The development of ICs allowed further advances in miniaturisation, reliability and the reduction of manufacturing costs of electronic devices. Time sharing, data communications, operating systems, high-level programming languages, and minicomputers were other features of the third generation. The third generation computers using ICs were first released into the market in 1964. Examples are IBM 360 series and the ICL 1900 series.

### **4. The Fourth Generation (1971 - 1980s)**

In the early 1970s two developments led to what many people called the 4th generation computers. First of all, many companies started to use Large Scale Integration (LSI). ICs with the equivalent of more than 100 components are called LSI. Similarly, computer main memory elements emerged in form of Integrated Circuits (IC Memory Chips) instead of magnetic cores, and input/output ports also in form of LSI instead of punched cards, tapes, etc. The second was the development and use of microprocessors. The first microprocessor was the model 4004 produced by the Intel Corporation in 1972. Model 4004 or Intel 4004 was a 4-bit microprocessor system. The 4-bit system implies that it can process four binary digits in parallel at a time. This development led to the design of microcomputers or personal computers (PCs). One of the first microcomputers was the ALTAIR.

Other features of the fourth generation computers include distributed processing, data base management system (DBMS), and enhanced man-machine interactions. The development of microcomputers in the fourth computer generation has been acclaimed as a second computer revolution (an expression which describes the fact that the computer has

significantly magnified our ability in all areas of life), because it is bringing computer power to both people and products.

### **In-Text Questions**

1. What was the main memory element of the third generation computers?
2. What two major developments led to the fourth generation computers?

### **5. The Fifth Generation**

The fifth generation of computers depends on major advances with Very Large Scale Integration (VLSI) and Supper Very Large Scale Integration (SVLSI). ICs consisting of several thousands of logic gates in one chip are called VLSI, while those consisting of tens of thousands of logic gates are called SVLSI. This era may be considered as the state-of-the art today. In this generation both the hardware and software components of the computer are designed to function as Artificial Intelligence (AI) and Expert Systems (ESs). Fifth generation computers are characterised by their large memory capacity and very high processing speed. In fact, computer processing capability is being brought to the users in an organisation through distributed processing and to everyone in society through personal computing and smart products. **Pentium** is an example.

### **In-Text Questions**

1. In the fifth generation computers the hardware and software components functioned as what?
2. What are the two main characteristics of the fifth generation computers?

### **3.3 Classification by Type of Signal/Data**

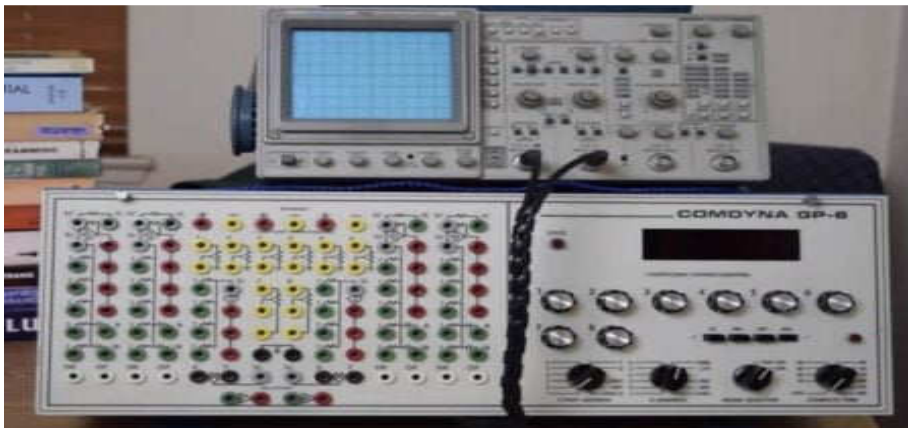
On the basis of the types of their processing signals or information, there are basically two different types of computers: ANALOG and DIGITAL.

#### **Analog Computer**

Is a type of computer which processes information or data in form of continuously varying signals. Examples of such continuously varying signals are electrical current, voltage, temperature, pressure, etc. Analog computers are fast but not extremely accurate. In other words, an analog computer performs tasks using continuous data (the physical amount that changes continuously). For example, an analog computer installed on a petrol pump measures the amount of petrol coming out of the pump

which appears in liters, and calculates its value. These quantities vary continuously while measuring the amount, such as the temperature of a human body changes consistently. A simple clock, the vehicle's speedometer, Voltmeter, etc. are examples of analog computer.

Analog computers are used primarily to measure physical units like voltage, pressure, electric current, temperature, and convert them into digits. It is also used to measure and perform arithmetic calculations of numbers, the length of an object, or the amount of voltage that passes through a point in an electrical circuit. Analog computers obtain all their data from some measurement way. They are mainly used in the fields of technology, science, research, engineering, etc. Because quantities like **voltage, pressure, electric current, temperature** are used more in these areas. These types of computers give only approximate estimates. The efficiency of this computer increases when we get the result of the data in graphs, etc. Analog computers are slow and equipped to measure things, they **cannot** store statistics.



**Fig. 1. 3: Analog Computer**

### **Digital Computer**

Is a type of computer which processes discrete or non-continuous signals. Examples of such discrete signals are Counting, On/Off states of Electronic devices, etc. A digital computer is usually more accurate and can be exact to more than 16, 32, and 64 digits. Some manufacturers of computers have attempted to combine the Analog and Digital to form a HYBRID computer. Computers used in stimulating guided missile system, where both forms of signals are involved are called Hybrid.

### **Features of Digital Computers**

Digital computers are general-purpose machines, i.e., they can solve virtually all kinds of problems. These computers have a large internal memory, where millions of characters can be entered. Digital computers

are used to process both **numeric as well as non-numeric data**. It can also perform many arithmetic operations such as addition, subtraction, multiplication, division, and logical operations. These types of computers are suitable for solving many problems, and therefore are very popular. They are commonly used in all places. Such as at the home, office, shop, railway, hotel too, etc. Other applications include business, banking, [education](#), entertainment, etc. These computers are precise because they provide the exact answer to a specific problem. Most of the computers which are available at present are all digital computers. Digital computers mainly represent the [5th generation of computers](#).



**Fig. 1. 4: Digital Computer**



**Fig. 1. 5: Other Example of Digital Computer**

## Working of Digital Computers in simple Terms

Digital computers work in four steps:

1. Read input
2. Save the input to the memory
3. Processing data
4. Provide the output

## Examples of Digital Computers

- Personal Computers (Desktops and Laptops),
- Smart phones, and Tablets,
- Calculators,
- Digital Weighing Machine,
- Accounting machines,
- Digital clock,
- ATM (Automated Teller Machine).

## Uses of Digital Computer

- **Scientific research:** Digital devices are used to solve mathematical calculations, numerical counts, etc.
- **Technical applications:** these are applications where digital tools are used to facilitate engineering designs, drawing plans, commercial product designs, etc.
- **Control systems:** consist of remote control mechanisms designed for use in private and industrial homes. Such as electrical appliances, turning the lights on or off, defrosting the refrigerator, regulating the heating or air conditioning, starting the coffee maker, etc.

## Advantages of Digital Computer

1. Digital systems have made possible many industrial, scientific, and commercial advances that would have been unattainable otherwise.
2. Information or data can easily store in digital computer systems as compared to analog ones. Also, many additional features and units can often be added to a digital system more efficiently.
3. If we talk about results, then digital computers provide more accurate results than analog computers but, Analog computers are much faster than digital.

4. Other merits of digital computers are more reliability, flexibility, versatility, compatibility, less expensive, and easy to manipulate.

### **Disadvantages of Digital Computers**

1. Digital systems consume more energy than analog circuits to accomplish the tasks, thus producing more heat.
2. The Digital circuits are often fragile. If a single piece of digital data is lost or misinterpreted, the meaning of large blocks of related data can completely change.
3. Digital computers manipulate discrete elements of information by using a machine language (binary code)

### **Hybrid Computer**

This system has the feature of both analog and digital computer. It can measure quantity in continuous flow as well as those in discrete values. The system used in electric meter reading is hybrid; it converts the quantity of flow of current (analog) into digits (digital), which are later converted to appropriate currency. Auto Gasoline pump is another example of a hybrid computer; this device is installed on a petrol pump not only to measure the amount of petrol but also to calculate its value. In this way it is capable of both functions i.e. **hybrid function**.

In other words, a hybrid computer is a combined complex computer unit built using both **analog and digital** properties and united by a single control system. The purpose of designing hybrid computers is to provide functions and features that can be found on both analog and digital devices. The aim behind creating a hybrid computer is to create a kind of work unit that offers the best of both types of computers. Hybrid computers are extremely fast when driving equations, even when those calculations are incredibly complex.

As both the properties of a computer consist in the form of a single hybrid computer made possible **to solve too complex calculations or problems**, at the same time, these devices are not only too expensive but also able to solve complex issues a bit faster. Incorporating the properties of both (analog and digital) computers into hybrid computers makes it possible to resolve more difficult equations immediately. The analog computer systems solve the equation process immediately. But it is not necessary that those solutions would be completely accurate. Here, the digital computer system gives 100 percent correct solutions, but it takes a bit of time in the calculation. Therefore, Hybrid computers are made to overcome the flaws of both analog and digital systems.



## Applications of Hybrid Computer

Hybrid computers are most commonly used in vast industries, research centers, organisations, and manufacturing firms (where many equations need to be solved). Also, the solutions and uses of hybrid computers have proved to be much more detailed, accurate, and useful. Hybrid computers are used in scientific calculations, for nations' defense and radar systems as well.

### In-Text Questions

1. On the basis of type of signal/data, computers may basically be classified into how many types?
2. Digital computers can solve virtually all kinds of problems; True or False?
3. Computers used in stimulating guided missile system are called what?
4. A computer that uses a discrete signal for its operation is called what?
5. Digital computers are more flexible and easy to manipulate than analog computers; True or False?
6. Analog and digital computers do not differ in the way information is transmitted; True or False?

## 3.4 Classification by Size and Volume of Data

On the basis of their sizes and volume of data processed, computers may be classified under the following broad headings:

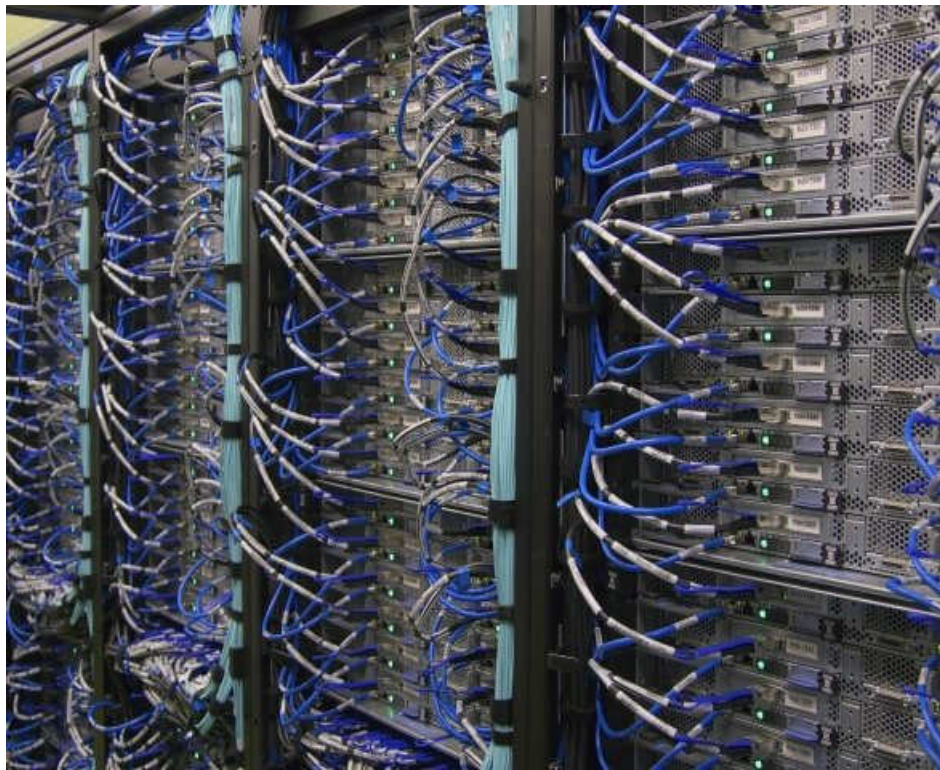
### a) Mainframe (Or Large Computers)

These are the largest and most powerful of all the computers. They are generally about the size of a room and are designed to work at very high speeds and process very large data words. The mainframe is quite expensive and the high cost is a direct consequence of its general purpose capability. You can use this type of computer to prepare payroll for staff and athletes, make inventory and perform calculations. Examples are the IBM 370, ICL 3900 Series, CDC 6600, etc.

Mainframe computers are multi-programming, high-performance computers, and multi-user, which means it can handle the workload of more than 100 users at a time on the computer. The storage capacity of the mainframe is enormous, with a high-speed data processing as well as handling hundreds of input and output devices at a time. It is a highly efficient computer capable of simultaneously solving complex calculations and continuously for a long time. These

computers have several microprocessors that have the ability to process data at too high performance and speed.

The mainframe is ahead of our conventional modern Personal computers in almost every metric. The possibility of their “hot” replacement in the mainframe computer ensures continuity of operation. And the standard amount of processor utilisation effortlessly exceeds 85% of the total power. Somehow mainframes can be more powerful than supercomputers because the mainframe supports many processes simultaneously. On the other hand, supercomputers can run a single program but faster than a mainframe. In the past, Mainframes requires entire rooms or even floors of whole buildings for set up.



**Fig. 1. 6: Mainframe Computer**

### **Applications (Uses of Mainframe Computer)**

Mainframe computers are mainly used by departmental and commercial organisations like Banks, Companies, Scientific research centers, and governmental departments like railways. These computers can work for 24 hours. Hundreds of users can work on these computers simultaneously to complete tasks, such as keeping details of payments, research centers, advertising, sending bills and notices, paying employees, ticket booking, maintaining details of purchases by users, keeping detailed tax details, etc.

## b) Minicomputers (Or Medium-Sized Computers)

These are physically small compared with Mainframes and tend to be used for special purposes or small scale general purpose. Examples are the Digital PDP11, IBM 800 Series, VAX, etc.

### Features of Minicomputers

Minicomputer is a **digital and multi-user** computer system with the connection of more than one CPU. Thus, many people can work on these computers simultaneously instead of a single person. Also, it can process with other accessories like a printer, plotter, etc. *In other words*, Minicomputers are the medium type of computers that have more functionality power and expensive than microcomputers. On the other hand, the size, storage, and speed of minicomputers are **large but less than** the mainframe and supercomputers. They are made for performing a lot of computations at a single point of time, instead of assigning many microcomputers for every task, which will be time-consuming and expensive.

In general, a minicomputer is a multi-threaded system (several processes at a time) capable of supporting from one to up to 200 users simultaneously: these computers are currently used to store large databases, multi-user applications, and the automation industry. The minicomputers are used as real-time applications in Industries, bookings, and Research Centres. Banks also use minicomputers for preparing payroll for employees' salaries, records, tracking of financial accounts, etc., as well as in the field of [Higher Education](#) and Engineering.



**Fig. 1. 7: Minicomputer**

### c) Microcomputers (Or Small Computers)

These are microprocessor based systems and hence relatively small in size and cheap. Adding just additional circuitry to the microprocessor chip had made it possible to build a complete microcomputer. Microcomputers have found a wide usage in areas of business, education and homes and are sometimes called personal computers (PCs). PCs can further be categorised into Desktop, Laptop and Notebook-size computers.

In other words, the design of microcomputers is minimal in size and storage capacity. These computers consist of many parts like Input and Output devices, Software, Operating systems, Networks, and Servers, all these need to connect to form a complete Personal Digital Computer. Other examples of the microcomputer are Smart phone, Tablet, Server, Palmtop, and Workstation. This can be installed in any work area or even at home for personal use. The primary purpose of microcomputers is to keep and process everyday tasks and needs of the people. Only one person can work on a [single PC](#) at a time, but its operating system is **multitasking**. The PC can be [connected to the Internet to take benefits](#) and enhance the user experience.



**Fig. 1. 8: Types of Microcomputer**

### Applications (Uses of Microcomputer)

Personal Computer is being widely used in many fields like home, office, data collection, [business](#), education, entertainment, publishing, etc. It keeps the details and prepares letters for correspondence in small

businesses, creating bills, accounting, word processing, and operation of the filing systems in a large company. Some of the major PC manufacturers are IBM, Lenovo, Apple, HCL, HP, etc.

### In-Text Questions

1. The high cost of mainframe computers is a consequence of what characteristic?
2. What is another name for Microcomputers?

### 3.5 Classification by Tasks

As noted earlier, modern computers are designed based upon the stored program concept requirements of John Von Neumann. Consequently, the functions/tasks a computer can perform depend on the type of programs stored in it. For this reason, three types of systems can be distinguished as follows:

- 1) **Embedded System:** In this the microprocessor acts primarily as a controller and its existence may be unknown to the user. An embedded system has no operating system, and typically implements a fixed or dedicated function, as in toys, thermostats, automobiles, and appliances.
- 2) **General-Purpose System:** The general purpose computers are those systems that have the ability to store different programs of instructions with which they can perform a variety of operations or tasks depending on the program the user selects for execution. A general purpose system may have either a single-user single-tasking operating system or a multi-user multi-tasking OS. Examples of general-purpose computers are PCs and Mainframe Systems.
- 3) **Special Purpose System:** Special-purpose computer systems are computers designed to carry out special functions and usually have special program of instructions built into them. A special purpose system may have a special type of Operating System called **Process Control**. Areas of application include production control of a refinery, missile production and testing. Special-purpose systems perform jobs more economically, quickly and with a higher level of efficiency.

### In-Text Questions

1. The function or task a computer can perform depends on what?
2. What are some examples of general purpose computers?

## **4.0 CONCLUSION**

Haven completed reading through this Unit, it is assumed that you have learned and acquired the knowledge you are required to have in the unit. The number of questions you answered correctly would indicate to you the amount of learning you have achieved in the unit.

## **5.0 SUMMARY**

In this Unit, you have learnt the criteria by which computers may be classified, such as computer generations, type of signal or data processed, size and volume of data processed, as well as type of tasks performed. Also, you have learnt types of computer.

## **6.0 TUTOR-MARKED ASSIGNMENT**

1. Which of the following is an example of fifth generation computers?
2. What was the first stored program computer that was actually operational?
3. The first commercial computer produced in 1951 was called.....
4. What is another name for transistors?
5. ICs with the equivalent of more than 100 components are called.....
6. One can classify the computer system in the following classes
7. General computers have the ability to do which of the following common tasks?
8. Which of the following fields are special computers not used?

## **7.0 REFERENCES/FURTHER READING**

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## **UNIT 4 THE COMPUTER SYSTEM AND ITS INPUT UNIT**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 The Computer System
  - 3.2 The Input Unit
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### **1.0 INTRODUCTION**

We are all aware of what computers are and their immense importance in our daily lives. It is an electronic device that not only stores data but also process and manipulates data to carry out functions. Upon receiving instructions, a computer can perform a variety of operations. What allows us to perform such tasks on the computer is a computer system. A computer system is the sum total of all the components (hardware and software) that makes up a fully functional computer.

### **2.0 OBJECTIVES**

By the end of this unit, you will be able to:

- state and explain two basic components of a computer
- explain the two types of computer software
- identify some input devices of a computer.

### **3.0 MAIN CONTENT**

#### **3.1 The Computer System**

Computers are automatic electronic machines that can: accept (read) data; store the accepted data in its memory; manipulate the data according to instructions stored in the computer's memory; produce intelligible reports (results) from the manipulated data. Based on the above definition, the computer has four functions. A computer system consists of series of components **hardware** (i.e. physical parts or components of the computer that we see) and **software** (i.e. a program or set of instructions that the computer use to perform a task or work)



that are brought together to do the work required by a specific person or organisation. There are two types of computer software, these include: **System Software (Operating System), and Application Software.**

**a) System Software (Operating System):** Is a program or set of instructions that interface between the computer hardware, application software and computer operator. The operating system is the controller or manager of the resources of the computer. Functions of the operating system includes: communicating with user through the monitor, loading and unloading programs, controlling and monitoring all information transferred. Examples of operating system are: MS-Windows 3, MS-Windows 98, MS-Windows 2000, Vista, MS-Windows 7, and MS-Windows 8.

**b) Application Software:** This software is developed to provide specific clients solution. Examples include: Word processing software, Spreadsheet, Database management system, Desktop publishing, Games, etc.

To fit individual jobs or organisations that they support, computers come in a wide range of sizes and capacities. In this course, we will concentrate on a specific type of computer, one which fits on a desktop and is known as a personal computer (PC) or microcomputer. The term, microcomputer, reflects the design of these desktop systems: all computing and operational controls are applied by a microprocessor built on a tinny electronic chip about the size of your finger nails.

### **In-Text Questions**

1. What are the two basic components of a computer system?
2. What are the two types of computer software?

### **3.2 The Input Unit of a Computer**

In computing, an input device is a piece of equipment used to provide data and control signals to the processing unit. Thus, the computer is really a collection of separate items working together as a team. A typical computer usually consists of FOUR main components, namely:

- 1) The Input Unit
- 2) The Memory Unit
- 3) The Central Processing Unit (CPU)

#### 4) The Output Unit

The means by which we communicate with the computer are called Input/output devices. The most commonly used in today's computer system are described below.

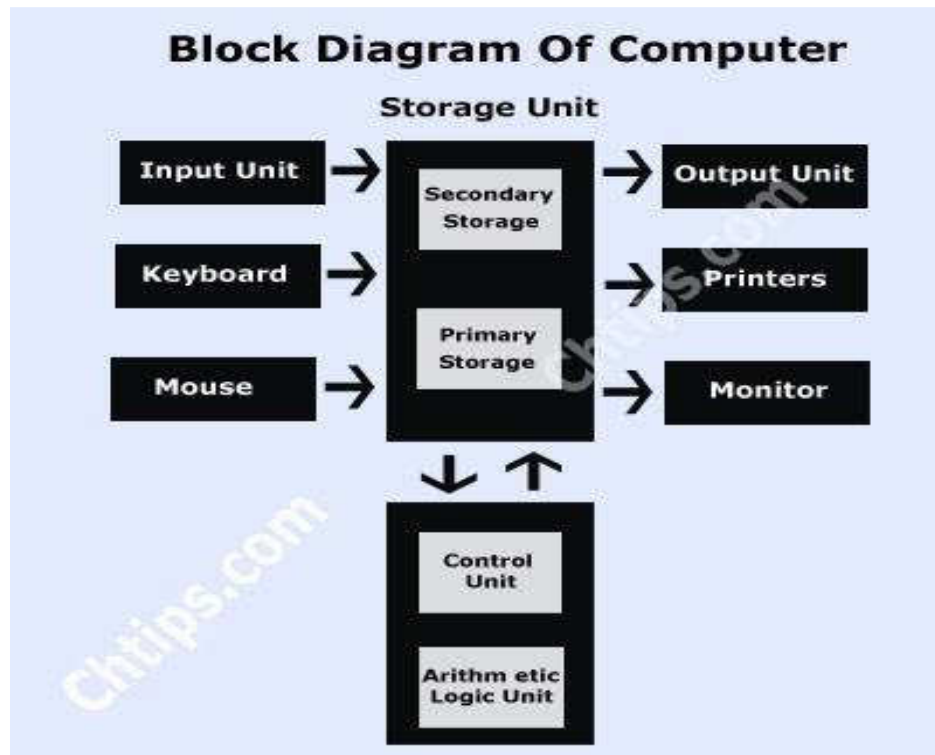


Fig. 1. 9: Structure of a Typical Computer

#### 3.2.1 Input Devices

**Input device** can be defined as an electro-mechanical device that allows a user to input the data into a computer, by usually typing on a keyboard, or by clicking a mouse, we input data into the Computer. The data is processed into the main memory through the input device. The Computer accepts instructions from the user and converts the received instruction into machine language. Each input unit of a computer system **reads** data or program from a specific format in a medium and **converts** it into electronic pulses. It then transmits these pulses to an area in the CPU. Examples of input devices or peripherals are: Punch-Card Readers, Punched Paper Tape Reader, Magnetic Tape Device, Magnetic Disk Drive, Optical Character Recognition (OCR) Readers, Tele-Typewriter Terminal, Mouse, Keyboard, Joystick, Light pen, Scanner, etc.



**Fig. 1.10: Input Devices of Computer**

### 1. Keyboard



**Fig. 1.11: Keyboard**

The keyboard is one of the most prominent input devices of the computer. It operates similarly to typewriters. The keyboard is designed

to input text, numbers and characters. By using a keyboard, we do entire writing work on the computer. Physically, the keyboard of a computer is rectangular. It has a set of keys or buttons arranged horizontally, containing about **108 Keys**, which act as electronic switches or mechanical levers, allowing us to the entry of information encoded to the computer system by pressing the keys. It is probably the primary **means of communicating** between the user and the computer system. The buttons of the input devices of the computer's keyboard is divided into:

### A. Alphanumeric



The above image of Alphanumeric Keys is located in the center of the keyboard. This part is most important because it consists of **Alphabets (A-Z), Number (0-9), Symbol (@, #, \$, %, ^, \*, &, +, !, =)**. In addition to keys of **digits, symbols, and alphabet, there are four keys: Tab, Caps, Backspace, and Enter** for some specific functions.

### B. Functions keys



The above are the 12 keys situated on the top of the computer keyboard, which reside in the same line known as function keys. The keys are starting from F1 to F12. These keys are helpful in using the instructions as shortcuts. The functions of these keys vary as per the software.

### C. Numeric keys

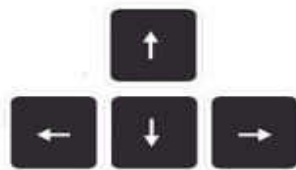


The numeric keypad consists of about 17 keys (*the pattern of keys can differ from keyboard to keyboard*), **with numbers 0-9, Mathematics operators like – +, -. \*, / and Enter button.**

### D. Special purpose keys

These special keys are used to perform specific tasks such as *Sleep, Power, Shortcut, Esc, Tab, Insert, Volume, Start, Home, End, Delete, etc.* These keys correspond to certain functions of the new operating system.

### E. Cursor keys



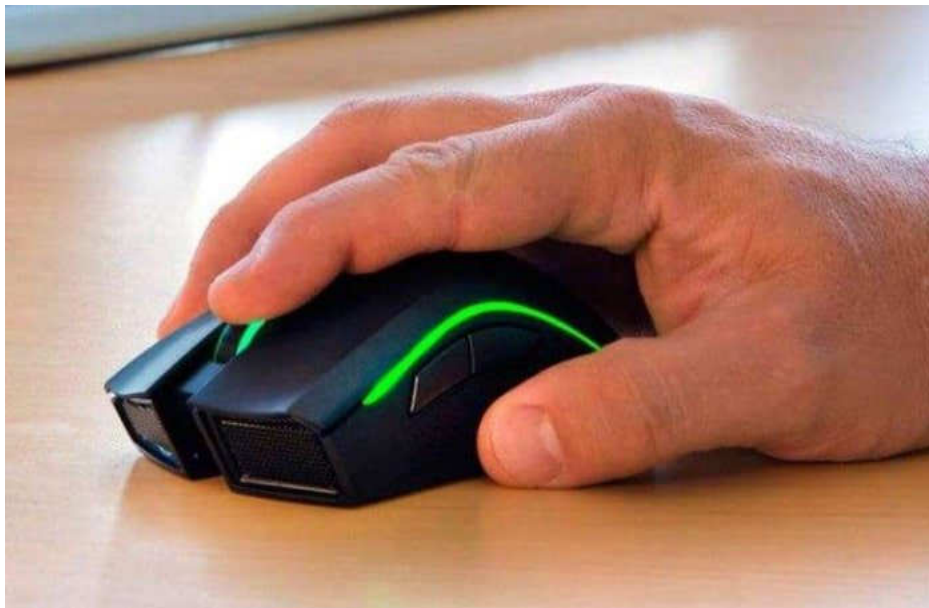
These cursor keys include UP, DOWN, LEFT, and RIGHT. They can be used to move the cursor on the screen.

## F. Modifier keys



It consists of three keys, i.e. **SHIFT, ALT, CTRL**. There is no special use on pressing them alone, but in combination with any other key; they change the input of those keys. Hence these modifiers are also known as call keys.

## 2. Mouse



**Fig. 1.12: Mouse**

The Mouse is the input device of the computer, also known as a pointing device and Cursor Moving Device. It is, along with the keyboard, one of the most **widely used** examples of input devices today. Its function consists of detecting the movement when being moved on a flat surface and inputting this information so that the [CPU interprets](#) it and, thus, the mouse pointer imitates the movement on the computer screen.

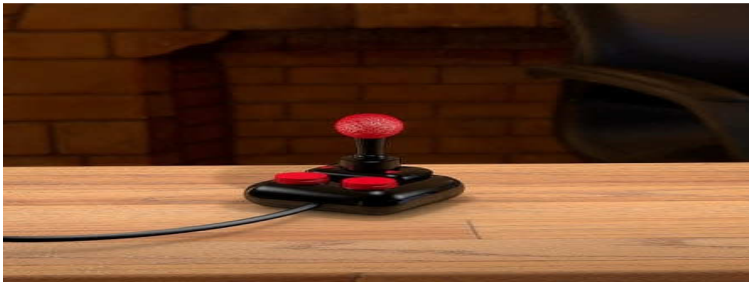
A Mouse can have 2 or 3 buttons and a scroll on the upper side. Like Left, Right, and Middle key Roller. The use of Mouse is to control the computer, create images, and other essential functions. With the help of a mouse, we can control our PC without even a keyboard. The Mouse is placed on the Flat Surface or Mouse Pad, which is used to control the Cursor. By **Left-Clicking, Double Clicking, Right-Clicking, Dragging, Scrolling**, we can do basic tasks like select, open, delete the files and folders.

A **rubber ball or Laser Light** is attached below it. When the Mouse moves on a surface, the rubber ball rotates, or laser light also moves. The speed and direction of the Mouse convert into the [monitor's screen](#) cursor; this is how the Mouse works. However, with the development of technology, the Mouse has come to be used without wiring for more efficiency. Wireless mouse **gives you freedom** from the mess of wire. It communicates to your computer with the help of radiofrequency technology. The wireless Mouse consists of two main components: transmitter and receiver. The transmitter is in the Mouse which sends the information of the Mouse's speed and its click in the form of an [electromagnetic signal](#) (Signal) to the receiver. The receiver is connected to your computer, which receives that signal.

There are different types of mouse, these include:

1. Optical Mouse
2. Wireless Mouse
3. Laser Mouse
4. Gaming Mouse
5. Trackball Mouse
6. 3D Mouse
7. Mechanical Mouse
8. Ergonomic Mouse
9. Stylus (Pen mouse)

### 3. Joystick



**Fig. 1.13: Joystick**

The joystick is another input devices example that is a vertical stick-shaped device that looks like a movable vertical handle. With the help of this computer input device, we can move the cursor in any direction on the screen. It resembles a gear lever or an aircraft control stick. **Most often it contains buttons, switches, and sliders.** The button is usually at the top of it which is used to select the option indicated by the cursor. It is often used by children to play games on the computer because this is an easy way to teach children to use computers. Although the keyboard or mouse can play all computer games, some games require **playing at a fast pace.** So, in this case, gamers by using joystick do not feel uncomfortable playing such games.

### Advantages

- The user can play more comfortably because there are fewer buttons, but he has the necessary ones to carry out the different tasks.
- It has fundamental buttons for some functions. As they also consist of elementary buttons for other actions, whether direct from the simulators, game, or multimedia.
- In the case of some games, **joysticks can facilitate play, such as FIFA and PES.**
- They are compact, comfortable, and mostly small.



Fig. 1.14: Gaming Simulator Joystick



## 4. Trackball



**Fig. 1.15: Trackball**

The trackball is a pointing device like a mouse but a bit different input device of a computer. It has a raised ball and some buttons. Naturally, while holding, you have your thumb on the ball, and your fingers are on the button, which is used by manually rotating by the fingers.

### Advantages of Trackball Over Mouse

- 1. Scroll:** It is an external roller that allows you to rotate up and down, thus smoothly moving the screens, in addition to having the function of a button since it can be pressed to keep the screen moving.
- 2. Function buttons:** These side buttons allow programming, to perform specific functions in the Internet browser or for particular tasks that the user wishes.
- 3. Trackball:** Means track-sphere. It is built into specific wireless mouse models; It has the function of giving movement to the screens in **360°** and not only from top to bottom like the Scroll, very practical for use in video games for graphic designing applications.

The uses of trackballs became very common in laptops and computers because they easily fit into the case, as it occupies relatively **less space to use**. They are considered more **accurate and durable than a mouse**, which is why they are still used a lot. People with mobility problems often use trackballs as an input device, since a trackball is **more**

**comfortable to manipulate** and the buttons can be activated without affecting the position of the pointer.

## 5. Digital Camera



**Fig. 1`16: Digital Camera**

Digital cameras are other examples of input devices, most common in the world today. A digital camera is a **photographic input device** in which the image or video is recorded on a Charge Coupled Device (CCD) system and stored in digital form in memory cards. It can not only capture and digitise an image but also record sound and shooting parameters. The digital camera allows us to take a photograph and immediately create a document in standardised formats for the computer or other devices. The camera uses its CCD sensor as its focal plane. The cameras are used by **both people who are interested** or not in photography to capture memorable moments, and professional photographers.

### **Advantages of Digital Camera**

- Images recorded (input) with a digital camera can be displayed on the screen immediately.
- Thousands of photos can be stored in a small memory card.
- To free up space in it, stored images or videos can also be deleted.

- In some digital cameras, it is also possible to **crop images** as required.

## 6. Scanner



**Fig. 1.17: Scanner**

Another computer input device's examples are scanners. A scanner is a digital input device that is used to scan hard copy images, printed text, and objects and then convert it to a digital format. How we use the printer to extract prints in different colors, so also we can scan any document to save on the computer. Since the document converts into an image in digital form so that it can be stored in the computer or can be edited, its best advantage is that the user is just required to type the information. The possibility of errors in capturing such information has reduced.

It is also known as the Xerox machine. Image scanners are used in a variety of domestic and **industrial applications such as design, gaming, reverse engineering, and testing.**

## 7. Bar Code Reader

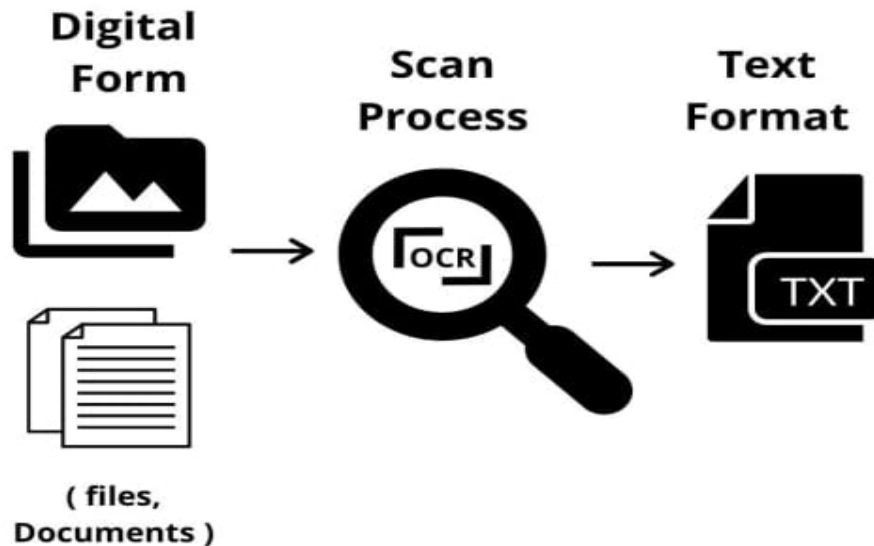
A barcode reader device used to input data from a barcode. It is used to read the bar code printed on any product by code bar. Barcode reader detects existing data in barcodes **by hitting beams of light on barcode lines.** In such a way, information obtains. The Barcode Scanner scans the data that can be saved very quickly on the computer. **This saves both time and physical exertion.** And the chances of mistakes have been reduced. Barcode systems and readers are examples of input

devices used mostly in commercials; they proved to be very helpful in businesses. With the help of a barcode, big companies can track their products. You can quickly know the Prices and Stocks Level from the bar code. Companies use this in their Computer Centralised System to increase their efficiency and productivity.



**Fig. 1.18: Barcode Reader**

#### 8. OCR (Optical Character Recognition)



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The full form of OCR is “**Optical Character Recognition**“. OCR is a technology used to read numbers, letters, or symbols in digital format. The characters and symbols can be read through the **light source**. OCR

is commonly used to recognise text by scanning documents in digital form. While OCR technology was initially designed to recognise printed text written by typewriters, it can also be used to identify and verify the book written by hand.

OCR is used mostly in the following fields:

- Banking
- Cloud Storage
- Invoice automation
- Form automation
- Information retrieval
- Healthcare

## 9. Biometric Machine



**Fig. 1.19: Biometric Machine**

A Biometric system is an example of input devices of a computer that identifies a person through biometric sensors. With the help of a biometric machine, a **person's details** can be identified by their face, finger, eyes, voice, or thumb impression. It is mainly used for **security purposes** to prevent unauthorised from entering a specific area. It is used as attendance for employees/students in institutions. Since biometric sensors are operating with accuracy, they are widely used in many institutions.

### Types of biometric devices

**Face scanner:** It is used to recognise a person's face. It measures the distance between one's mouth, eyes, and nose, sufficient to identify a person.

**Hand scanner:** Used to scan a person's palm to identify a person.

**Finger scanner:** It scans the fingerprint of a person to identify a person and his details.

**Retina/iris scanner:** It is used to identify a person by scanning his Eyes.

### 10. Microphone



**Fig. 1.20: Microphone**

Mics or microphones are examples of input devices. A microphone is a device that converts sound vibration into an electronic signal which is listened to through speakers. Such applications and software have significantly contributed to the filmmakers. Through this, we can send recorded or live sound to a computer microphone. The microphone is used in a voice recorder, online chatting, singing, etc. Nowadays, microphones are also being used as speech recognition software. This means that we do not have to type but speak and the words that were spoken appear in our document, which we know as The Speech Input Device. The significant **benefits of mics are that they are minimal and cheap and have good response sensitivity.**

### **In-Text Questions**

1. What is another name for electro-mechanical parts of the Computer?
2. The computer accepts instructions from the user and converts them into what?
3. One of the most prominent input devices of the computer is the --  
-----

### **4.0 CONCLUSION**

Haven read this Unit and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of the computer system and its input unit.

### **5.0 SUMMARY**

In this Unit, you have learnt about the computer system and its input unit. The assessment and self-assessment exercise have been provided to enable you understand your own rating of the learning and understanding you achieved reading this unit.

### **6.0 TUTOR-MARKED ASSIGNMENT**

1. What is another name for the physical components of a computer?
2. The operating system of a computer is also known as
3. Which of the following is not an example of a computer mouse?
4. What is another name for a set of instructions used by a computer to perform a task?
5. Any hardware device that sends data to a computer, allowing you to interact with and control it is called -----

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## MODULE 2

### UNIT 1 COMPUTER MEMORY

#### CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 The Memory Unit
  - 3.2 Types of Memories
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

#### 1.0 INTRODUCTION

Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called **Cells**.

#### 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain computer memory
- identify some basic computer memories.

#### 3.0 MAIN CONTENT

##### 3.1 The Memory Unit

The [concept of memory and storage](#) can be easily conflated as the same concept; however, there are some distinct and important differences. **Memory** is most often referred to as the primary storage on a computer, such as RAM. Memory is also where information is processed. It enables users to access data that is stored for a short time. The data is only stored for a short time because primary memory is volatile, meaning it isn't retained when the computer is turned off. The term **storage** refers to secondary memory and is where data in a computer is kept. An example of storage is a hard drive or a hard disk drive ([HDD](#)). [Storage is nonvolatile](#), meaning the information is still there after the computer is turned off and then back on. A running program may be in a computer's primary memory when in use -- for fast retrieval of information -- but when that program is closed, it resides in

secondary memory or storage. How much space is available in **memory and storage** differs as well. In general, a computer will have more storage space than memory. For example, a laptop may have 8 [GB](#) of RAM while having 250 GB of storage. The difference in space is there because a computer will not need fast access to all the information stored on it at once, so allocating approximately 8 GB of space to run programs will suffice.

Although CPU is the brain behind all the operations in your computer, it needs to be supplied with the data to be processed and the instructions to tell it what to do. Once the CPU has carried out each instruction, it needs somewhere to store the result. This storage space is provided by the computer's memory. The computer's memory is the source or destination of all the information flowing to or from the other components of the computer. It may be regarded as a collection of storage locations or cells served for storage and issuing of sequences of software instructions (i.e. programs) and transient information (data) used during processing. Computer memories are usually organised into locations, with each location assigned an address by means of which that location (or content of it) may be accessed by the processor.

### 3.2 Types of Memories

A single computer may employ a hierarchy of memory devices of varying speed and capacity ratios. Generally, the computer has two types of memory:

- a) **Primary (or Main) memory:** This is the main memory of the computer. CPU can directly read or write on this memory. It is fixed on the motherboard of the computer. Primary memory is further divided in two types:

1. RAM (Random Access Memory)



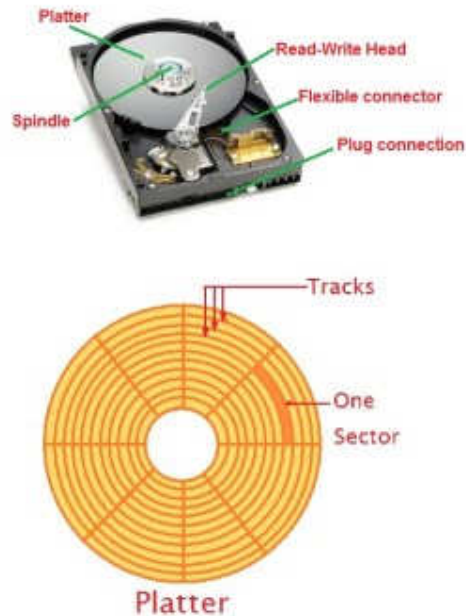
2. ROM (Read Only Memory)



**Fig. 1.21: RAM (Random Access Memory)**  
(Read Only Memory)

**Fig. 1.22: ROM**

**b) Secondary (or Auxiliary) memory:** This memory is permanent in nature. It is used to store the different programs and the information permanently (which were temporarily stored in RAM). It holds the information till we erase it. Different types of secondary storage devices are: Hard Disc, Compact Disc, DVD, Pen Drive, Flash Drive, etc.



**Fig. 1.23: Hard Disc**

The Hard Disc is the main storage device of the computer which is fixed inside the CPU box. Its storage capacity is very high that varies from 200 GB to 3 TB. As it is fixed inside the CPU box, it is not easy to move the hard disc from one computer to another. A hard disc contains a number of metallic discs which are called platters. Information is recorded on the surface of the platters in a series of concentric circles. These circles are called Tracks. For the purpose of addressing information, the surface is considered to be divided into segments called

Sectors. This division helps in the proper organization of data on the platter and helps in maximum utilization of the storage space.



**Fig. 1. 24: Compact Disc (CD)**

**Compact Disc (CD)** is a thin plastic disc coated with metal. Computer can read and write data stored on it. This is an optical storage device with a storage capacity of up to 700 MB and it can store varieties of data like pictures, sounds, movies, texts, etc. CDs are slow in comparison to hard discs to read or write the information on them. They are portable storage devices.

**CD-ROM:** Refers to Compact Disc-Read Only Memory. Data or information is recorded at the time of manufacturing and it can only be read. A CD-ROM cannot be used to record fresh data by the computer.

**CD-R:** Is the short form of Compact Disc-Recordable. Data can be written on it once and can be read whenever required. The data written once cannot be erased.

**CD-RW:** Stands for Compact Disc Re-writable. CD-RW can be used to write information over and over again, i.e. previous information can be erased and new information can be written on it using a CD writer fixed inside the CPU box.



**Fig. 1.25: DVD (Digital Versatile Disc)**

DVD stands for Digital Versatile Disc. It is an optical storage device which reads data faster than a CD. A single layer, single sided DVD can store data up to 4.7 GB, i.e. around 6 times that of CD and a double layer DVD can store data up to 17.08 GB, i.e. around 25 times that of CD. Though DVDs look just like CDs, they can hold much more data, for example, a full length movie.

**Fig. 1.26: Flash Drive**

**Flash Drive** is an electronic memory device popularly known as pen drive in which data can be stored permanently and erased when not needed. It is a portable storage device that can be easily connected and removed from the CPU to store data in it. Its capacity can vary from 2 GB to 256 GB.

**Fig. 1.27: Blu-Ray Disc**

**Blu-Ray Disc** is a newly invented optical data storage device whose storage capacity can be from 25 GB up to 200 GB. It is mainly used to store high quality sound and movie data. They are the scratch resistant discs, that is why storing data on these is much safer than a CD OR DVD.

**i) The Primary or Main Memories**

The main memory holds the programs being executed and the data to be worked upon. Results of processing are also stored here prior to transfer to an output device. The part of the main memory that performs these functions is known as RAM, i.e. Random Access Memory. It is made up of MOS (Metal Oxide Semi-conductor). The advantage of RAM is partly because of the inherent speed of the technology and partly because MOS-memories are non-destructive unlike the magnetic core of the second generation computers. However, unlike the magnetic core, semi-conductor memories have the disadvantage of being volatile, and loss their content when power is switched off. It is partly for this reason that most modern computers are provided with smaller pieces of memory that cannot be erased either by reading or switching off the current. Such a memory is known as Read Only Memory (ROM). A ROM is particularly useful for holding short programs that help to start up the computer - start-up programs, Diagnostic programs, and in some systems the BASIC interpreter. Many calculators also use ROM to store square root, percentage, average and standard deviation functions. The contents of Rom are fixed and cannot be altered because the writing circuit was disconnected or burnt-in during manufacturing.

**ii) Secondary or Auxiliary Memories**

Very often the main memory is not sufficient to accommodate all that may be required to be stored for processing. In such a case auxiliary or secondary storage devices linked up by cables to the CPU are used to supplement the main storage. These are usually provided on magnetic tapes or disk devices and are essential to any computer system to provide back-up storage. It provides economical storage of large volumes of data on magnetic media, thereby offering permanent (non-volatile) storage, quick transfer of data into the main memory and greater processing potential by expanding CPU's ability to handle more data than its main memory can hold. Secondary memories are basically Read/Write memories, and there are two types available for storage and retrieval of data: Serial Access Memory (SAM), and Random Access Memory (RAM). In RAM data are fetched/stored randomly, e.g. Disks, Drums, etc. In SAM data are stored and accessed serially as its name implies, e.g. Charge-coupled devices (CCD), is volatile, while Magnetic Bubble Memories (MBM), is non-volatile.

Data processing considerations play a very important role in determining the type of secondary memory needed i.e. serial versus random. Microcomputers have made diskettes (**floppies**) and Winchester disks (**hard disks**) very popular secondary storage media by providing random access memory. The amount of data that can be stored on a disk is measured in kilobytes or megabytes. There are basically two types of disks: a) **Floppy disk**, and b) **Hard disk**.

**Floppy Disk:** Computers use disk to store information. Although there is a permanent hard disk inside the system unit, you can use floppy disks to store and move data easily from one PC to another. You should copy onto your floppy disks any important information that is found on the hard disk in case your hard disk fails. Floppy disks used for this purpose are called BACK-UP diskettes.



**Fig. 1.28: Floppy Disk (or Floppy Diskette)**

A **floppy disk** or **floppy diskette** (sometimes casually referred to as a **floppy** or **diskette**) is a type of disk storage composed of a thin and flexible disk of a magnetic storage medium in a square or nearly square plastic enclosure lined with a fabric that removes dust particles from the spinning disk. Floppy disks are read from and written to by a **floppy disk drive (FDD)**.

**Hard Disk (Or Winchester):** A hard disk is similar to a floppy disk which stores information, but a hard disk is much larger and much faster than a floppy disk. A small hard disk might be as much as 25 times larger than a floppy disk. Hard disks are measured in megabytes and come in various sizes: 40M, 80M, 120M, 200M and so on. A hard disk is made of aluminum platters and is enclosed in a sealed dustproof case located in the system box as is the floppy drive. Once attached to the

system unit the hard disks are not taken out and hence also called **fixed disks** or **Winchester disk**.

### **In-Text Questions**

1. Disks and Magnetic tapes are examples of what computer memory?
2. What are the two basic types of computer disks?
3. The part of the computer memory that is useful for holding short programs is called -----

### **4.0 CONCLUSION**

Haven read this Unit and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of the memory unit, and types of memories.

### **5.0 SUMMARY**

In this Unit, you have learnt about the memory unit of a computer system, as well as types of computer memories. The assessment and self-assessment exercise have been provided to enable you understand your own rating of the learning and understanding you achieved reading this unit.

### **6.0 TUTOR-MARKED ASSIGNMENT**

1. Secondary memories are basically -----
2. The temporary storage unit which holds instructions and data being processed is called
3. Disks used to store important information found on a PC are called ---
4. Which of the following is not true about hard disk?

### **7.0 REFERENCES/FURTHER READING**

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## UNIT 2 THE CENTRAL PROCESSING UNIT (CPU)

### CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 The Central Processing Unit
  - 3.2 The Arithmetic and Logic Unit (ALU)
  - 3.3 The Control Unit (CU)
  - 3.4 The Small Memory Buffers
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### 1.0 INTRODUCTION

The Central Processing Unit comprises of the Arithmetic/Logic Unit (ALU), which is the processing unit; the Control Unit (CU); and the Random Access Memory (RAM). In essence, the CPU also called the **Microprocessor**, is made up of the Processing Unit (PU), the Internal Memory (IM), and the Control Unit. It should be noted that the CPU and the Storage Units are usually combined as the System Unit and both constitute the "**heart**" of the personal computer as it accommodates the microprocessor, the memory and disk drives.

### 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the central processing unit of a computer
- identify the basic components of a computer central processing unit.

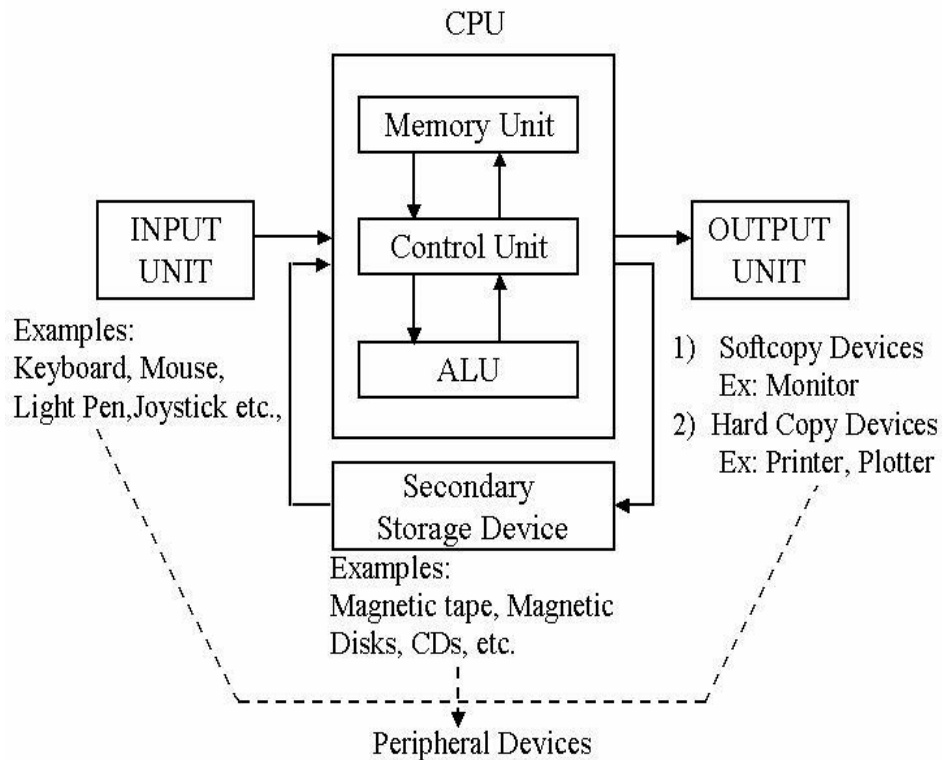
### 3.0 MAIN CONTENT

#### 3.1 The Central Processing Unit (CPU)

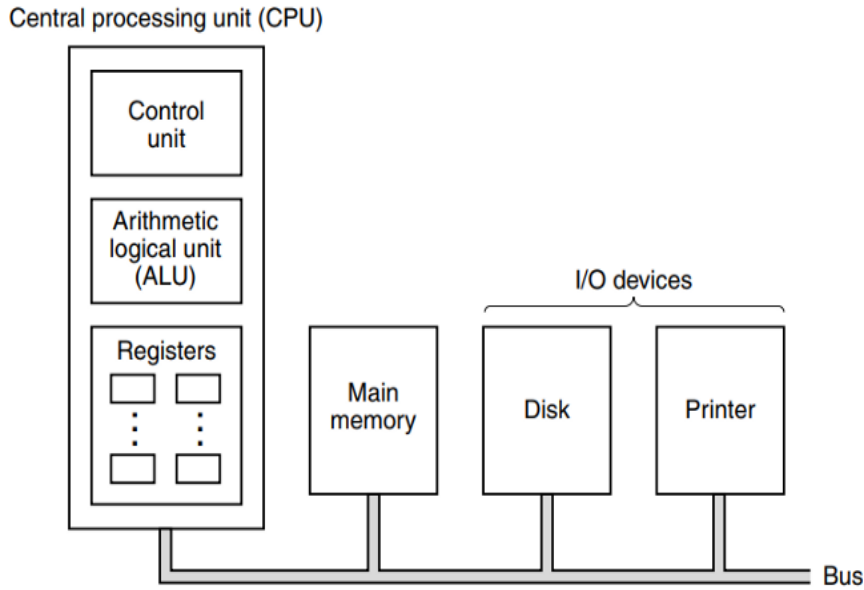
As its name denotes, the CPU is the computer's most important component. It does the entire computer's thinking, calculation and runs the programs (series of instructions) that you request. It is also referred

to as **Microprocessor** or simply **Processor**. To perform its function, the CPU chip consists of three main sections:

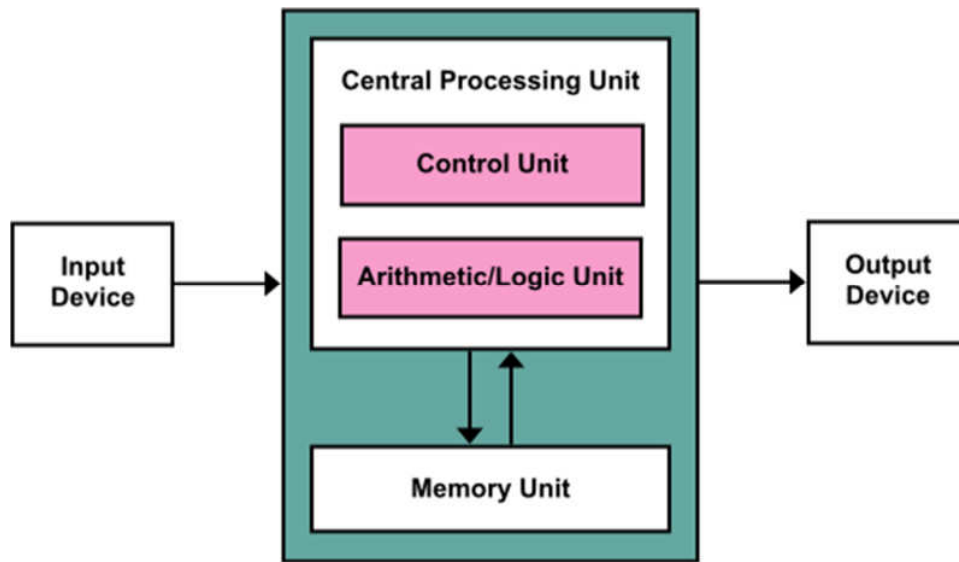
- a) The Arithmetic/Logic Unit (ALU);
- b) The Control Unit (CU), and
- c) The Small Memory Buffers (or Registers).



**Fig. 1.29: Organisation of a Typical Central Processing Unit (CPU)**



**Fig. 1.30: Structure of Central Processing Unit (CPU)**



**Fig. 1.31: Major Parts of a CPU**

### 3.2 The Arithmetic and Logic Unit (ALU)

The ALU contains logical circuitries used to perform arithmetic, logic and manipulation operations on the operand units. These operations can involve single operand or more operands. Special registers necessary for performing arithmetic operations e.g. subtraction, addition, multiplication and division, are located in this unit. These registers are

used to temporarily hold the operand that is being processed. Electronic circuits called **gates** are also used by this unit to perform logical operations, e.g. AND, OR, NOT, etc. on operands and to obtain a result in binary form. The ALU also computes values (True or False) represented in binary as 1 or 0, which allow the computer system to make decision during the execution of a program.

### 3.3 The Control Unit (CU)

The control unit of the CPU generates two types of control signals: 1) the external control signals, and 2) the internal control signals, for the external CPU devices and the internal CPU activities respectively. The CU supervises execution of the instructions of the stored program in the correct sequences. It also activates the appropriate input and output devices, retrieves data from and sends it to the memory, and directs the processor's activities. To perform its functions, the control unit requires a number of special storage locations of its own called **register**. CU includes the Program Counter (PC) or Sequence Control Register, the Instruction Register (IR), and the Instruction Decoder. Central in the work of the CU is the processor's clock which delivers a steady stream of pulses for timing all transition from event with the CPU. The sequence of operations carried out by the CU may differ from one computer to the other, but the principle is the same.

### 3.4 The Small Memory Buffers (or Registers)

Both the CU and the ALU require a small amount of temporary storage to hold the instructions and data currently being processed. These small temporary storage units are called **registers** (or **buffers**). A register is a small high-speed storage area used to hold important information during CPU operations. In most cases, registers can hold only one number or one instruction. Registers of the CPU are of two types: General-Purpose Registers (GPR) and Special-Purpose Registers (SPR). GPR can be used in a number of different ways. Examples include the Array of Registers, Accumulator, etc. SPR are used to perform specific activities. Examples are Address buffer, Data buffer, Program Counter (PC), etc. The registers are the building blocks of the CPU because both CU and ALU also consist of registers.

#### In-Text Questions

1. Registers are the building blocks of the Central Processing Unit; True or False?

2. What are the two types of signals the control unit of the CPU generates?

#### **4.0 CONCLUSION**

Haven read this Unit and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of the central processing unit of a computer system, and its components.

#### **5.0 SUMMARY**

In this Unit, you have learnt about the central processing unit of a computer system. Also, you have learnt about the basic components of a computer CPU. The assessment and self-assessment exercise have been provided to enable you understand your own rating of the learning and understanding you achieved reading this unit.

#### **6.0 TUTOR-MARKED ASSIGNMENT**

1. The central processing unit comprises all of the following except
2. Which of the following is not true about the central processing unit of a computer?
3. What is another name for the CPU of a computer?
4. The CPU and the Storage Units are usually combined as -----

#### **7.0 REFERENCES/FURTHER READING**

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## **UNIT 3 THE OUTPUT UNITS**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 The Output Units
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### **1.0 INTRODUCTION**

The third and final component of a computer system is the output unit. After the computer process data, it has to represent the result in a human understandable form. For this purpose, we need an output device, which will accept the result from the CPU and present to the user in a form which he/she can understand. We have got two major categories of output device, i.e. soft copy output device and hard copy output device. Thus, user can only see the result of processing on a soft copy output device such as visual display unit (VDU) or monitor, but the user can take the result on a paper by using a hard copy output device such as printers, plotters, etc.

### **2.0 OBJECTIVES**

By the end of this unit, you will be able to:

- explain the output unit of a computer
- identify some common computer output devices.

### **3.0 MAIN CONTENT**

#### **3.1 The Output Units**

The output unit usually transmits information from the CPU and converts the electronic pulses to an appropriate output form. The output device allows a computer to exchange information with the outside world. In addition, it provides a computer with the means of storing information on disks and tapes. Examples of output units include: i) Card Readers. ii) Tape Punches. iii) Magnetic Tape Units. iv) Automatic Typewriters. v) Printers. vi) Graph Plotters. vii) Monitors. iiiv)



Machines that produce Engineering Drawings. ix) Telephone lines. x) Speaker. xi) Head phone. xii) Computer output on Microfilm (COM). Probably, the most common output devices are the **monitor** and the **printer**.

#### a) The Monitor



**Fig. 1.32: Monitor**

Monitors are the most crucial output devices of a computer. Without it, the computer is incomplete. The monitor is a **versatile device** of the computer for visual display of all types of information. The monitor is designed to display symbolic and graphical information. It shows all the data and information as Soft Copy on its screen. It **acts** as an interface between the CPU and the user.

A PC's monitor works like a TV-Screen, displaying text characters and graphics in colours or in shades of gray or black and white. The image you see on the screen is made up of tiny dots of picture elements called PIXELS. Whatever is typed on the keyboard usually gets displayed on the monitor screen. Also, whenever a program is executed, the information is displayed on the monitor. There are two types of monitors: Monochrome (single colour) and Colour monitors. The quality of monitor is usually determined by its resolution (i.e. the sharpness of the image produced by the screen). Monitors having a higher resolution are more expensive and are used for specialised jobs like creating graphics.

A cable is connected with a video adapter set up with the computer's motherboard to display the data. Anyone can view Files, photos, videos,

texts, graphics, and tables in real-time through the monitor. They are increasingly being produced thinner in width and with advanced technologies such as **LED, Plasma, or Liquid Crystal**. This output device comes in different sizes: 15, 17, 19, 21 inches measured on its diagonal. However, the monitor screens of laptops are much thinner and smaller. There are basically 5 types of Monitor:

1. [CRT Monitors](#) (Cathode Ray Tube)
2. [LCD Monitors](#) (Liquid Crystal Display)
3. [LED Monitors](#) (Light Emitting Diode)
4. [OLED Monitors](#) (Organic Light Emitting Diode)
5. [Plasma Monitors](#)

#### b) **The Printer**

A printer is an electronic external output device of computer used to print digital information on paper as hard copies (i.e. printed copies). The main task of printers is to **convert the data from soft copy to hard copy** on the computer. They are used to print the files stored in a computer at homes, offices, and business establishments (data can be in text form, signs, or office documents); it can be small or big as per the page size. The resolution or clarity of images produced by a printer is measured in **DPI (dots per inch)** resolution. The more dots per inch a printer has, the better quality can be printed and seen more clearly. Usually, the printer is connected to a computer with a data cable or only a wireless connection with Wifi. At present, many digital printers featured with the latest wireless technologies like Bluetooth, Wi-Fi, or Cloud. Due to this, it becomes easier to complete the printing task.

There are various types of printers: **Dot Matrix**, the **Line** and the **Laser** printers. Dot Matrix printers are most commonly used. They print character by character and therefore, have a comparatively slow speed. The Line printers can print very fast, and so are useful where large volumes of data are to be printed. Laser printers produce the best quality of print. The Printers generally use paper and various [inkjet](#) or [laser systems](#). A printer is an optional component in that it is either attached to the PC or not.

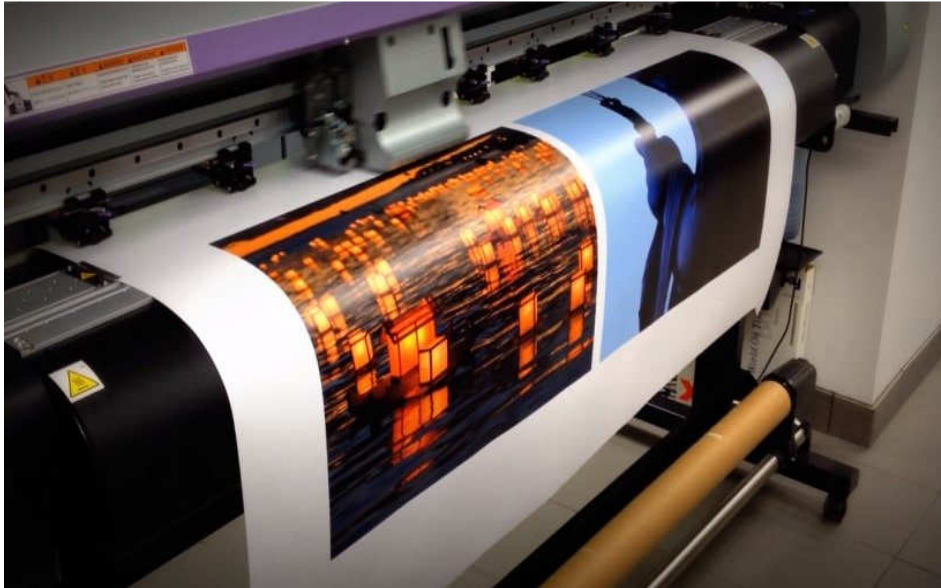


**Fig. 1.33: Printer**

### **3. Plotter**

A plotter is an output device that prints graphics with high-quality images in many color formats. It is analogous to a printer but has more advanced features. The plotter allows us not only for graphic design but also to print large maps, architectural drawings, large-format printing, create pictures, 3D postcards, advertising signs, charts, and various designs of the internal structure of building machines. It is mainly used in engineering, building construction, city planning, map, etc.

The printer prints only on paper, but the plotter can print on **cardboard, fabric, film, and other synthetic materials**. Some unique models allow you to print on T-shirts, bags, other lightweight clothing, and even round objects such as cups. Plotters are different from printers because they are more accurate, faster with high-resolution graphics. That is why plotters are used by **Engineers and architects** fields as engineering applications, where **accuracy** is mandatory. Printers design the pictures as per the commands given by the computer user. In this case, pens are used to draw multicolor plotters using different color pens.



**Fig. 1.34: Plotter**

#### **4. Multimedia and Screen Projector**



**Fig. 1.35: Multimedia and Screen Projector**

The multimedia screen projector is also an output device. A multimedia projector is a miracle of technology, and it is a beneficial and multi-functional device. In the conditions of having a limited area like an apartment, you can organise home theater because the image's projection allows us to view the video on the screen over the entire wall. **For example**, if you want to present your Power Point in front of thousands of people, then you don't need to hesitate. You need a

projector that will display all your presentation data on a big screen on the wall.

Using the projector for [educational purposes](#), projects, data graphs, or showing documentaries makes it possible to broadcast video in a comprehensive format to understand information by viewers better. We can cast information like **Audio, video, images, and animation** from the laptop/computer to the big screen simultaneously. That's why it is widely used in office Presentations that make parenting more lively and exciting.

Since the output results by a multimedia projector are displayed on a large screen, it can be seen by a vast gathering of people in a meeting/conference room, classroom, or even in the hall. Video quality is highly dependent on the specifications of the multimedia projector and screen properties. The canvas should have high reflectivity, and then the screen quality will be more precise and much sharper.

## 5. Speakers



**Fig. 1.36: Speaker**

A speaker is a hardware output device connected with a computer to produce the audios. The sound produced by computer speakers is made

by a hardware component called a **sound card**, which is pre-installed with the computer. The word “**speaker**” is not a technical term. The real name of the device is “**dynamic head.**” This Speaker can now be found on many devices, for example, on a TV, radio, telephone, children’s toys, and others. The audio signal is sent through the computer’s sound card to produce the sound coming from a computer speaker. Many **Laptops** already have the inbuilt Speaker at the upper end of the keyboard. The Speaker that is inbuilt with the motherboard is called Internal Speaker. One can need an external speaker separately when producing the sound from the computer in a louder way.

## 6. Headphone



**Fig. 1.37: Headphone**

### **Some Advantages of Headphones over Speakers:**

- High sound quality.
- Availability to purchase headphones is much cheaper than a specific speaker system.
- Isolation from external sound signals.
- While using this accessory, no noise is created for strangers that comfort others.

## 7. Sound Card



**Fig. 1.38: Sound Card**

Sound cards are the output devices of computers that are installed inside a computer. To produce any computer's sound, you need a sound card, external or internal (built-in). An external sound card allows you to generate higher quality and is necessary for surround and clear sound, to get sound without noise and distortion when recording it. With the help of an internal sound card, it becomes possible to listen to music through speakers or headphones connected to a PC, and if this is the only thing that you need, then it is enough.

Most of the sound cards have at least one analog input line and one stereo output line connection. These connectors are typically **3.5 mm minijacks**. These are the size of most headphones that we use. Some sound cards also support digital audio input and output, using a standard TRS (tip-ring-sleeve) connection or an optical audio port, such as the Toslink connector. Although all computer does not require a sound device to function as they are included on every machine in some form or another, it can be either installed in an expansion slot or built into the motherboard.

## 8. Video Card

Computer Video cards are internal inbuilt hardware output devices. Every PC user, especially gamers, knows very well that a video card is one of the essential components of a computer and laptop. So that while playing videos and games, the cards do not get slow down, they work **stably**, and everything goes **smoothly**. A video card or video

adapter is part of a computer and laptop. This device is responsible for processing data – machine code and translating it into an accessible image. In simple words, the video adapter is engaged in the output process of translating the program code into a user-friendly image on the monitor, TV, or any other display.

Nowadays, to work in professional video processing programs, playing high definition games, **3D modeling, designing videos, and 3D games** with elevated details, you need an external video card.



**Fig. 1.39: Video Card**

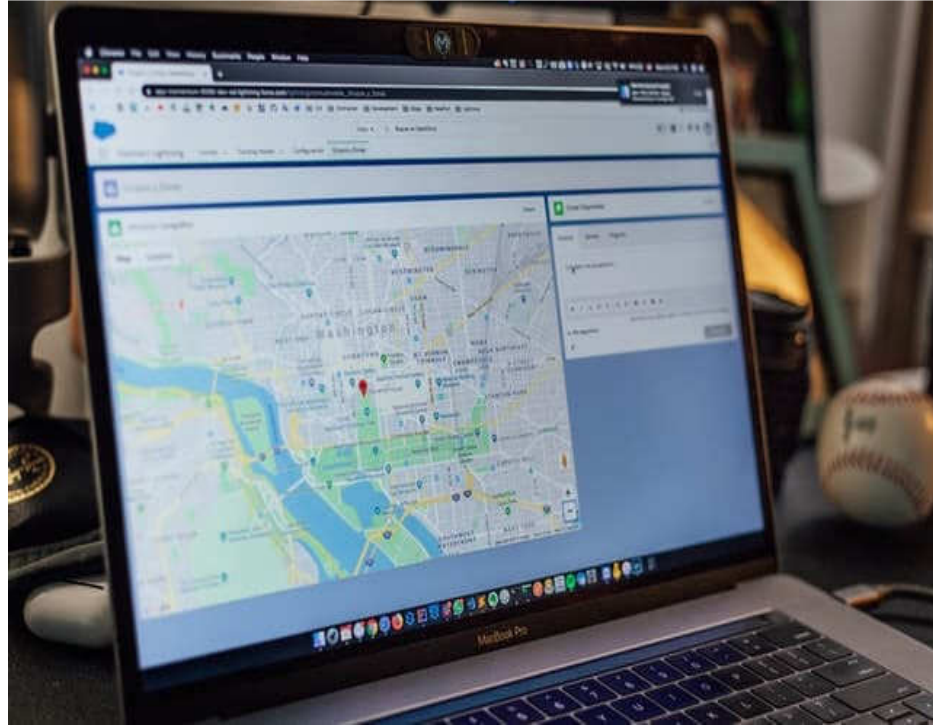
## **9. GPS**

GPS is a space-based satellite navigation output device that determines the time and location information in all weather conditions and allows you to find the desired object on the map, whether it is situated in any place on the Earth. The main output of GPS is **Providing location, weather conditions, and also tracking**. Almost every modern person has used GPS navigation on their smart phone or tablet, even laptops too. The need for GPS can arise at any time for people of different professions and different occupational needs.

This GPS is a satellite-based navigation system made up of a network of 24 Satellites placed in the orbit of the Earth by the Department of Defense. GPS was initially designed by the USA to use for military applications. This system provides significant capabilities to military,



civil, and commercial users across the world. It can work in any weather, in any place of the world, up to **24 hours a day**. Simultaneously, the best point is that you do not have to pay any subscription fees or setup charges. It is free to use the GPS.



**Fig. 1.40: GPS**

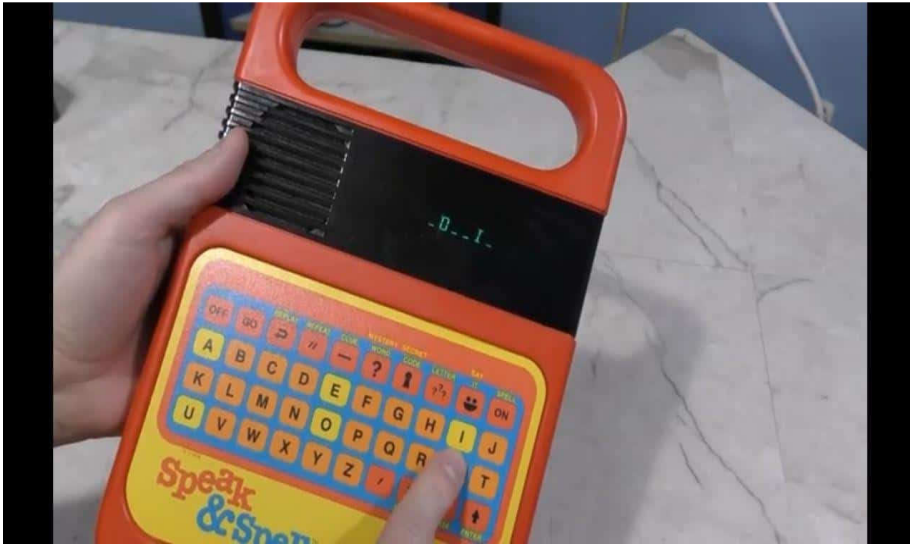
### **In-Text Questions**

1. A piece of computer hardware equipment which converts information into human readable form is called -----
2. To produce any computer's sound, you need -----

### **10. Speech synthesizer**

Speech synthesizers are special output devices examples consisting of many modules that provide the ability to convert typed texts into sentences voiced by a human voice. A speech synthesizer is a response mechanism that collects the vowels and then provides the output in sounds. There is a mechanism in this system by which we can pre-record using required vowel codes with a set of instructions in a voice response device. Speech synthesizers are mainly used when studying foreign languages, listening to texts on the pages of books, creating vocal parts, issuing search queries in the form of voiced phrases, etc. The voice response device arranges the voice's response in the appropriate

sequence and transmits it as output. These speech synthesis systems are widely used in telephone exchanges and the treatment of blind and mute people.



**Fig. 1.41: Speech Synthesizer**

#### **4.0 CONCLUSION**

Haven read this Unit and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of the computer output units.

#### **5.0 SUMMARY**

In this Unit, you have learnt about the computer output units. The assessment and self-assessment exercise have been provided to enable you understand your own rating of the learning and understanding you achieved reading this unit.

#### **6.0 TUTOR-MARKED ASSIGNMENT**

1. Which of the following is not an example of output unit of a computer?
2. What are the most crucial output devices of a computer?
3. Disks used to store important information found on a PC are called
4. What is the output unit which acts as an interface between the CPU and the user?

5. Which of the following is an electronic external output device of the computer?

## **7.0 REFERENCES/FURTHER READING**

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## MODULE 3

### UNIT 1 COMPUTER TECHNICAL LANGUAGE

#### CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 Computer Technical Language
  - 3.2 Advantages of Computers
  - 3.3 Disadvantages of Computers
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

#### 1.0 INTRODUCTION

Computer technical language (or computer jargon) refers to words that have to do with computers and surrounding topics. Knowing what these words mean can help people know more about computers. Most people use these words to discuss computer ideas, but some people use them to impress others. Some of those terms are highlighted below.

#### 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- identify and explain some technical terms used in operating a computer system
- highlight some advantages of computers
- state some disadvantages of computers.

#### 3.0 MAIN CONTENT

##### 3.1 Computer Technical Language (Or Computer Jargon)

Some terms would be useful to you while operating a computer system. The following are some of those terms and their uses:

- i) **Close:** A process of putting back a document into the memory and quitting the application.
- ii) **CD-Writer:** A device for copying documents into the CD-ROM.
- iii) **Computer Virus:** Bad software made to mess up a computer or destroy data; nothing good comes from it.

- iv) **Dialogue Box:** A box that would open prompting a user to give instruction for the execution of relevant task.
- v) **Disk:** A place to store data, e.g. Hard disk and Floppy disk.
- vi) **Download:** Downloading is the method by which users access and save or "pull down" software or other files to their own computers from a remote computer via the internet.
- vii) **Drive A:** This refers to floppy disk drive.
- viii) **Drive C:** This refers to the hard disk of the computer. It is the main internal memory of the computer and contains all the programs and other necessary information supported by the computer.
- ix) **Drive D:** This is the CD-ROM drive.
- x) **Enter:** This has two meaning: First, it implies changing the line when you are typing. Second, it means a command such as **Yes, Ok, Go**, when used within the context of a dialogue box.
- xi) **Exit:** Is a process of closing down an application.
- xii) **File:** Is a unit of document that can be stored separately.
- xiii) **Folder:** Is a collection of files held together in a given location in a hard disk.
- xiv) **Flash Drive:** Refers to a high density removable storage medium that is attached to the computer using USB port.
- xv) **Icon:** Is a graphical or pictorial representation of a task on a tool bar, clicking on which would execute that task or function.
- xvi) **Menu:** Is a folder of command for executing tasks that are grouped around specific headings. The main menus are: **File, Edit, Insert, Format, View, Table, Window** and **Help**.
- xvii) **Save:** To put data on a disk
- xviii) **Selection:** Is the process of highlighting specific portions of a text or document with a view to work on it.
- xix) **Tool Bar:** This is the presentation of on-screen buttons, icons, menus, or other input or output elements at the top of the screen.
- xx) **Upload:** To put data on somewhere, for example, on the internet or a website.

**In-Text Questions**

1. What is the technical term for bad software made to mess up a computer or destroy data?
2. A graphical or pictorial representation of a task on a tool bar is known as what?

**3.2 Advantages of Computers**

The computer can be viewed generally as a tool for enhancing the various technologies of instruction and of instructional management. Specific advantages are:

- 1) The novelty of working with a computer raises students' motivation'.
- 2) Colour, music, and animated graphics can add realism and appeal to drill exercises, laboratory activities, simulations, etc.
- 3) High speed personalized responses to learner actions yield a high rate of reinforcement.
- 4) Memory capacity allows students' past performance to be recorded and used in planning next steps.
- 5) The patient, personal manner that can be programmed provides a more positive affective climate, especially for slow learners.
- 6) The record-keeping ability of the computer makes individualised instructions feasible. Individual prescriptions can be prepared for all students (particularly mainstream and special students) and their progress can be monitored.
- 7) The teacher's "span of control" is enlarged as mere information is put easily at the teacher's disposal, helping to keep control close to the point of direct contact with the learner.

**In-Text Questions**

1. The computer could be a tool for enhancing instructional management; True or False?
2. The computer is faithful to its program thus, it may not stifle creativity in computerised instruction; True or False?

**3.3 Disadvantages of Computers**

As we have seen with all other media and technological innovations, there are always trade-offs to be made and limitations to consider. Some of the major limitations of computers in instructions are:

- 1) Despite the dramatic reduction in cost of computers and computer use, computerised instruction is still relatively expensive. Careful consideration must be given to the costs and benefits of computers in education. Maintenance can also be a problem, especially if equipment is subjected to heavy use.
- 2) Design and production of computers specifically for instructional purposes have lagged behind design and production for other purposes.
- 3) There is a lack of high-quality direct instruction materials for use with microcomputers. There is also a compatibility problem. Often, software developed for one computer system cannot be used with another. The ease with which software, especially on cassette, can be duplicated without permission has inhibited commercial publishers, private entrepreneurs from producing and marketing instructional software.
- 4) Teacher design of instructional materials for use with computers can be a laborious task, even for teachers with computer literacy.
- 5) Creativity may be stifled in computerised instruction. The computer is slavish in its obedience to its program. Creative or original learner responses will be ignored or even rebuked if the program's designer has not anticipated such possibilities.
- 6) Some learners, especially adult learners, may resist the linear, lock-step control of the learning process typical of run-of-the mill computer instruction materials.

#### **4.0 CONCLUSION**

Haven completed reading through this Unit, it is assumed that you have learnt and acquired knowledge of some computer technical language which you are required to have in this unit. The questions you answered correctly would indicate to you the amount of learning you have achieved in the unit.

#### **5.0 SUMMARY**

In this Unit, you have learnt some technical languages that are commonly used when operating a computer system. Also, you have learnt some advantages and disadvantages of computer in teaching-learning process.

#### **6.0 TUTOR-MAREKED ASSIGNMENT**

1. The main internal memory of the computer is called -----
2. The CD-ROM drive is known as -----
3. A collection of files in a given location in hard disk is known as -

4. Which of the following is not an example of Main Menus?

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## **UNIT 2      COMPUTER APPLICATION PACKAGES**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 Computer Application Packages
  - 3.2 Microsoft Word Processor
  - 3.3 Microsoft Excel
  - 3.4 Microsoft PowerPoint
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### **1.0 INTRODUCTION**

Application packages can be described as the readymade software or program designed in a standardized form for solving various problems that are common to users. They are written by users themselves or acquired from manufacturers as packages come in various format on compact disk (CD/DVD) or available on developer or manufacturers server on the internet that can be downloaded for usage at a cost or no cost.

### **2.0 OBJECTIVES**

By the end of this unit, you will be able to:

- identify some computer application packages and their examples
- state some common computer application packages and their starting procedures
- identify some shortcuts in MS-Word and their uses.

### **3.0 MAIN CONTENT**

#### **3.1 Computer Application Packages**

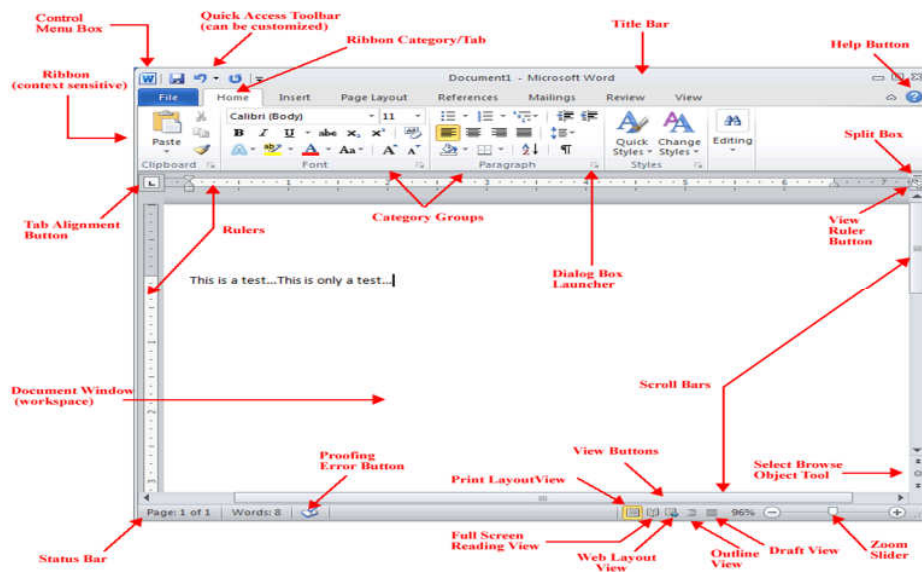
These are suites of programs with associated documentation, used for solving general everyday problems. Application packages come in a complete set suite or programs with its documentation covering a business routine. It is usually supplied by a software house or a manufacturer, either on lease or purchased from dealers in computer hardware. Examples include:

- i) Account Package, e.g. Sage Accountant.

- ii) Database Management Packages, e.g. MS Access, Dbase III, IV, Paradox and Fox Base. Database package is otherwise known as fourth generation languages.
- iii) Desktop Publishing Package, e.g. Gold, Ventura Publisher, Dbase and PageMaker.
- iv) Games Package, e.g. Chess, Scrabble, etc.
- v) Graphics Package, e.g. Corel Draws, PM (Print Master) and Harvard Graphic.
- vi) Spreadsheet Package, e.g. Lotus 1-2-3 and Microsoft Excel.
- vii) Statistical Package, e.g. SPSS
- viii) Utilities, e.g. Norton Utilities, AVAST.
- ix) Word Processing Packages, e.g. MS Word, WordStar, Word Perfect, etc.

### 3.1a Microsoft Word Processor (MS-Word)

Word Processing is the ability to manipulate alphabets and numbers to form words, sentences and documents using computer as a device. Microsoft Word is used in the computer as software to create, edit, view, store, retrieve and print textual materials, e.g. letters, memos, document, etc. Before the advent of word processor, typewriters were used to produce textual materials, but they had many limitations and disadvantages which word processor came to solve.



**Fig. 1.42: Microsoft Word Window**

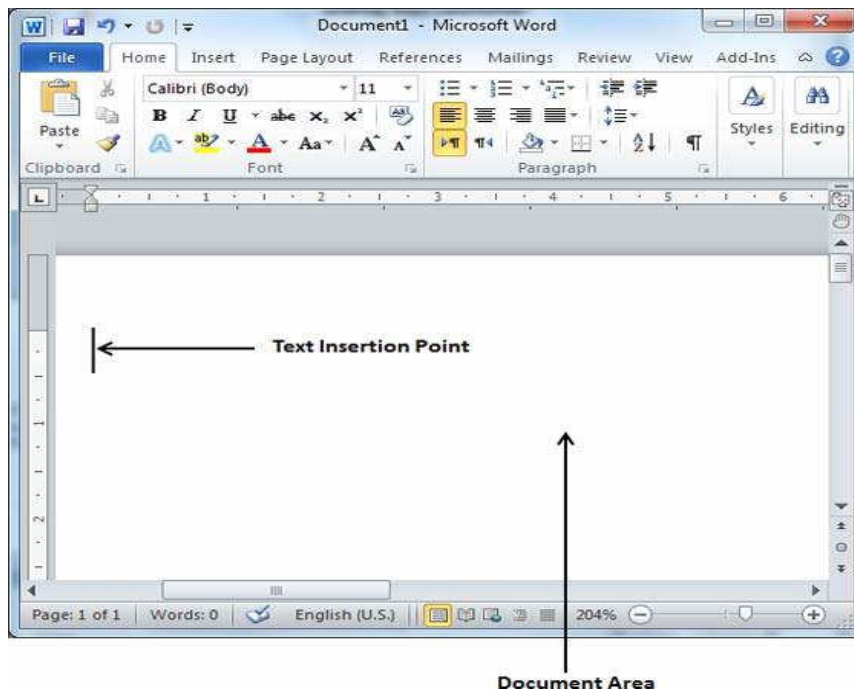


Fig. 1.43: Microsoft Word Window

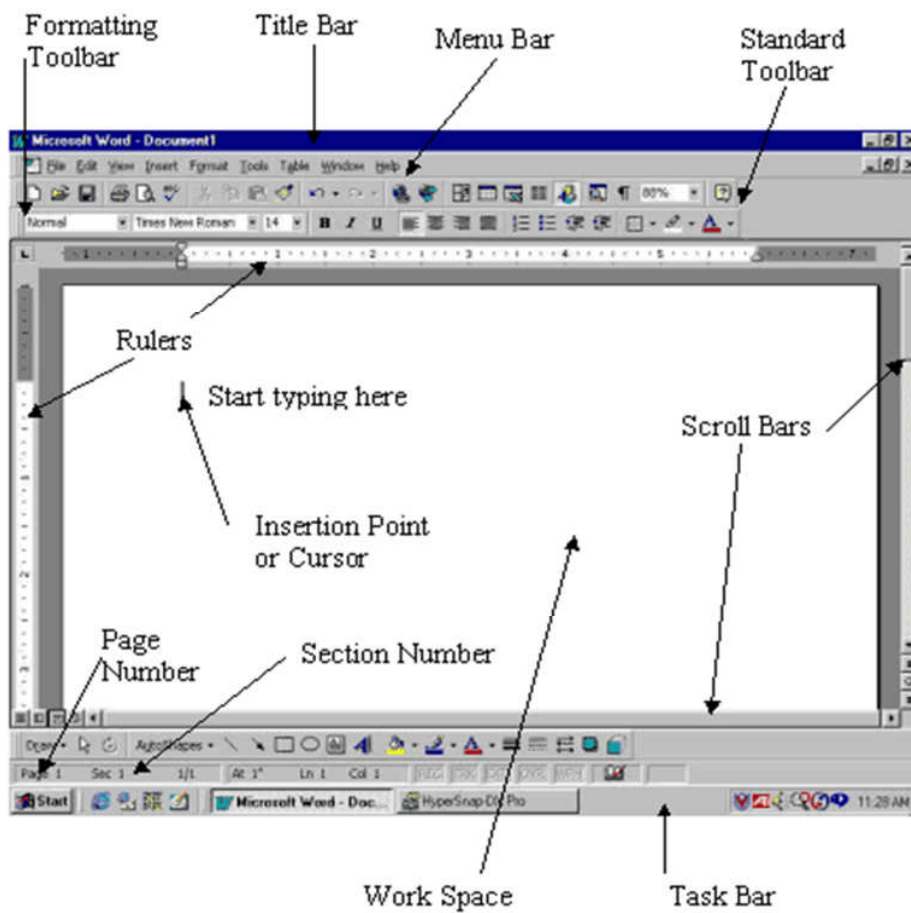


Fig. 1.44: Microsoft Word Window

### 3.1b Advantages of Word Processor Over Typewriter

- i) The printout of computer is far better than both the electronic and manual typewriter.
- ii) Many copies of computer printout can be made, compared to the use of carbon papers in typewriters for molding more than one copy.
- iii) Graphics and pictures can be added to the document.
- iv) There are special facilities such as spell check and grammar checker, automatic table generators, auto format, etc. which make word processing easier and faster.
- v) Editing and updating are easier and faster as you would not need to start all over again (i.e. if you need to edit already typed and saved documents).
- vi) Colours, font type, styles and special effects like shadows, strikethrough, etc. make word processor documents more beautiful and fanciful.

### In-Text Questions

1. Suites of programs used for solving general everyday problems are called what?
2. Manipulation of alphabets and numbers to form words, sentences and documents is known as what?

### 3.1c Starting MS-Word

To start using MS-Word, you must first open it. To open it:

- Click on the **start button** on the desktop.
- Select **programs**.
- Select **Microsoft Word** from the program menu by clicking on it.

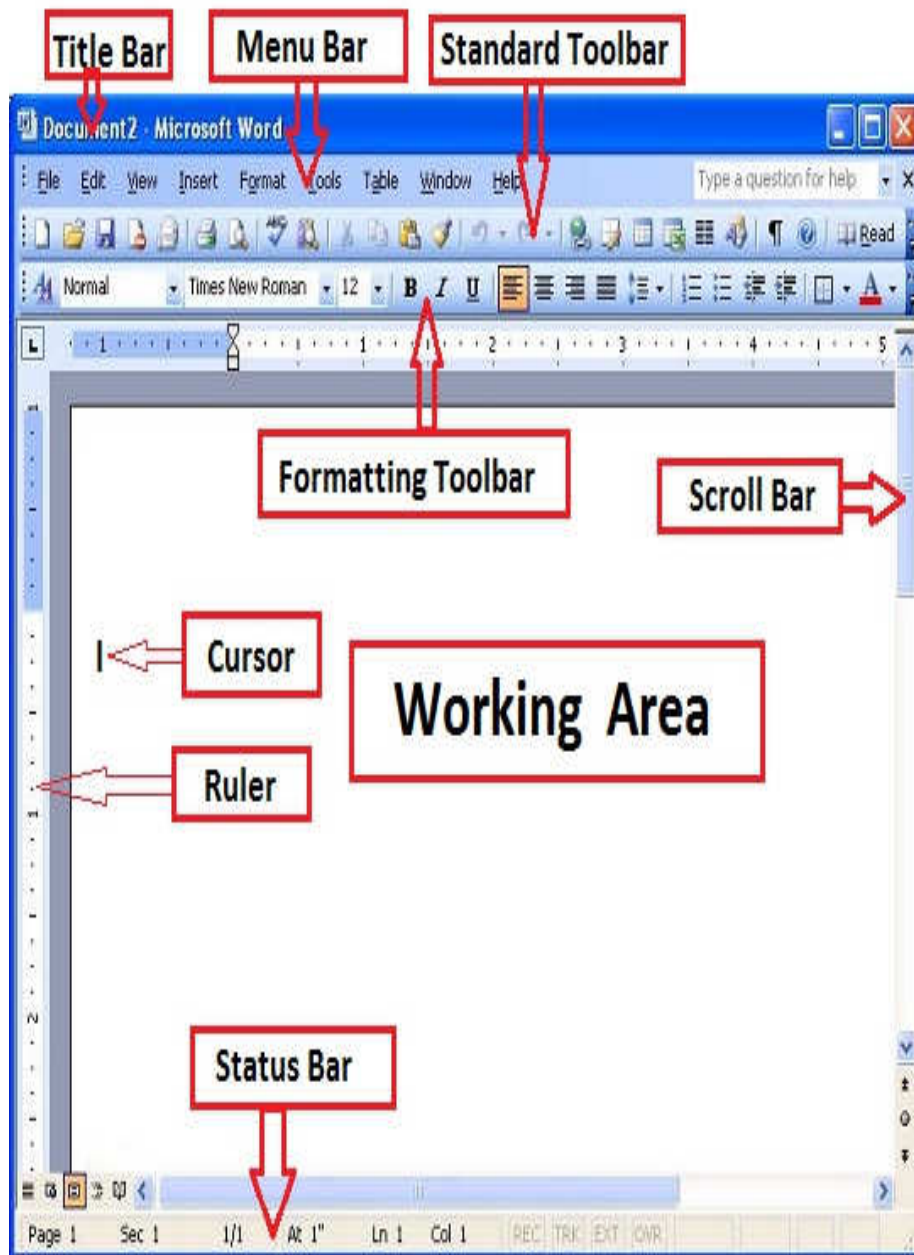
**Note:** If you have MS-Word on your desktop, you can open it by double clicking on the icon.

### 3.1d MS-Word Screen

This is the window you will see when you open Microsoft Word. The screen is divided into:

**a. The Title Bar:** Displays "Microsoft Word" and the name of the active document.

- b. The Menu Bar:** Contains a list of menus. You open menus and choose commands from them to instruct Word to perform actions.
- c. The Standard Tool Bar:** Provides instant access to frequently used Word commands.
- d. The Status Bar:** Displays information about the active document or selected commands.
- e. The Scroll Bar:** The vertical scrollbar helps you move through your document and keep track of where you are.



**Fig. 1.45: Microsoft Word Screen**

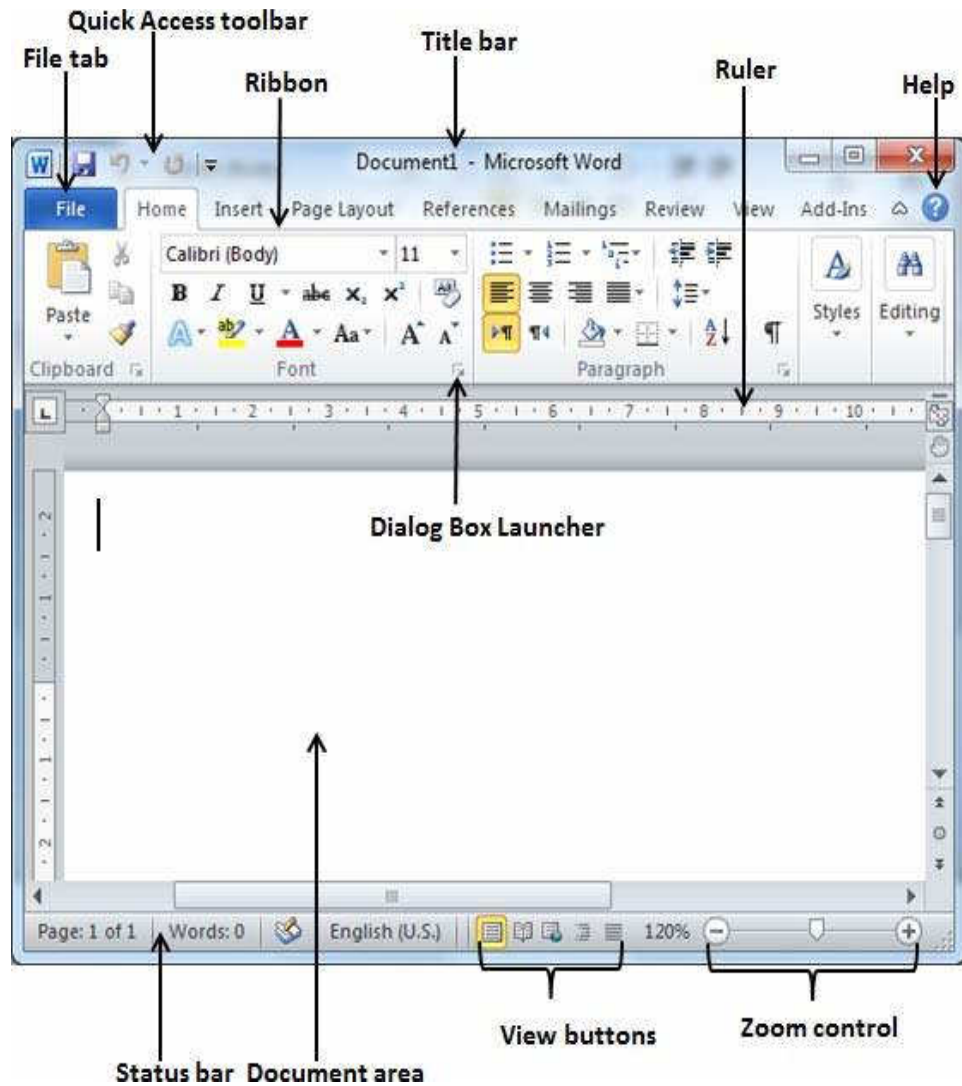


Fig. 1.46: Microsoft Word Screen

### 1. To Save a Document for The First Time

- Click on the **File Menu**.
- Click on **Save As** (it gives a dialogue box).
- At the **File Name**, type the name you want to give the document.
- Click **Save**.

### 2. To Save a Document that Has been Saved Before

- Click on **File Menu**
- Click on **Save**

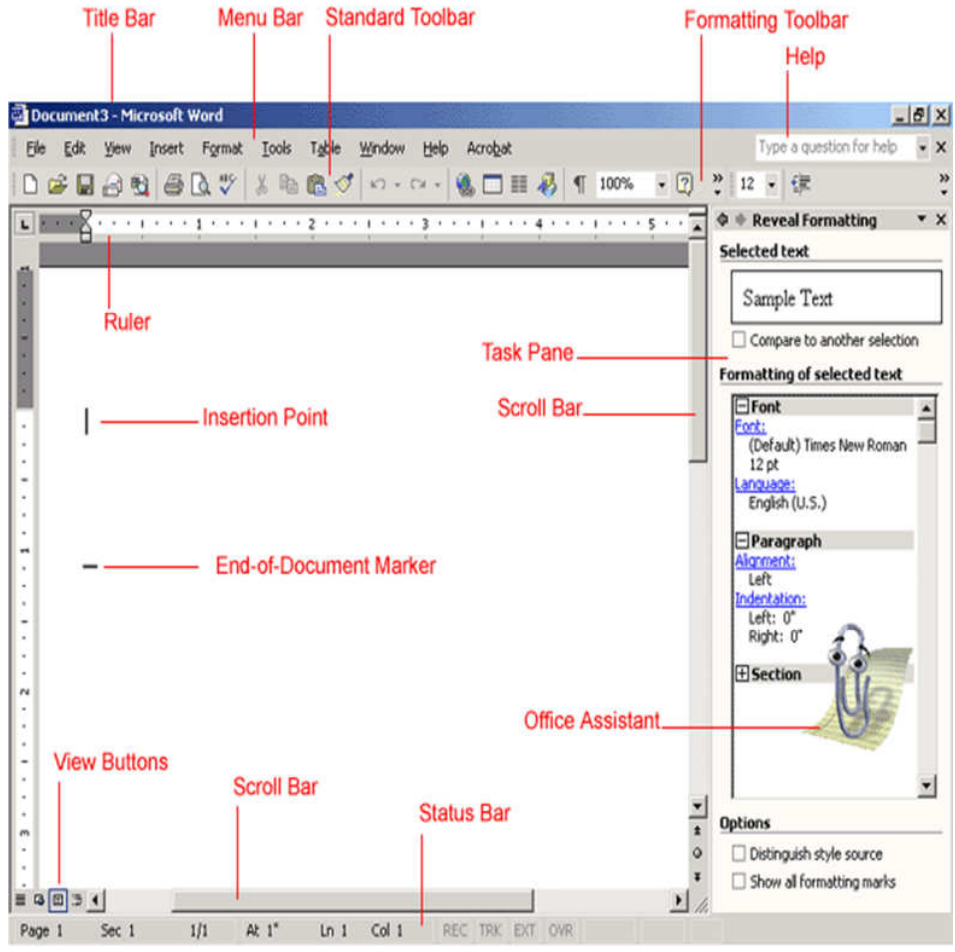
### 3. To Open an Existing Document

- Click **File Menu** on the main Menu.

- Select **Open** (this gives a dialogue box).
- Select document of your choice by clicking on it.
- Click **Open**.

**4. To Close a Document**

- Click on **File Menu**.
- Click on **Close**.



**Fig. 1.47: The Basics of the Word Window**

**In-Text Questions**

1. MS Word Screen consists of how many subdivisions?
2. What is the appropriate command to use when saving a word document for the first time?

## 5. To Change Margin Setting

- Click on **File Menu**.
- Click on **Page Setup**.
- Click on **Margins**.

Change the top, bottom, right and left margins as you wish by clicking the text box, delete what is there and type the new margin settings you want.

## 6. To Print a Document

a. Printing the whole thing:

- Click on the **Print** icon.

b. Printing certain pages or several copies:

- Click on **File**.
- Click on **Print**.
- At the copies selection, click on the number of copies you want or type the number of copies you want.
- Click **Ok**.

## 7. To Exit from MS-Word

- Click on the **File Menu**.
- Select **Exit**.

It may give information whether you want to save before Exit or not; click Yes to save before exit or No to exit without saving.

## 8. To Copy and Paste

- Select the text to copy (by highlighting the text either by using your mouse, i.e. point the cursor at the beginning of the text to copy, press the mouse and drag until the end of the text, or by using the **Shift** and one of the navigation keys).
- Click on **Edit Menu**.
- Click on **Copy**.
- Place your cursor at the point where you want to insert the copied text.
- Click **Edit Menu**.
- Click **Paste**.



## 9. To Cut and Paste

Cut refers to making a copy of the text after which the original is automatically deleted. The copied text can be moved to another place.

- Select the text that is to be **Cut**.
- Click **Edit Menu** and click **Cut**.
- Take your cursor to where you want to paste the text.
- Click **Paste**.

## 10. To Delete a Text

- Select the text to delete.
- Press **Delete** or click on **Edit Menu** and select **Clear**.

## In-Text Questions

1. The process of making a copy of a text after which the original is lost is known as what?
2. Pointing the cursor at the beginning of a text and using Shift + one of the navigation keys effect what action?

### 3.1e Some Shortcuts In MS-Word

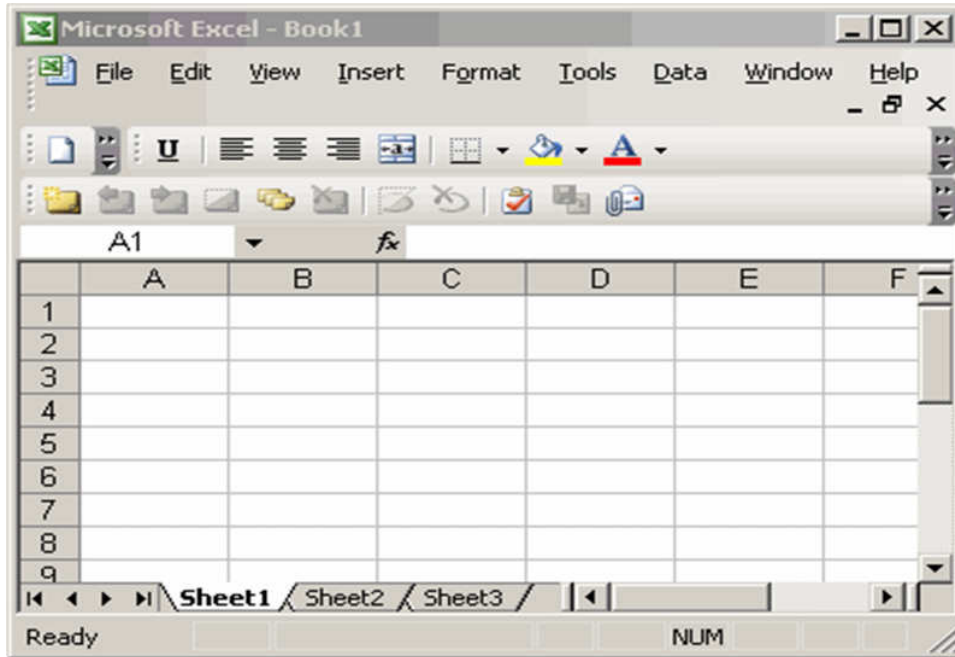
S/N	Command	Uses
1	CTRL+A	Select All
2	CTRL+B	Bold
3	CTRL+C	Copy
4	CTRL+D	Font
5	CTRL+E	Centering
6	CTRL+F	Find
7	CTRL+G	Go To
8	CTRL+H	Find and Replace
9	CTRL+I	Italic
10	CTRL+J	Justify
11	CTRL+K	Insert Hyperlink
12	CTRL+L	Align Left
13	CTRL+M	Increase Indent
14	CTRL+N	Open New Window
15	CTRL+O	Open Existing Document
16	CTRL+P	Print
17	CTRL+Q	Decrease Indent
18	CTRL+R	Align Right
19	CTRL+S	Save
20	CTRL+T	Left Indent
21	CTRL+U	Underline
22	CTRL+V	Paste

23	CTRL+W	Close Existing Document
24	CTRL+X	Cut
25	CTRL+Y	Redo
26	CTRL+Z	Undo
27	ALT+E	Open Edit Menu
28	ALT+F	Open File Menu
29	CTRL+1	Single Line Spacing
30	CTRL+5	1.5 Line Spacing
31	CTRL+2	Double Line Spacing
32	CTRL+SHIFT+	Super Script
33	CTRL+=	Subscript
34	ALT+V	Open View Menu
35	ALT+I	Open Insert Menu
36	ALT+O	Open Format Menu
37	ALT+A	Open Tool Menu
38	ALT+W	Open Window Menu
39	ALT+H	Open Help Menu

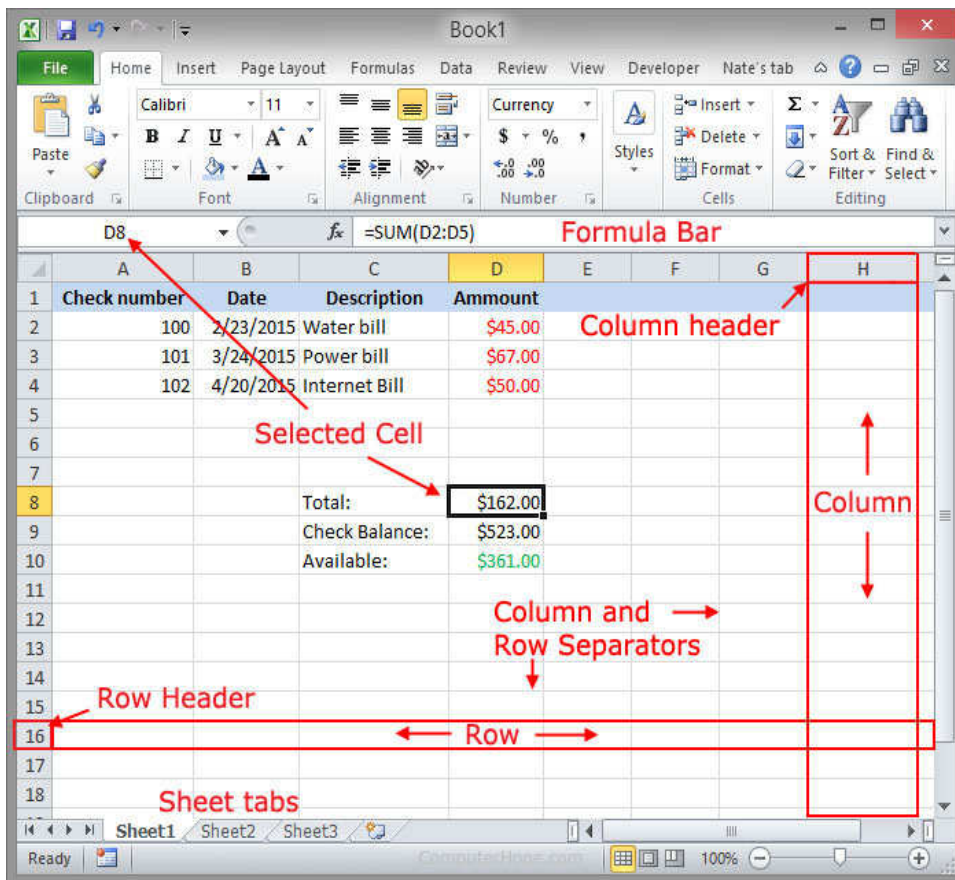
### 3.2 Microsoft Excel (Spreadsheet)

Is a software program that uses spreadsheet to organise numbers and data with formulas and functions. It is a tool for organising and performing calculations on data. It can analyse data, calculate statistics, generate pivot tables, and represent data as a chart or graph. Unlike a word processor, such as Microsoft Word, Excel organises data in columns and rows. Rows and columns intersect at a space called a **Cell**. Each cell can contain a single data, such as text, a numerical value, or a formula. Microsoft Excel can be used to:

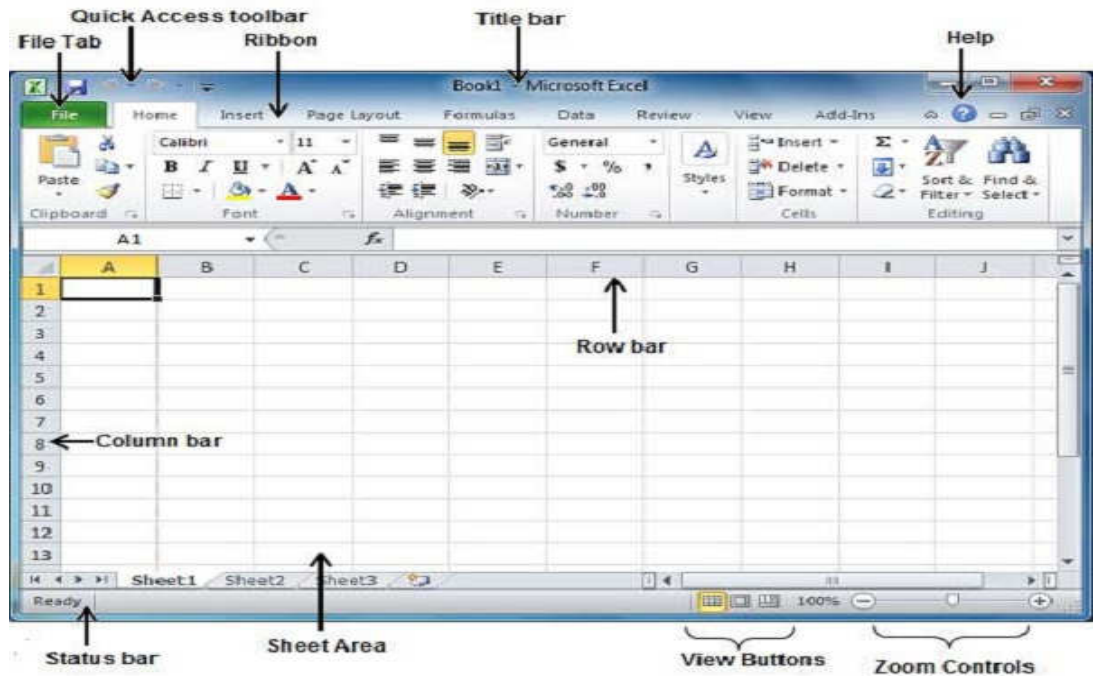
- i) Preserve and analyse data in our daily life.
- ii) Make annual report of your organisation or council.
- iii) Prepare annual budget/production management for your organisation
- iv) Make any scientific calculation.
- v) Prepare payroll for teachers, coaches and other administrative staff in any organisation.
- vi) Represent data in an attractive format, i.e. graphs (e.g. bar chart, pie chart, histogram, etc.).



**Fig. 1.48: Microsoft Excel Worksheet**



**Fig. 1.49: Microsoft Excel Worksheet**



## Ms/Excel 2007 Window

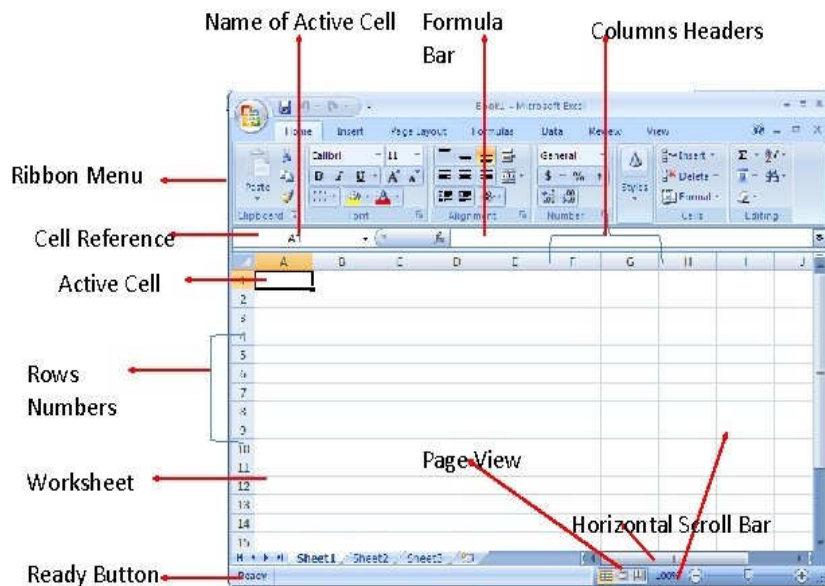


Fig. 1.50 and 1.51: Microsoft Excel Windows

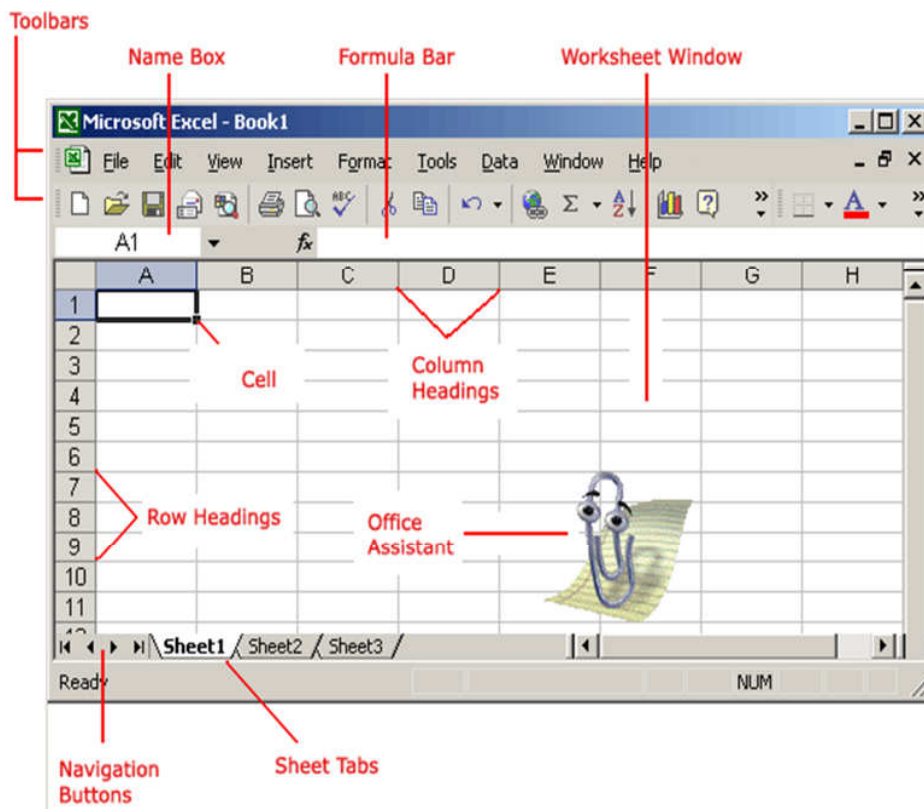
### 3.2.1 Starting the Microsoft Excel

- Click the **Start** button in the lower-left corner of the task bar.
- Click **All Programs**.

- Click on **Microsoft Office**.
- Click on **Microsoft Excel 2010**.

The files you create in Excel are called workbooks. You can start a new workbook any time you want to create a new file for your Excel data. By default, every new workbook you open automatically contains three blank worksheets (sheet1, sheet2, sheet3) you can use to enter Excel data. As you enter and edit data, you will need to move through the worksheet, which can be done using your mouse or keyboard shortcuts. The following is a summary of available spreadsheet navigation techniques.

- **Single Click a Cell:** Makes the cell active.
- **Enter:** Moves the active cell one cell down.
- **Shift + Enter:** Moves the active cell one cell up.
- **Tab:** Moves the active cell one cell to the right.
- **Shift + Tab:** Moves the active cell one cell to the left.



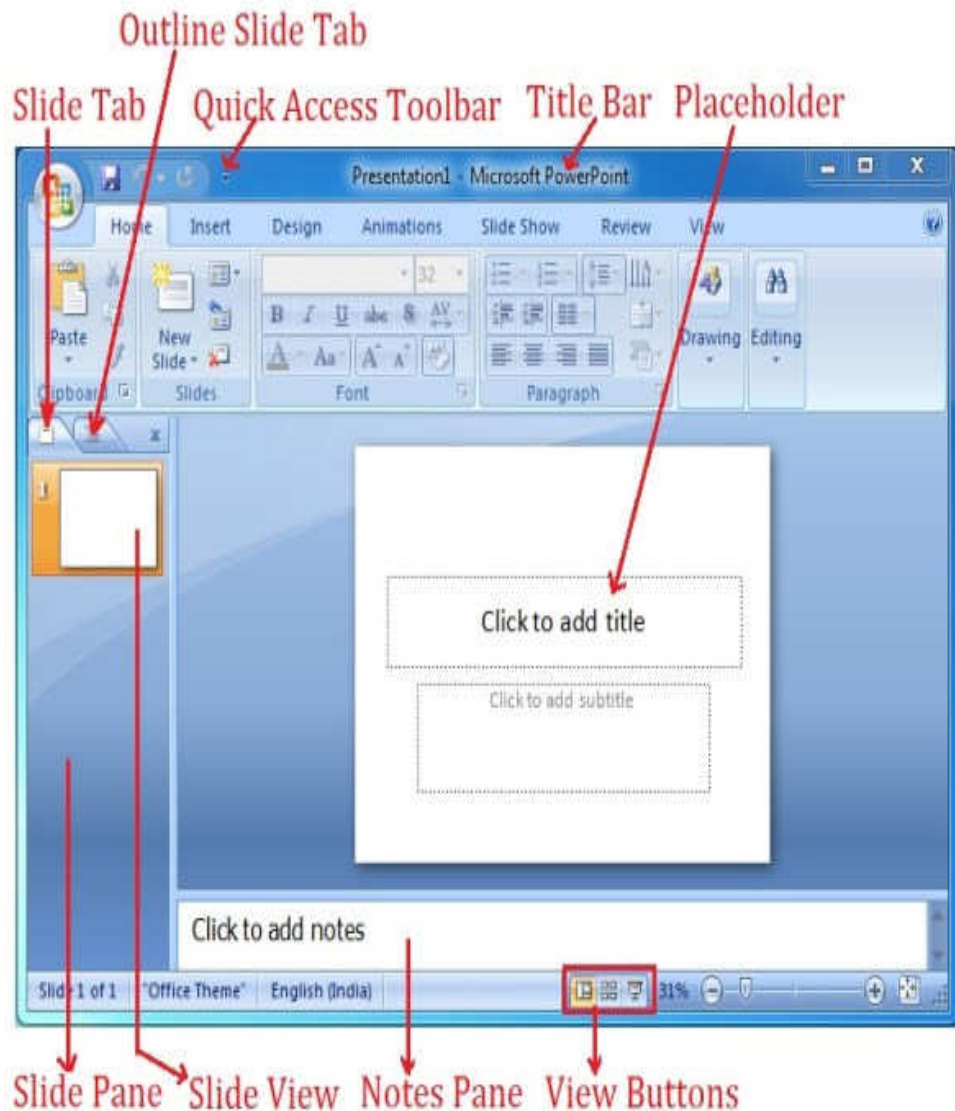
**Fig. 1.52: The Basics of Microsoft Excel Window**

### In-Text Questions

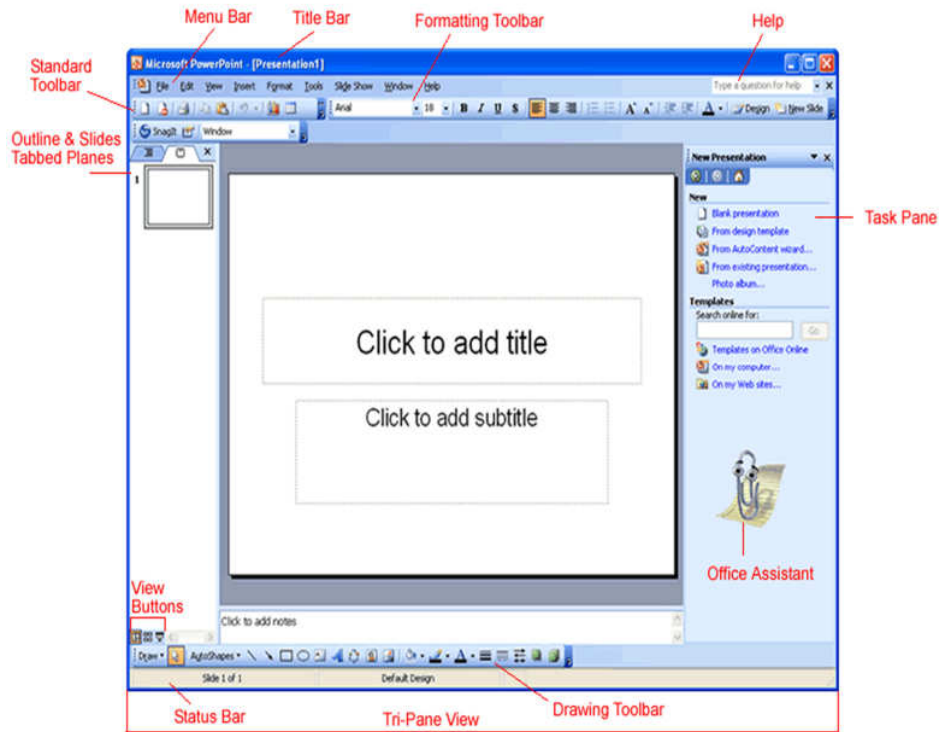
1. What is the name of files created in Microsoft Excel?
2. In Microsoft Excel, the place of intersection of rows and columns is known as what?

### 3.3 Microsoft PowerPoint

Microsoft PowerPoint Software is a presentation program that creates a slide show of important information, charts, and images for presentation. PowerPoint slides may contain only text, or they can include pictures, videos, or animated text and images. Text may be formatted in the same ways as in Microsoft Word, with custom colour, size, and font type. It is most often used for business and school presentations.



**Fig. 1.53: PowerPoint Window**



**Fig. 1.54: PowerPoint Window**

### 3.3a Functions of Microsoft PowerPoint

1. It can be used as desktop publishing software.
2. It can be used by health/sports marketers and other media houses for advertisement of health/sports services and products.
3. It can be used to enhance speeches of teachers/presenters during lessons, seminar presentations, workshop and conferences.
4. It can be used to animate text and graphics to amuse the audience and enhance presentation.

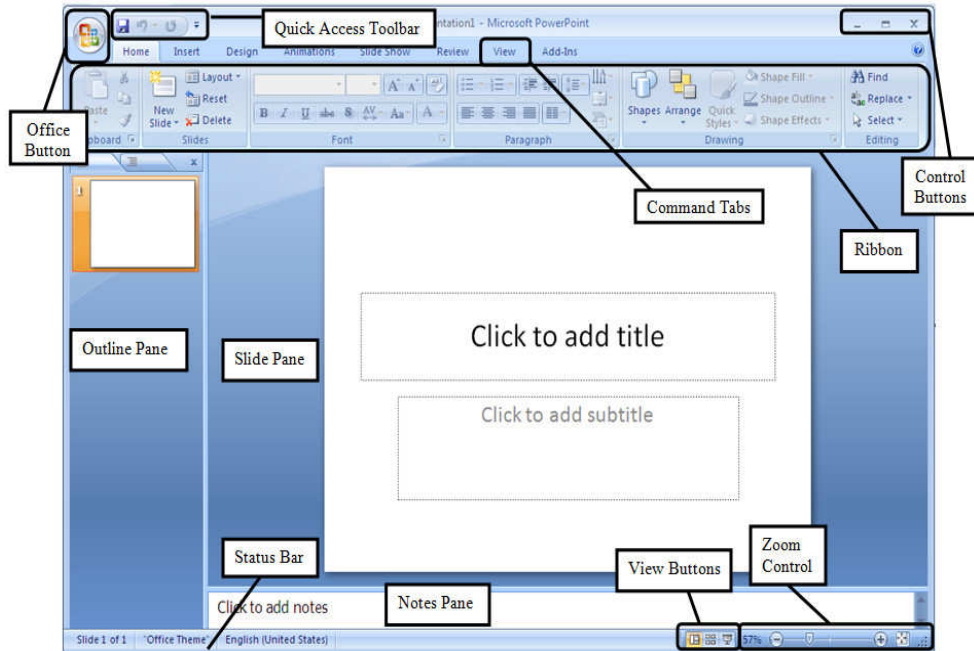
### 3.3b Starting PowerPoint

- Click on **Start**.
- Click on **Program**.
- Click on **Microsoft PowerPoint**.

If you have shortcut on the desktop, double click **the icon** on the desktop to open.

### 3.3c Exiting PowerPoint

- Click on **File**.
- Click on **Exit**.



**Fig. 1.55: Components of PowerPoint Window**

### 3.3d PowerPoint Technical Language

The following are some terms used in operating Microsoft PowerPoint:

- i) **Slide:** A slide is a basic unit that is contained in a presentation. Every presentation you make is made up of slides.
- ii) **Presentation:** Is a combination of two or more slides fused together.
- iii) **Layout:** Refers to arrangement of sentences, work, graphics and letters on a slide.
- iv) **Animation:** Is a process of giving life to an object. With animation, objects are manipulated to behave just like animals.



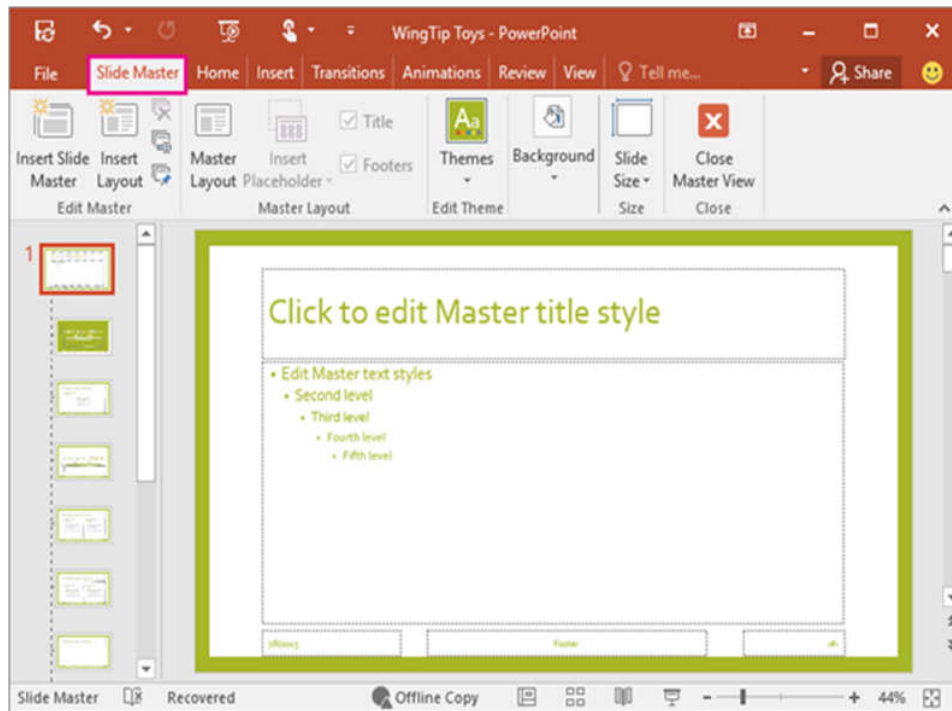


Fig. 1.56: PowerPoint Slide

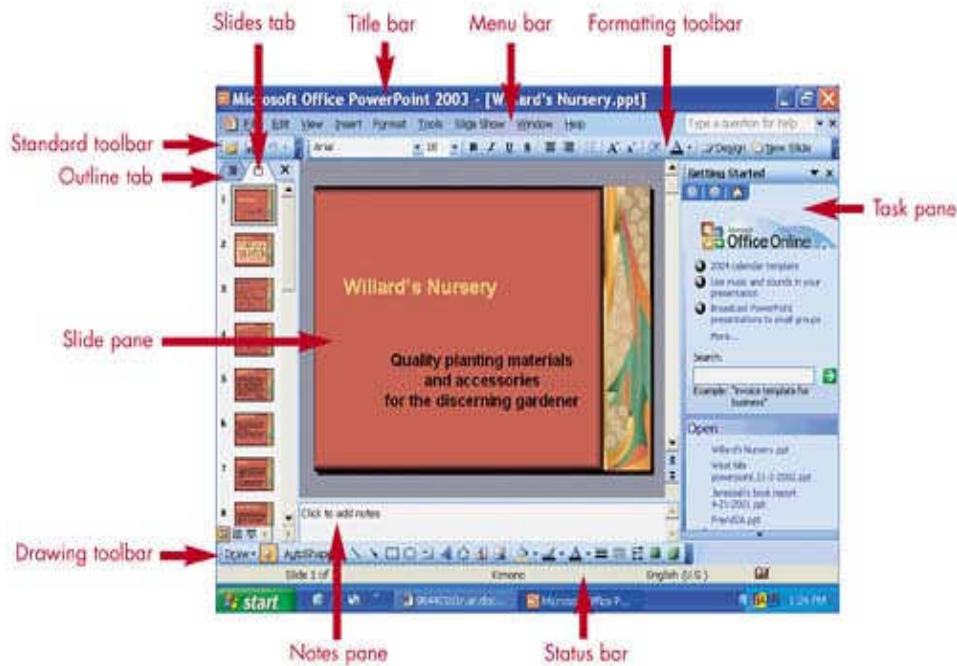


Fig. 1.57: PowerPoint Slides

**In-Text Questions**

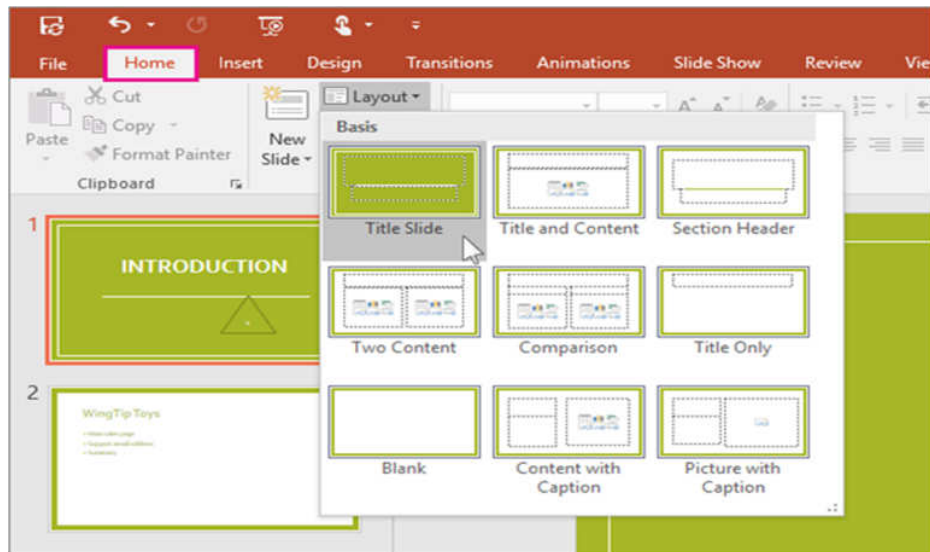
1. Microsoft PowerPoint presentations consist of what?

2. The manipulation of objects to behave like animals is called what in MS PowerPoint?

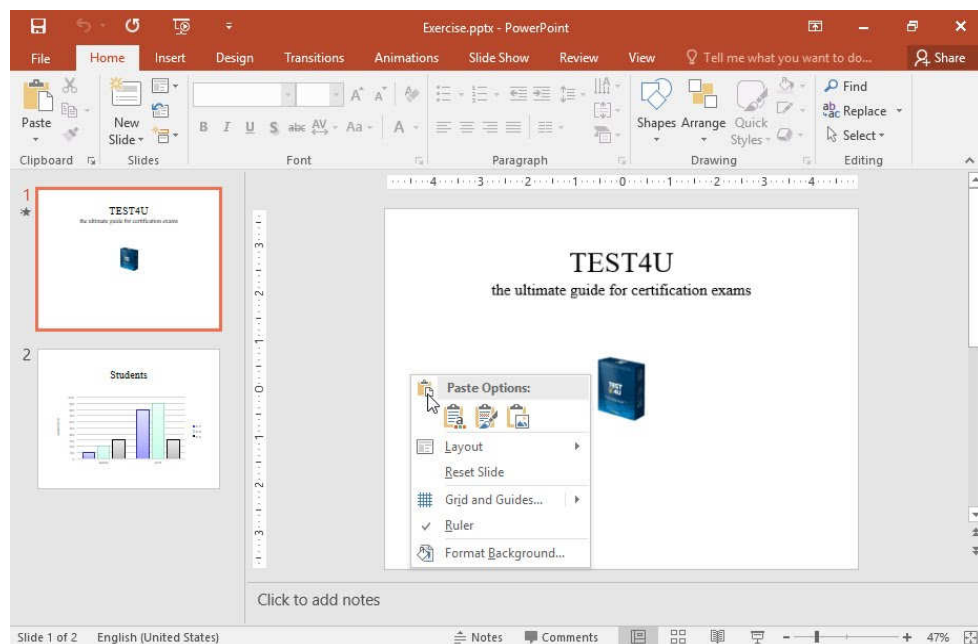
### 3.3e Ways of Creating Presentation

There are three ways of creating presentation, these include:

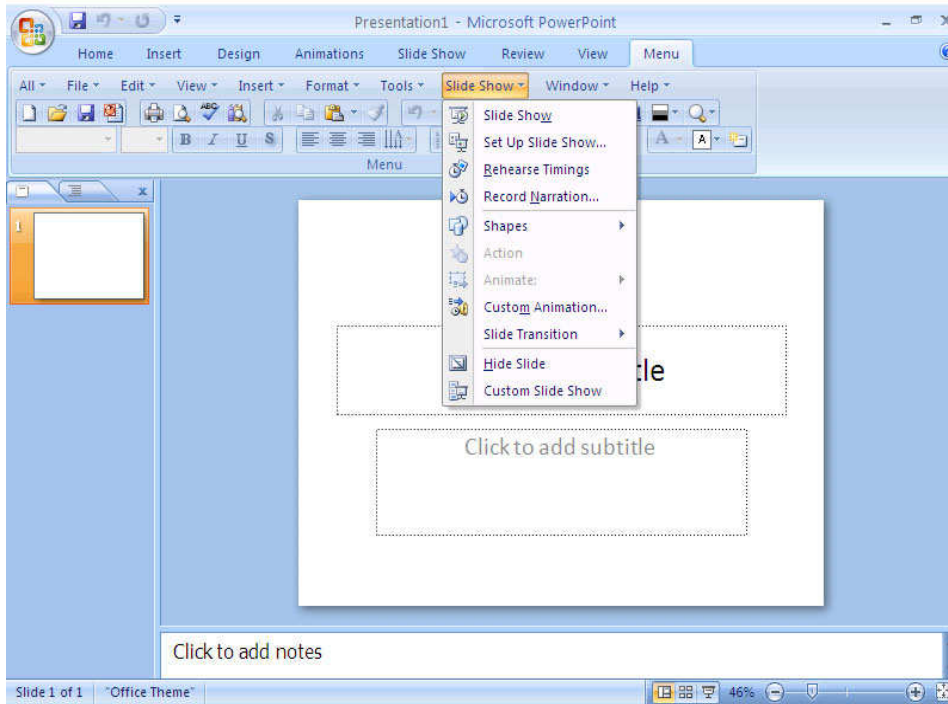
- AutoContent Wizard;
- Design Template; and
- Blank Presentation.



**Fig. 1.58: PowerPoint Slide Template**



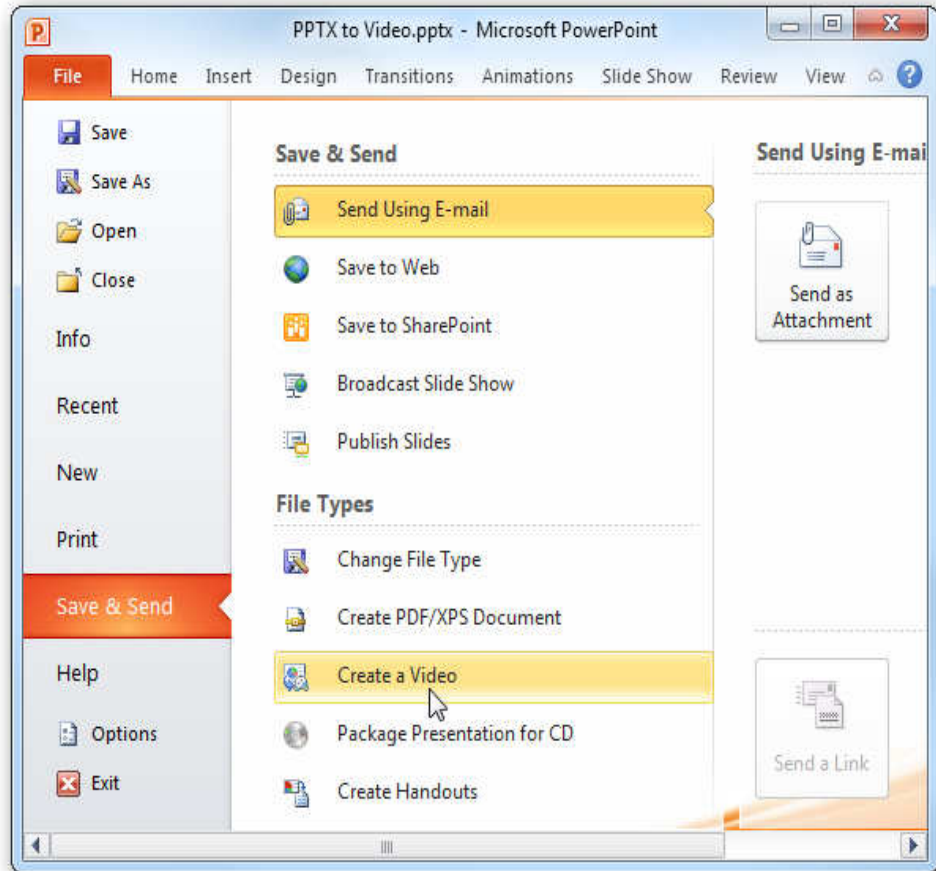
**Fig. 1.59: PowerPoint Slides**



**Fig. 1.60: Slide Show Menu**

i) **AutoContent Wizard:** When you first start PowerPoint presentation, the AutoContent Wizard will ask you questions on the subject matter of your presentation; it will create presentation, including text, based on the answers you provided. In creating AutoContent Wizard you follow the following procedures:

- Click on **File Menu**.
- Select **New** and Click.
- Click on **General Tab**.
- Click on **AutoContent**.
- Click on **Ok**.
- Select the **presentation type** and click **Next**.
- Select the **presentation style** and click **Next**.
- Select the **presentation option** and click **Next**.
- Click on **Finish** at the End.



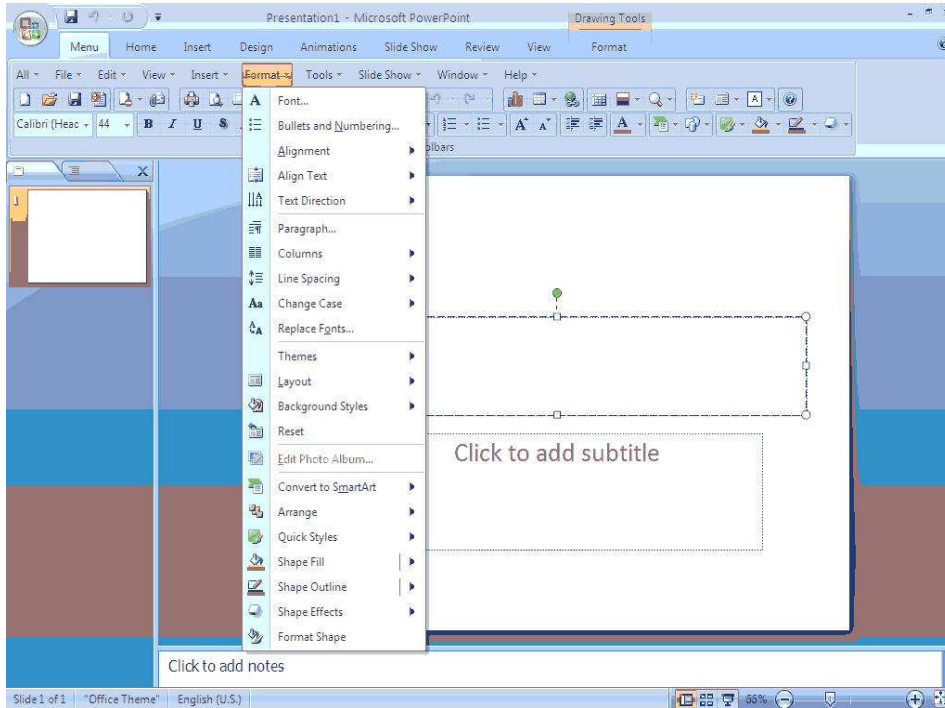
**Fig. 1.61: File Menu**

**ii) Design Template:** A template presents designs for your presentation; it does not add any text, but put colours and graphics into the background of your slides. The procedure for creating presentation with graphics and colours in the background is as follows:

- Click on **File**.
- Click on **New**.
- Click on **Design Template Tab**.
- Click on **Design Template** you desire, e.g. **Artsy**.
- Click **Ok**.

**iii) Blank Presentation:** This produces presentation with white background and black text. It is up to you to format it to your taste. The procedures include:

- Click on **File**.
- Click on **New**.
- Click on **Blank Presentation**.
- Click **Ok**.



**Fig. 1.62: Format Menu**

## 4.0 CONCLUSION

Have you read this Unit and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of the introductory knowledge to computer application packages.

## 5.0 SUMMARY

In this Unit, you have learnt computer application packages, such as MS Word, Microsoft Excel, and Microsoft PowerPoint. Also, you learnt some advantages of Microsoft Word over typewriter, as well as some shortcuts in MS Word and their uses.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. What are utilities packages?
2. MS Access is an example of what application package?
3. Which of the following is not a subdivision of MS Word screen?
4. Lotus 1-2-3 is regarded as an example of which of the application packages?
5. Which of the following is not an example of application program?

6. The arrangement of sentences and graphics in PowerPoint slides is known as .....

## **7.0 REFERENCES/FURTHER READING**

Bakpo, F.S. (2002). *Introduction to Computer Science*. Unpublished Material, University of Nigeria Nsukka.

Federal Ministry of Education Special Teacher Upgrading Programme (2007). *Nigeria Certificate in Education Course Book on General Studies Education Year 1*. National Teachers' Institute, Kaduna.

Ozochinanuife, E.S. (2008). *Computer Science for Beginners*. His Glory Publications.

Ozochinanuife, E. S. (2016). *New General Computer Course and ICT: Theory and Practice for Students and others (Revised Edition)*. His Glory Publications.

## **UNIT 3      MICROSOFT EXCEL AND POWERPOINT**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 Microsoft Excel
  - 3.2 Microsoft PowerPoint
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### **1.0 INTRODUCTION**

Microsoft Excel is a software program produced by Microsoft that allows users to organise, format and calculate data with formulas using a spreadsheet system. This software is part of the Microsoft Office suite and is compatible with other applications in the office suite. On the other hand, Microsoft PowerPoint is a computer software created by Microsoft which allows the user to create slides with recordings, narrations, transitions and other features in ORDER TO PRESENT INFORMATION.

### **2.0 OBJECTIVES**

By the end of this unit, you will be able to:

- identify common uses of Microsoft Excel
- state some functions of Microsoft PowerPoint
- explain technical terms used in PowerPoint.

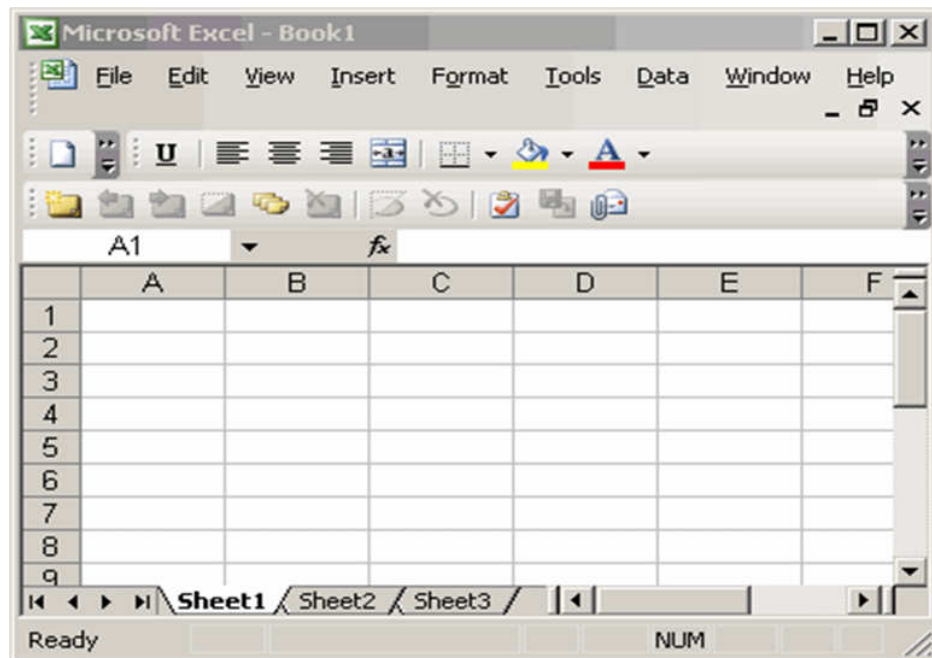
### **3.0 MAIN CONTENT**

#### **3.1 Microsoft Excel (Spreadsheet)**

It's a software program that uses spreadsheet to organise numbers and data with formulas and functions. It is a tool for organising and performing calculations on data. It can analyse data, calculate statistics, generate pivot tables, and represent data as a chart or graph. Unlike a word processor, such as Microsoft Word, Excel organises data in columns and rows. Rows and columns intersect at a space called a **Cell**.

Each cell can contain a single data, such as text, a numerical value, or a formula. Microsoft Excel can be used to:

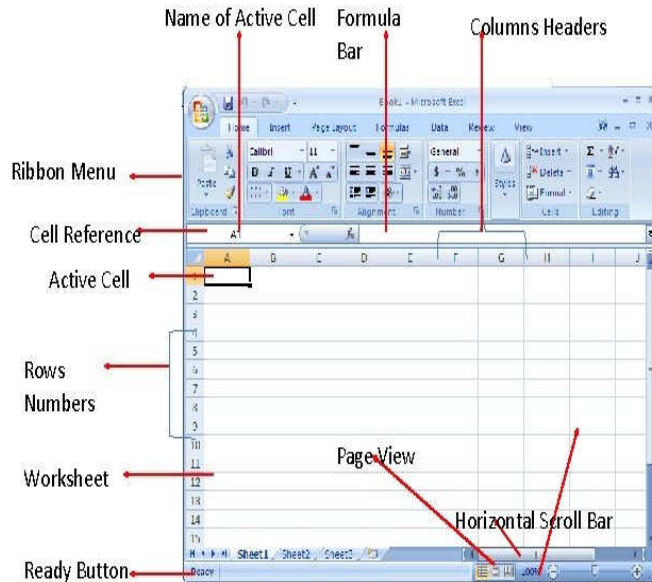
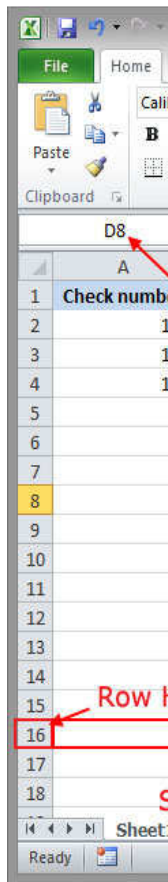
- i) Preserve and analyse data in our daily life.
- ii) Make annual report of your organisation or council.
- iii) Prepare annual budget/production management for your organisation
- iv) Make any scientific calculation.
- v) Prepare payroll for teachers, coaches and other administrative staff in any organisation.
- vi) Represent data in an attractive format, i.e. graphs (e.g. bar chart, pie chart, histogram, etc.).



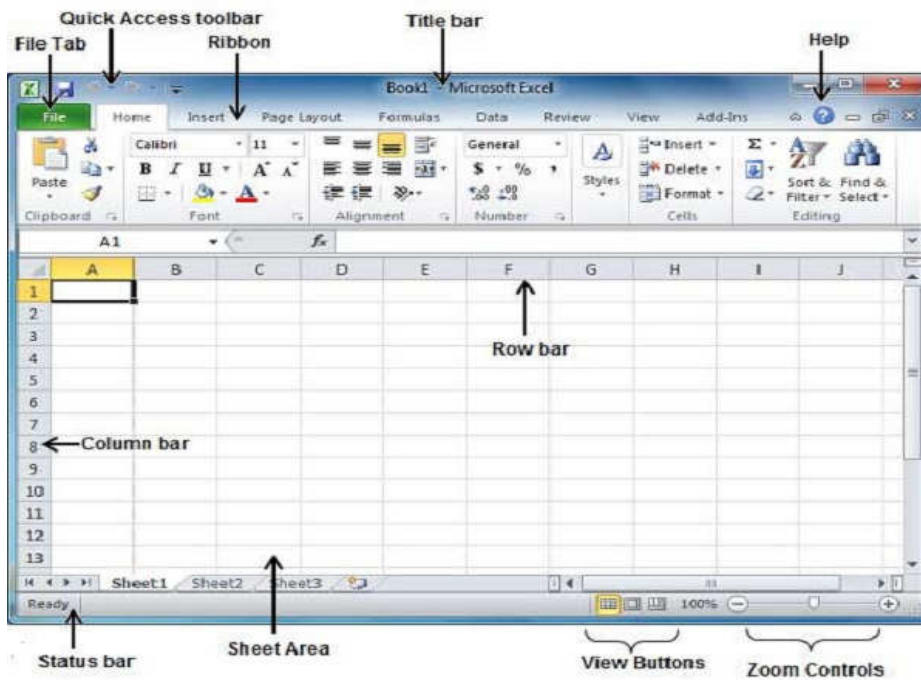
**Fig. 1.48: Microsoft Excel Worksheet**



# Ms/Excel 2007 Window



**Fig. 1.49: Microsoft Excel Worksheet**



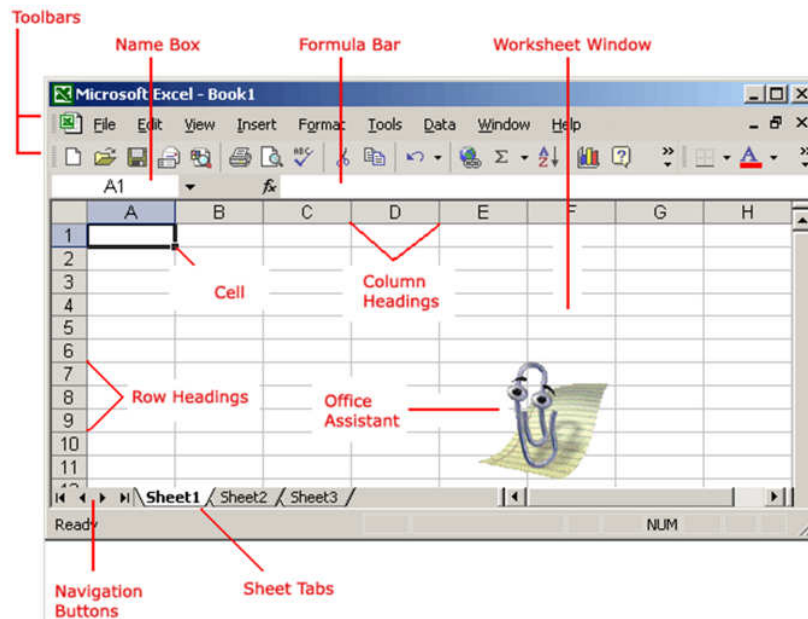
**Fig. 1.50 and 1.51: Microsoft Excel Windows**

### 3.1.1 Starting the Microsoft Excel

- Click the **Start button** in the lower-left corner of the task bar.
- Click **All Programs**.
- Click on **Microsoft Office**.
- Click on **Microsoft Excel 2010**.

The files you create in Excel are called workbooks. You can start a new workbook any time you want to create a new file for your Excel data. By default, every new workbook you open automatically contains three blank worksheets (sheet1, sheet2, sheet3) you can use to enter Excel data. As you enter and edit data, you will need to move through the worksheet, which can be done using your mouse or keyboard shortcuts. The following is a summary of available spreadsheet navigation techniques.

- **Single Click a Cell:** Makes the cell active.
- **Enter:** Moves the active cell one cell down.
- **Shift + Enter:** Moves the active cell one cell up.
- **Tab:** Moves the active cell one cell to the right.
- **Shift + Tab:** Moves the active cell one cell to the left.



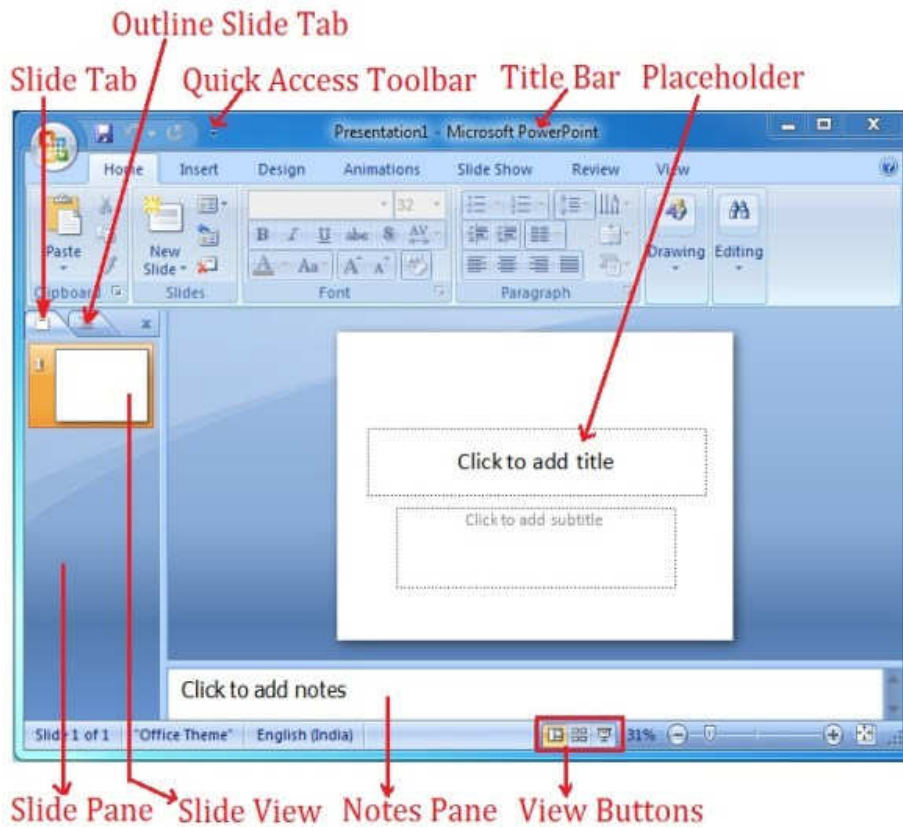
**Fig. 1.52: The Basics of Microsoft Excel Window**

**In-Text Questions**

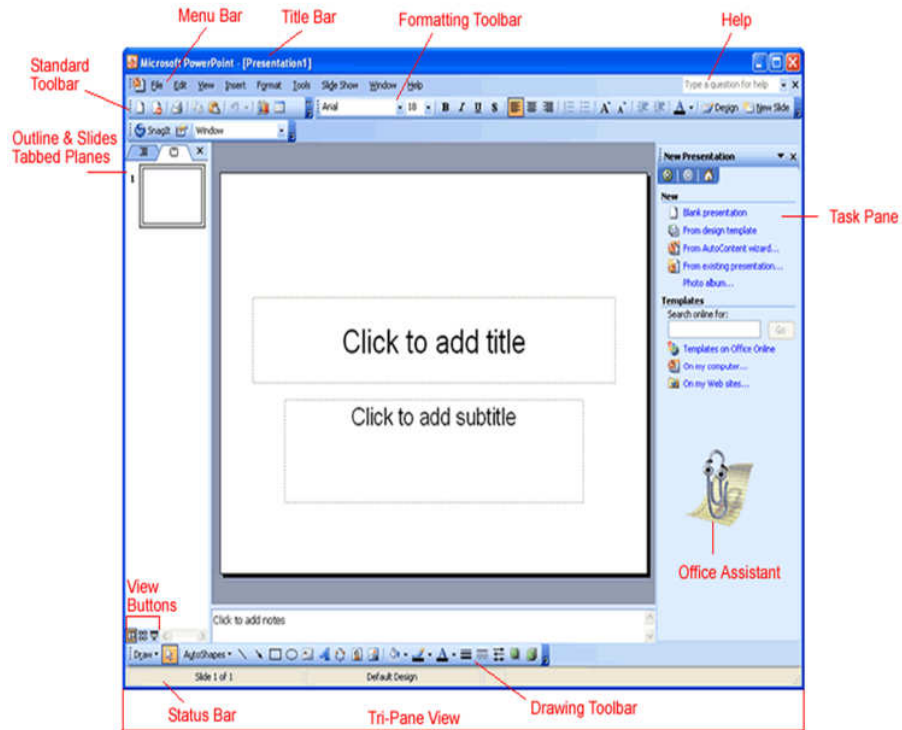
1. What is the name of files created in Microsoft Excel?
2. In Microsoft Excel, the place of intersection of rows and columns is known as -----

**3.2 Microsoft PowerPoint**

Microsoft PowerPoint Software is a presentation program that creates a slide show of important information, charts, and images for presentation. PowerPoint slides may contain only text, or they can include pictures, videos, or animated text and images. Text may be formatted in the same ways as in Microsoft Word, with custom colour, size, and font type. It is most often used for business and school presentations.



**Fig. 1.53: PowerPoint Window**



**Fig. 1.54: PowerPoint Window**

### 3.2.1 Functions of Microsoft PowerPoint

1. It can be used as desktop publishing software.
2. It can be used by health/sports marketers and other media houses for advertisement of health/sports services and products.
3. It can be used to enhance speeches of teachers/presenters during lessons, seminar presentations, workshop and conferences.
4. It can be used to animate text and graphics to amuse the audience and enhance presentation.

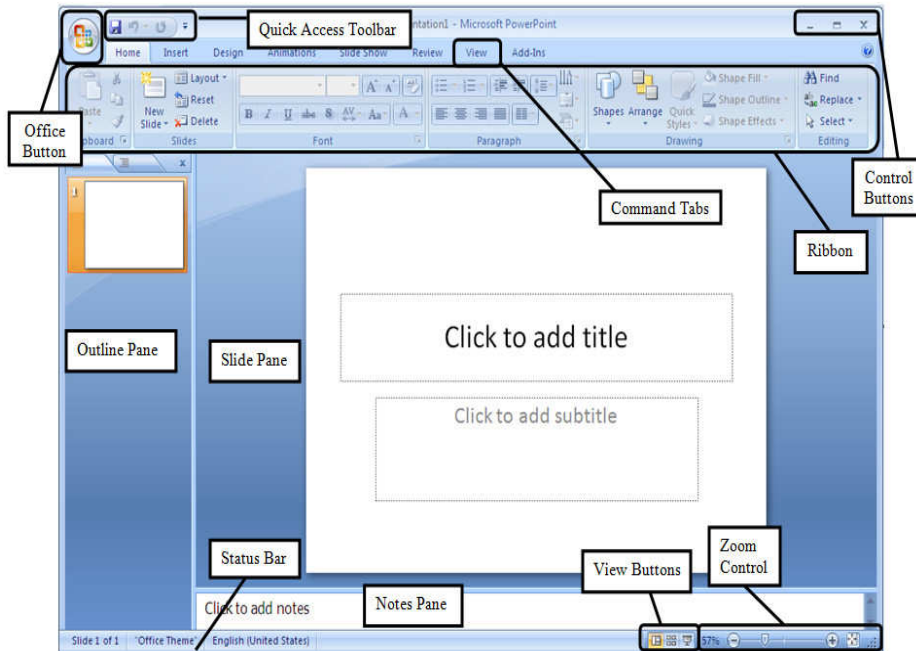
### 3.2.2 Starting PowerPoint

- Click on **Start**.
- Click on **Program**.
- Click on **Microsoft PowerPoint**.

If you have shortcut on the desktop, double click **the icon** on the desktop to open.

### 3.2.3 Exiting PowerPoint

- Click on **File**.
- Click on **Exit**.



**Fig. 1.55: Components of PowerPoint Window**

### 3.2.4 PowerPoint Technical Language

The following are some terms used in operating Microsoft PowerPoint:

- i) **Slide:** A slide is a basic unit that is contained in a presentation. Every presentation you make is made up of slides.
- ii) **Presentation:** Is a combination of two or more slides fused together.
- iii) **Layout:** Refers to arrangement of sentences, work, graphics and letters on a slide.
- iv) **Animation:** Is a process of giving life to an object. With animation, objects are manipulated to behave just like animals.

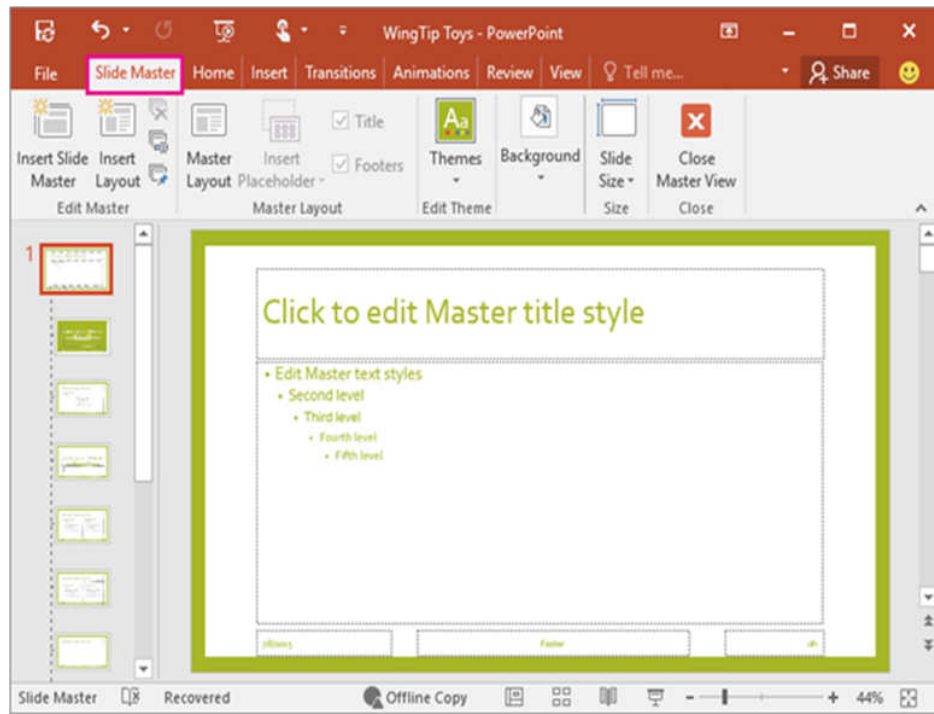


Fig. 1.56: PowerPoint Slide

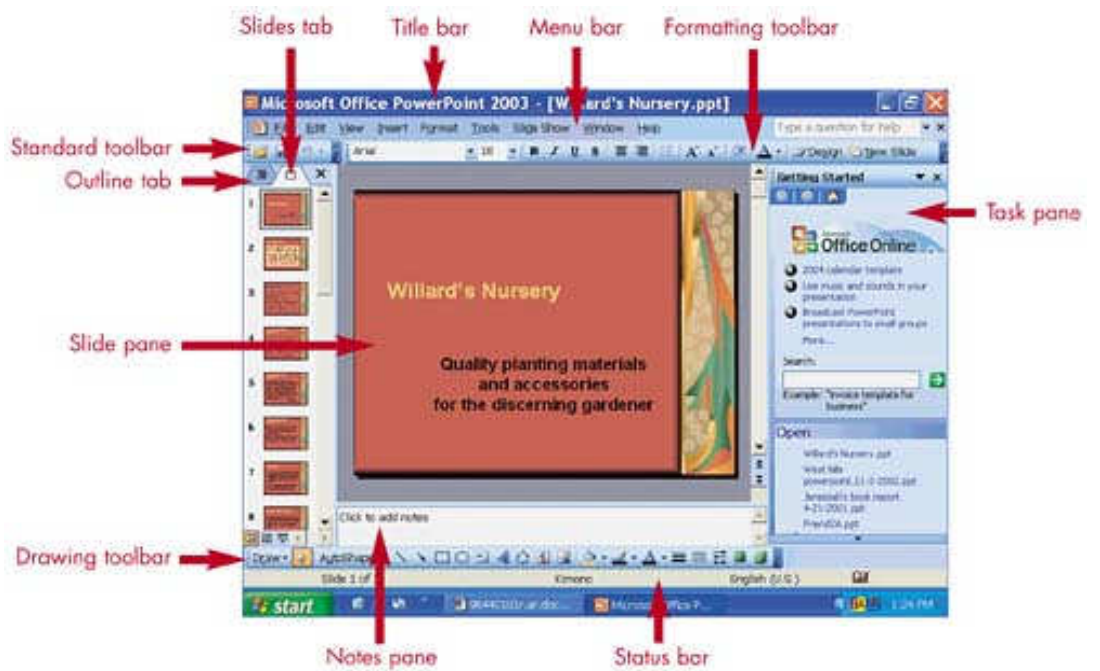


Fig. 1.57: PowerPoint Slides

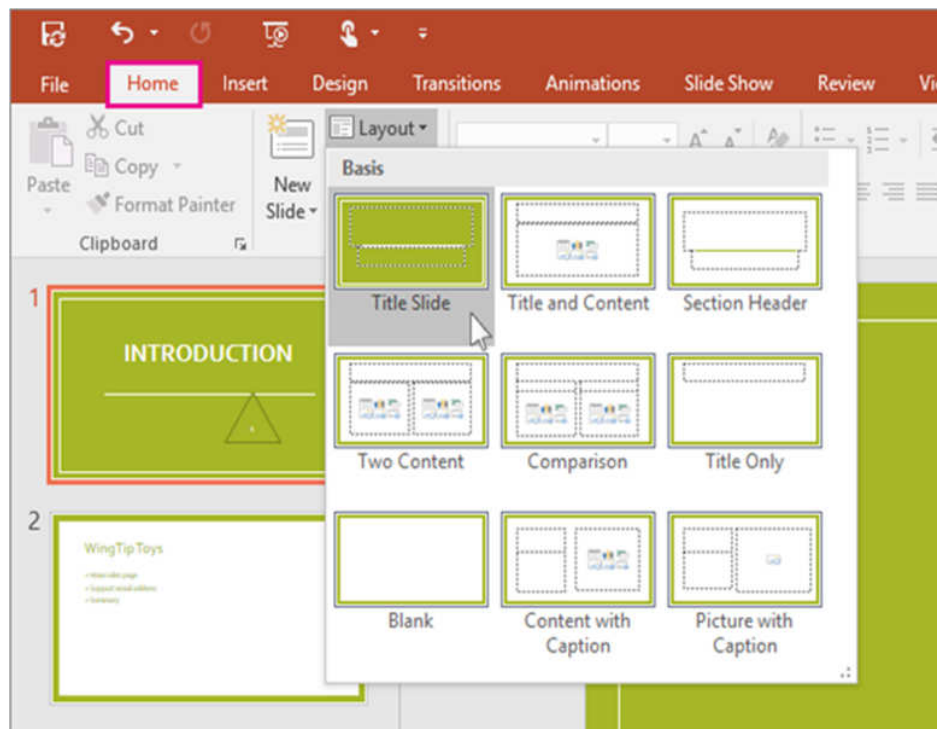
## In-Text Questions

1. Microsoft PowerPoint presentations consist of what?
2. The manipulation of objects to behave like animals is called what in MS PowerPoint?

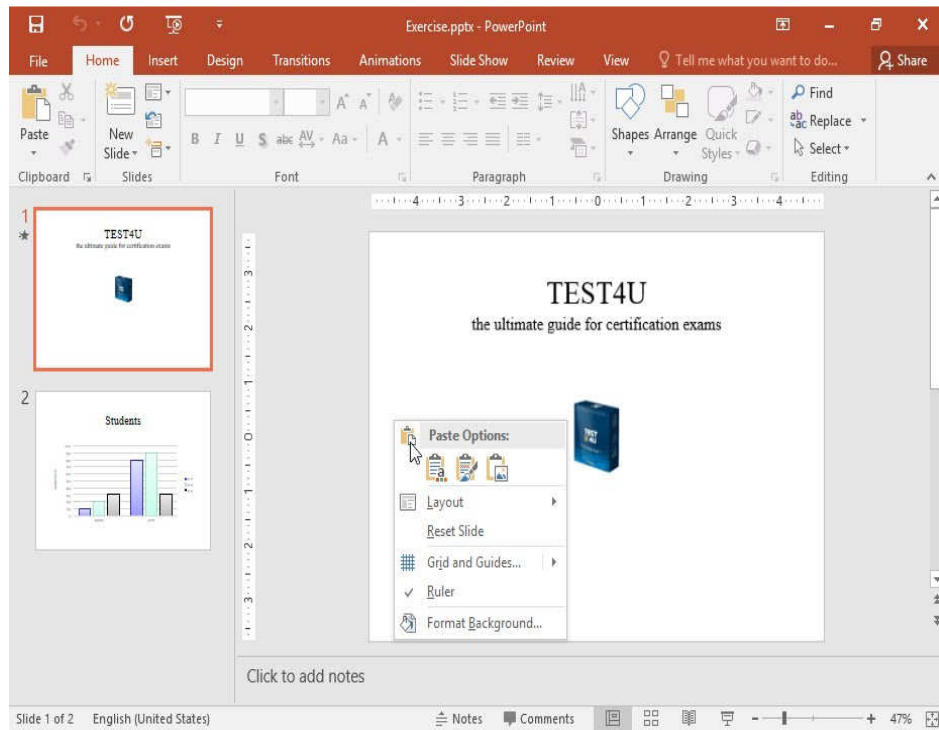
### 3.2.5 Ways of Creating Presentation

There are three ways of creating presentation, these include:

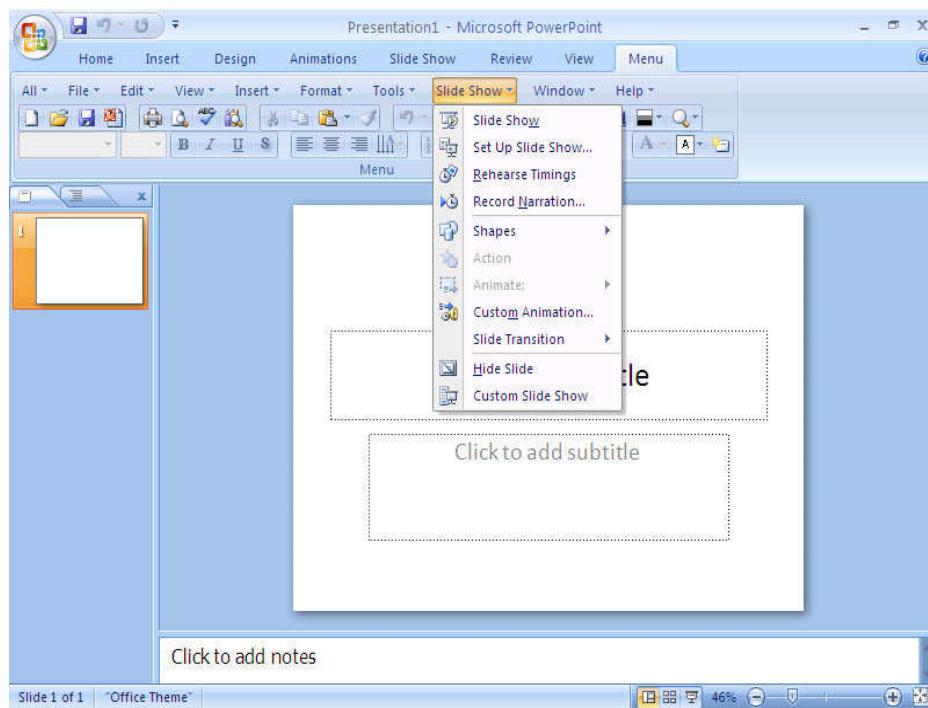
- AutoContent Wizard;
- Design Template; and
- Blank Presentation.



**Fig. 1.58: PowerPoint Slide Template**



**Fig. 1.59: PowerPoint Slides**



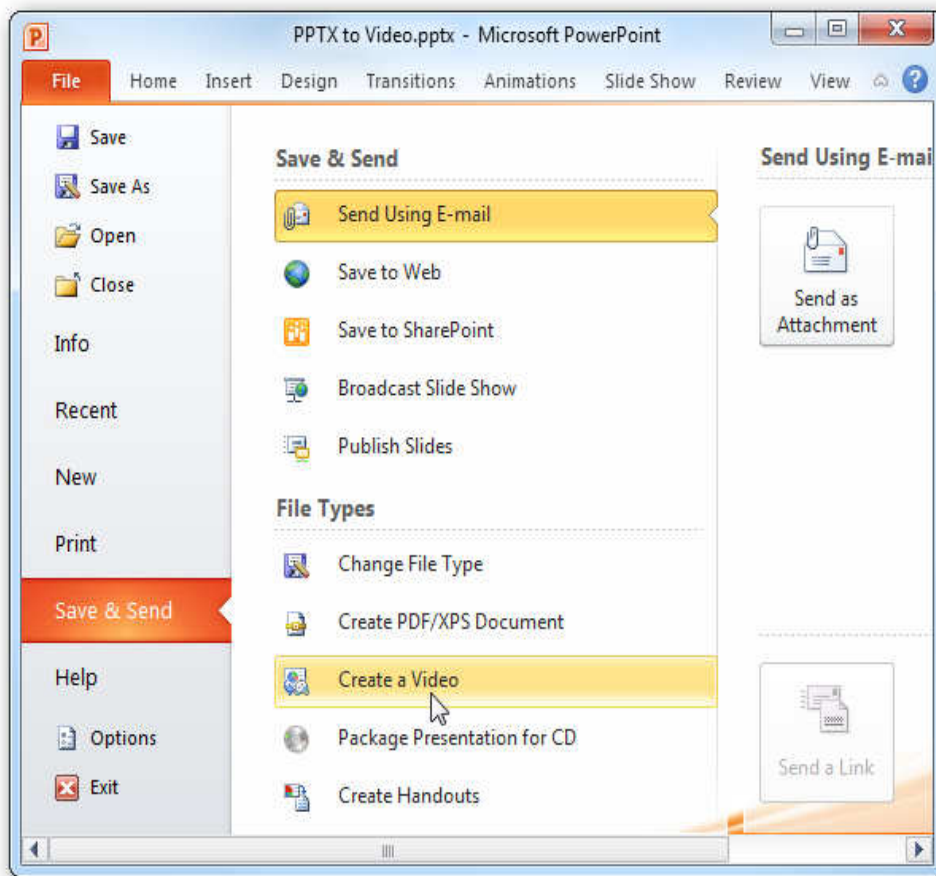
**Fig. 1.60: Slide Show Menu**

**i) AutoContent Wizard:** When you first start PowerPoint presentation, the AutoContent Wizard will ask you questions on the subject matter of



your presentation; it will create presentation, including text, based on the answers you provided. In creating AutoContent Wizard you follow the following procedures:

- Click on **File Menu**.
- Select **New** and Click.
- Click on **General Tab**.
- Click on **AutoContent**.
- Click on **Ok**.
- Select the **presentation type** and click **Next**.
- Select the **presentation style** and click **Next**.
- Select the **presentation option** and click **Next**.
- Click on **Finish** at the End.



**Fig. 1.61: File Menu**

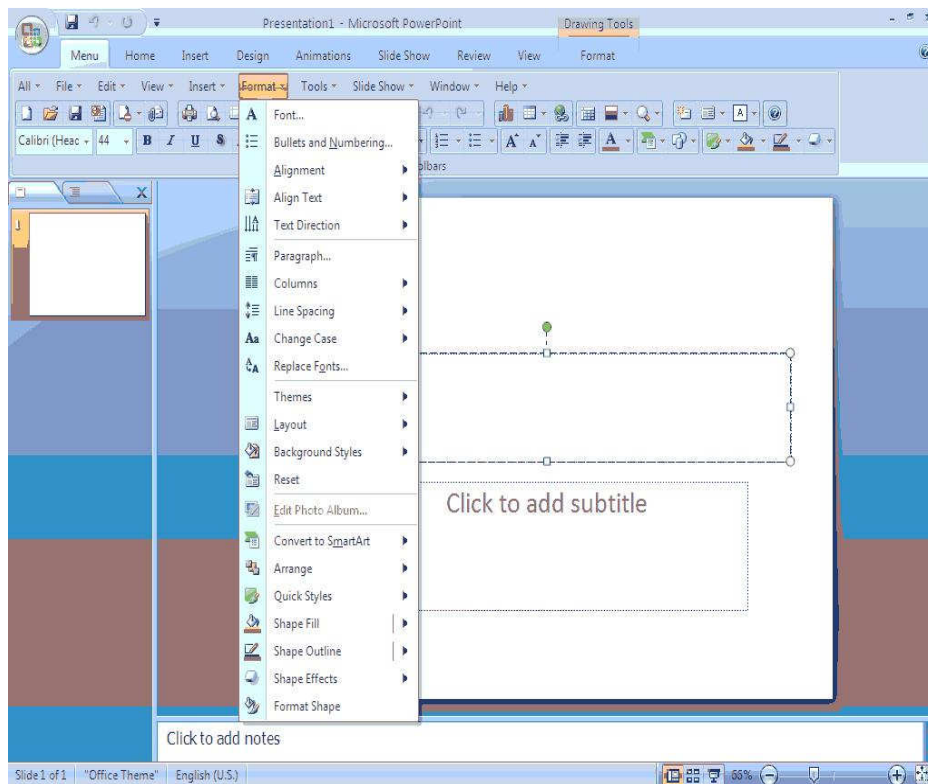
**ii) Design Template:** A template presents designs for your presentation; it does not add any text, but put colours and graphics into the

background of your slides. The procedure for creating presentation with graphics and colours in the background is as follows:

- Click on **File**.
- Click on **New**.
- Click on **Design Template Tab**.
- Click on **Design Template** you desire, e.g. **Artsy**.
- Click **Ok**.

**iii) Blank Presentation:** This produces presentation with white background and black text. It is up to you to format it to your taste. The procedures include:

- Click on **File**.
- Click on **New**.
- Click on **Blank Presentation**.
- Click **Ok**.



**Fig. 1.62: Format Menu**

#### **4.0 CONCLUSION**

Haven read this Unit and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of the introductory knowledge to Microsoft Excel and PowerPoint application packages.

## **5.0 SUMMARY**

In this Unit, you have learnt about Microsoft Excel and Microsoft PowerPoint application packages, as well as their uses.

## **6.0 TUTOR-MARKED ASSIGNMENT**

1. Which of the following is not one of the uses of MS Excel?
2. Which of the following is true about MS PowerPoint?
3. Lotus 1-2-3 is regarded as an example of which of the application packages?
4. The arrangement of sentences and graphics in PowerPoint slides is known as .....

## **7.0 REFERENCES/FURTHER READING**

Bakpo, F.S. (2002). Introduction to Computer Science. Unpublished Material, University of Nigeria Nsukka.

Federal Ministry of Education Special Teacher Upgrading Programme (2007). Nigeria Certificate in Education Course Book on General Studies Education Year 1. National Teachers' Institute, Kaduna.

Ozochinanuife, E.S. (2008). Computer Science for Beginners. His Glory Publications.

Ozochinanuife, E. S. (2016). New General Computer Course and ICT: Theory and Practice for Students and others (Revised Edition). His Glory Publications.

**MODULE 4****UNIT 1 APPLICATION OF COMPUTER TECHNOLOGY IN HEALTH, PHYSICAL EDUCATION AND SPORTS****CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 Application of Computer Technology in Health Education
  - 3.2 Importance of Using Computer Technology in Health Education
  - 3.3 The Internet in Health Education
  - 3.4 Potential Negative Health Consequences of Computer Technology
  - 3.5 Application of Computer in Physical Education and Sports
  - 3.6 The Internet in Physical Education and Sports
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

**1.0 INTRODUCTION**

The use of computer in this modern age is inevitable. This requires every one especially health and physical educators to have the knowledge of computer technology through computer education. This includes learning a computer through reading and practicing. The knowledge obtained in computer education will enhance the ability to teach health and physical education. It will also make health instruction/physical education easier for the teachers, richer and more meaningful for the students, leading to more individualised instruction and less rote learning.

**2.0 OBJECTIVES**

By the end of this unit, you will be able to:

- explain how computer can be used in teaching and learning Health, Physical Education and Sports
- state and explain ways by which internet facilities can be used in solving problems related to Health, Physical Education and Sports
- mention some potential negative health consequences of the use of computer/internet in teaching and learning of Health, Physical Education and Sports.

### 3.0 MAIN CONTENT

#### 3.1 Application of Computer Technology in Health Education

The computer with its virtually instantaneous response to student inputs, its extensive capacity to store and manipulate information, and its unmatched ability to serve many individual students simultaneously is becoming more and more widely used as an aid to instruction. The computer has the ability to control and manage a wide variety of learning material, e.g. films, filmstrips, tandem access slides, audio tapes, and printed information. The computer can also record, analyse, and react to student responses that are typed on a special typewriter keyboard or indicated with a "light pen" on a cathode ray tube (television display screen). Some display screens would even react to the touch of a student's finger.

There are two types of computer based instruction: **Computer-Assisted Instruction (CAI)** and **Computer-Managed Instruction (CMI)**. CAI is a program of instructional material presented by means of a computer or computer systems. In other words, Computer-Assisted Instruction is the use of computer in the teaching and learning activities. Contrary to the deficiencies of the conventional method of instruction, CAI enables students to progress at their own pace, individualises the learning process and motivates them to learn better by providing immediate feedback. CAI programs are therefore interactive and can engage the learner instructional decisions which give the teacher more time for assisting students with peculiar learning difficulty, as well as offering the learner positive reinforcement for the learning progress made. This approach goes a long way to help in overcoming the problem of rote memorisation of facts, processes, principles, logic and computations by the students. This is because this approach gives them the opportunity to learn by doing. Examples of CAI applications include: **guided drill and practice exercises; computer visualisation of complex object; and computer facilitated communication between students and teachers.**

Computer-Managed Instruction is an instructional strategy whereby the computer is used to provide learning objectives, learning resources, and assessment of learner performance. CMI aids the instructor in instructional management without actually doing the teaching. Simply put, CMI is the management of instructional courseware through a computer software application. User registration, course enrollment, random test generation and scoring, student record-keeping, and other registrar functions are maintained by the CMI system. In addition, the computer can diagnose the learning needs of students and prescribe optional sequences of instruction for them.

Application software packages are programs that direct the computer to solve specific problems for the user. Although originally developed for the business sector and private industry, software has proven to be very beneficial in health education. Commonly used applications include Microsoft Word, Microsoft PowerPoint, Database Management Systems, and Electronic Spreadsheets. Traditionally, health information for children and adults has been presented through parents, books and healthcare professionals. But with growing use of technology in society, the use of computers and video game technology presents an opportunity to have a profound effect on health information dissemination. A generation of children raised on video games will probably be more attuned to health messages coming from interactive videos than from lectures by the school Nurse. Games and simulations potentially can help users personalise health information, assess risks and consequences, and then make decisions in a realistic situation.

Without doubt, the future of health education is bright with the widespread of health information through computer technology. The principal results of the use of computer in health education research remains to be seen. The results from these researches will enable man to make informed wise decisions that are favourable to their health and reject those that are detrimental to their health therefore reducing the cost of medical care.

### **3.2 Importance of Using Computer Technology in Health Education**

It has been well documented that technology can engage children as active learners and support skill development in the classroom environment. Computer technology promotes learning and development in early childhood education. For example, the software program "Hungry Red Planet" produced by Health Media Labs. This interactive program provides the child with a sense of realism and individuality, when making decisions about his or her nutritional choices. Video and computer-based games may possess advantages not present in other learning strategies. For example, the ability to choose different solutions to a difficult problem and then see the effects those decisions have in a fictional game, allows students to experiment with problem-solving in a relatively safe environment. The multisensory nature of many computer programs gives learners more cues which may lead to increased learning and remembering of health information.

Students learn and develop at different rates. Health education principle holds that the educator must consider the individual health and learning needs of the students. Use of computer technology in the classroom can facilitate this goal by evaluating and assessing the health needs of the students. For example, many computer-based games and learning

programs are able to assess the level of competence, record the playing history, and start the user at the appropriate level of the program. Use of computer technology in the health education setting will enhance computer literacy and the ability to manage electronic health information, an increasingly important life and vocational skill. Computer technology opens avenues for study and exploration about health that, until now, would have required visiting a health centre or library.

### **In-Text Questions**

1. What are the two types of computer based instruction?
2. The use of computer technology does not allow consideration of individual learning needs of students; True or False?

### **3.3 The Internet in Health Education**

Internet is a global system of interconnected computer networks that promote free flow of information by using the standardized internet protocol suit. It is a network that consists of millions of private and public, academic, business and government network of local/global scope that are linked by copper wires, fibre-optic cables and wireless connections technologies. The internet today is providing a vast amount of information in shorter time to greater amounts of people at an increasing rate. This increase is potentially very influential in health education for young students in both schools and homes. As technology use increases in our society, it is important learners become more capable and proficient at accessing health information via computer technologies. The internet contains vast amounts of credible health information students can access within seconds. And as they access advanced health information websites, e.g. websites from the Center for Disease Control and Prevention, National Institute for health, World Health Organisation, and several others, those websites would stimulate advanced thinking about health issues and allow the student to investigate more advanced solutions to health problems. The following are some top internet uses and learning which are very relevant to teachers, lecturers, health educators and health education students:

- 1) **Research:** Is the number one use of the internet. With the technology of today you no longer have to spend hours at the library, search through hundreds of cards in the card catalog, periodicals, or carry heavy books home just to get enough information to support ones ideas. Today those resources are at ones fingertips. Refine your search terms and you have a wealth of health information in a matter of minutes.



- 2) **Social Networking:** This is an online community of individuals who share interests and activities. It can build communication links between diverse populations of people. Face book is an example of a social network.
- 3) **Video and Podcasting:** This is one of the most widely adopted internet technologies in the instructional setting. With this technology there is an abundance of lectures, how-to videos and supporting materials available in the form of web based video. Podcasts is also available to offer similar audio materials through popular sites.
- 4) **Collaboration and Brainstorming Tools:** This is a wide ranging category of tools that include thought-organising tools like mind map, and collaborative tools like web based interactive whiteboard.
- 5) **Presentation Tools:** The internet offers hundreds of tools that can be used to create and share presentations. This may range from the simple PowerPoint slide players to multimedia timeline tools. These tools can be used to support classroom teaching or distance learning, or for student reports and presentations.
- 6) **Online Schools:** Many people who are unable to go the distance needed to complete a degree program (and in some cases even their high school diploma) can complete the needed classes in the comfort of their home. A syllabus is given to the students illustrating to them the requirements of the class and timelines set. Instructors are available to answer questions and grade assignments.
- 7) **Blogs and Blogging:** These are areas where people can express their thoughts and feeling and have others comment on them and state their point of view on the subject without personal interaction.
- 8) **E-mail (Electronic mail):** Is a way of sending mails through the internet. Instead of typing and sending a letter in an envelope and post it through post office, the letter is typed and sent through an electronic address, and the recipient will also receive it through the same device or print it on paper. Email is faster, cheaper and more convenient compared to mail through post office. The mail can be sent and delivered to any part of the world within few minutes and the recipient has the message in minutes provided there is access to internet. An excellent way for inter office messages to be delivered as well as a way to stay in touch with superiors (especially mentors and protégés).

### **3.4 Potential Negative Health Consequences of Computer Technology**

Although there are many benefits to technology application in students' health promotion, it is important to recognise that there may be potential negative consequences. An important component of health education is the promotion of daily physical activity. Young students most often take a passive role (i.e. sitting for extended period of time) when engaging in computer and video games, web-browsing and multimedia. This may be viewed as counterproductive to the overall goal of health education when physical activity is considered. Research has shown that playing video games significantly increases heart rate, systolic and diastolic blood pressure and oxygen consumption in both males and females but the cardiovascular stress from playing these video games is not sufficient to improve cardio respiratory fitness.

Also, video games and television viewing may contribute to a sedentary lifestyle by displacing involvement in sport and other physical activities. Harmful physical conditions such as video game induced seizures have also resulted from the use of video games. Furthermore, computer possesses "artificial intelligence" so whatever result got depends on the directives or command given to it. Thus, if one enters wrong data and program, it will release equivalent wrong output and vice-versa. Pornography is another problem of computer technology. Young students, especially secondary school students indulge in all acts of sexual 'games'. This may not only increase the incidence of abnormal sexual behaviours in future but may also lead to other social problems such as unwanted pregnancy, increase in school dropout and traumatic psychological effects.

#### **In-Text Questions**

1. What is the number one use of the internet in Health education?
2. The use of computer in teaching and learning Health Education promotes participation in daily physical activity; True or False?
3. Internet use in Health Education would stimulate advanced thinking about health issues and solutions in students; True or False?

### **3.5 Application of Computer in Physical Education and Sports**

Physical education/sports involve the performance of physical activities which are associated with the development of motor skills. To make the lessons more real and dynamic, physical educators need to avail themselves of available computer technologies. Many pieces of computer technology, such as heart rate monitor, pedometers and active

games, have the ability to track performance, allowing students and athlete to document and monitor their progress. Computer technology provides access to information, compresses information, motivate learners, and connect learners to teachers and teacher to the colleagues. There are several available technological innovations nowadays that could be inserted into the physical education lesson. Example, visual physical education lesson is essentially based on the connected learning environment which uses technologies that are networked in structure.

Computer can be used to store, retrieve and process information concerning staff, athletes, and finance in any sports organisation faster and accurately. To P.E. teachers, it can be used to produce documents, lesson plans, convey students' examination scores. It can also be used to monitor heart rate, pulse rate, body mass index (BMI) and VO<sub>2</sub>max monitor in an automated treadmill. Computer also aid learning experience when they are used for motion analysis. This involves using computer to examine the way learner/athlete moves and then determine ways in which this movement can be improved in a practical physical education class. This device stresses how human motor abilities can be perfected and controlled. For example, motion analysis visually shows the rudiments and sequence of actions involved in arm-leg movements to enhance performance of skills.

Video tape images are also transferred into computers. Special application software analyses the images; it measures the exact angle at which the player is holding his/her arms and legs. The speed and efficiency of each movement is measured. Other computer software such as the programs Professional Evolution Soccer (PES) is used to play games. Learners play, identify, appreciate the skills, rules, and evaluate officiating of the game.

### **3.6 The Internet in Physical Education and Sports**

The internet provides various information resources and services which can be used by physical educators for teaching and learning. They include electronic mail, online chat, electronic transactions, file transfer and file sharing, online newspapers and journals, online gaming and interlinked hypertext documents and other resources of the worldwide web. Physical education teachers share experiences with other professionals via the internet which are integrated into teaching lessons. Students explore new knowledge as they surf the web for assignments, chat with fellow students and play games online.

**In-Text Questions**

1. Computer technology aids learning experience in Physical Education; True or False?
2. Computer hasn't the capacity to make P.E. lessons more real and dynamic; True or False?

**3.6.1 Searching for Information:** The internet is a digital library from which information on any subject or issues in health, P.E. and sports could be obtained. This information is stored in different computers scattered by different people and organisations to enable people look for information. Thus, the internet can be used to maximise the students' effectiveness in learning process in physical education. Students have the opportunity to email their questions or comments concerning issues on health and fitness, physical education programmes, courses, etc. to their physical education teachers and academic staff.

**3.6.2 Online Chat:** Interactive chat improves communication with experts and colleagues, as well as community members. Chats such as Facebook and WhatsApp allow fellow physical educators to simultaneously communicate on your website, internet or extranet. Team members, class and course mates from different locations can easily conduct online meetings. Colleagues gather together into intimate groups and discuss issues related to physical education. They could gather in large online events to interact with experts, celebrities, instructors, coaches and teachers can access chat groups on particular academic issues in physical education and sports.

**3.6.3 Video Conferencing:** It allows two or more people at different locations to see and hear each other at the same time. The communication technology offers new possibilities for sport colleges, organisations, or councils to share strategies for coaching sport skills. A very attractive multimedia tool determining students' enthusiastic participation in physical education lesson is represented by the audio aids.

**4.0 CONCLUSION**

Haven completed reading through this Unit, it is assumed that you have learned and acquired the knowledge you are required to have in the unit. The questions you answered correctly would indicate to you the amount of learning you have achieved in the unit.

**5.0 SUMMARY**

In this Unit, you have learnt application of computer technology in health, Physical Education and Sports. Uses of internet applications

such as e-mail, chatting and video conferencing were highlighted. Potential negative health consequences in using computer applications were also highlighted.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Which of the following is not an example of advanced health information website?
2. Computer has the ability to control and manage variety of learning materials except.....
3. Which of the following is not true about use of computer in Health and Physical Education?
4. Which of the following is not true about the use of internet in learning P.E.?

## 7.0 REFERENCE/FURTHER READING

- Haruna, L. (2018). *Computer Science Education in Universal Basic Education (UBE): Problems and Prospects*. <http://www.resjournals.com/erj>.
- Igudia, E. O. (2010). Analysing Electronic Assisted Health Instruction. *Nigerian Journal of Health Education*, 14 (1), 118-126.
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## **UNIT 2 APPLICATION OF COMPUTER IN PHYSICAL EDUCATION AND SPORTS**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 Application of Computer in Physical Education and Sports
  - 3.2 The Internet in Physical Education and Sports
  - 3.3 Potential Negative Health Consequences of Computer Technology
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### **1.0 INTRODUCTION**

Computers are highly useful in making wide tasks and projects including budgeting, financial statements, calculations and scheduling in Physical Education programs. Using computers not only enhances the quality of documentation, but also saves time and operational expenses for sports organisations. Influenced by the technological, social and cultural changes, the educational domain faces a new dimension dominated by lifelong learning. For the physical education and sports specialists, this trend is also reflected by the necessity to improve their teaching methodology. A modern alternative is represented by the use of computers and of other information technologies meant to increase the teaching process effectiveness. Although physical education and sports are practical activities, they fully allow the application of modern teaching technologies; that is why specialists must be able to use them.

### **2.0 OBJECTIVES**

By the end of this unit, you will be able to:

1. explain how computer can be used in teaching and learning P.E. and Sports
2. state and explain ways by which internet facilities can be used in solving problems related to Physical Education and Sports.

### **3.0 MAIN CONTENT**

#### **3.1 Application of Computer in Physical Education and Sports**

Physical education/sports involve the performance of physical activities which are associated with the development of motor skills. To make the lessons more real and dynamic, physical educators need to avail themselves of available computer technologies. Many pieces of computer technology, such as heart rate monitor, pedometers and active games, have the ability to track performance, allowing students and athlete to document and monitor their progress. Computer technology provides access to information, compresses information, motivate learners, and connect learners to teachers and teacher to the colleagues. There are several available technological innovations nowadays that could be inserted into the physical education lesson. Example, visual physical education lesson is essentially based on the connected learning environment which uses technologies that are networked in structure.

Computer can be used to store, retrieve and process information concerning staff, athletes, and finance in any sports organisation faster and accurately. To P.E. teachers, it can be used to produce documents, lesson plans, convey students' examination scores. It can also be used to monitor heart rate, pulse rate, body mass index (BMI) and VO<sub>2</sub>max monitor in an automated treadmill. Computer also aid learning experience when they are used for motion analysis. This involves using computer to examine the way learner/athlete moves and then determine ways in which this movement can be improved in a practical physical education class. This device stresses how human motor abilities can be perfected and controlled. For example, motion analysis visually shows the rudiments and sequence of actions involved in arm-leg movements to enhance performance of skills.

Video tape images are also transferred into computers. Special application software analyses the images; it measures the exact angle at which the player is holding his/her arms and legs. The speed and efficiency of each movement is measured. Other computer software such as the programs Professional Evolution Soccer (PES) is used to play games. Learners play, identify, appreciate the skills, rules, and evaluate officiating of the game.

### **3.2 The Internet in Physical Education and Sports**

The internet provides various information resources and services which can be used by physical educators for teaching and learning. They include electronic mail, online chat, electronic transactions, file transfer and file sharing, online newspapers and journals, online gaming and interlinked hypertext documents and other resources of the worldwide web. Physical education teachers share experiences with other professionals via the internet which are integrated into teaching lessons. Students explore new knowledge as they surf the web for assignments, chat with fellow students and play games online.

**3.2.1 Searching for Information:** The internet is a digital library from which information on any subject or issues in health, P.E. and sports could be obtained. This information is stored in different computers scattered by different people and organisations to enable people look for information. Thus, the internet can be used to maximise the students' effectiveness in learning process in physical education. Students have the opportunity to email their questions or comments concerning issues on health and fitness, physical education programmes, courses, etc. to their physical education teachers and academic staff.

**3.2.2 Online Chat:** Interactive chat improves communication with experts and colleagues, as well as community members. Chats such as Facebook and WhatsApp allow fellow physical educators to simultaneously communicate on your website, internet or extranet. Team members, class and course mates from different locations can easily conduct online meetings. Colleagues gather together into intimate groups and discuss issues related to physical education. They could gather in large online events to interact with experts, celebrities, instructors, coaches and teachers can access chat groups on particular academic issues in physical education and sports.

**3.2.3 Video Conferencing:** It allows two or more people at different locations to see and hear each other at the same time. The communication technology offers new possibilities for sport colleges, organisations, or councils to share strategies for coaching sport skills. A very attractive multimedia tool determining students' enthusiastic participation in physical education lesson is represented by the audio aids.



**In-Text Questions**

1. Computer technology aids learning experience in Physical Education; True or False?
2. Computer hasn't the capacity to make P.E. lessons more real and dynamic; True or False?

**3.3 Potential Negative Health Consequences of Computer Technology**

Although there are many benefits to technology application in students' health promotion and maintenance, it is important to recognise that there may be potential negative consequences. An important component of physical and health education is the promotion of daily physical activity. Young students most often take a passive role (i.e. sitting for extended period of time) when engaging in computer and video games, web-browsing and multimedia. This may be viewed as counterproductive to the overall goal of physical and health education when physical activity is considered. Research has shown that playing video games significantly increases heart rate, systolic and diastolic blood pressure and oxygen consumption in both males and females but the cardiovascular stress from playing these video games is not sufficient to improve cardio respiratory fitness.

Also, video games and television viewing may contribute to a sedentary lifestyle by displacing involvement in sport and other physical activities. Harmful physical conditions such as video game induced seizures have also resulted from the use of video games. Furthermore, computer possesses "artificial intelligence" so whatever result got depends on the directives or command given to it. Thus, if one enters wrong data and program, it will release equivalent wrong output and vice-versa. Pornography is another problem of computer technology. Young students, especially secondary school students indulge in all acts of sexual 'games'. This may not only increase the incidence of abnormal sexual behaviours in future but may also lead to other social problems such as unwanted pregnancy, increase in school dropout and traumatic psychological effects.

#### 4.0 CONCLUSION

Haven completed reading through this Unit, it is assumed that you have learned and acquired the knowledge you are required to have in the unit. The questions you answered correctly would indicate to you the amount of learning you have achieved in the unit.

#### 5.0 SUMMARY

In this Unit, you have learnt application of computer technology in Physical Education and Sports. Uses of internet applications such as e-mail, chatting and video conferencing were highlighted. Potential negative health consequences in using computer applications were also highlighted.

#### 6.0 TUTOR-MARKED ASSIGNMENT

1. Which of the following is not a problem of the use of internet in P.E. and sports?
2. Which of the following is not true about use of computer in P.E. and Sports?
3. Which of the following is not true about the use of internet in learning P.E.?
4. All the following are benefits of the internet in P.E. and sports except -----

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- Haruna, L. (2018). Computer Science Education in Universal Basic Education (UBE): Problems and Prospects. <http://www.resjournals.com/erj>.
- Igudia, E. O. (2010). Analysing Electronic Assisted Health Instruction. *Nigerian Journal of Health Education*, 14 (1), 118-126.
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## UNIT 3      COMPUTER VIRUS

### CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 Meaning of Computer Virus and Symptoms
  - 3.2 The Different Types of Computer Virus
  - 3.3 Operations and Functions
  - 3.4 Infection Targets and Replication Techniques
  - 3.5 Counter Measures
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### 1.0 INTRODUCTION

In everyday conversation and the popular press, people often use **virus** *and* **malware** interchangeably. But strictly speaking a virus is a specific type of malware that inserts itself into some other application. The two other main types are *Trojans*, which masquerade as harmless applications to trick users into executing them, and *Worms*, which can reproduce and spread independently of any other application. The distinguishing feature of a virus is that it needs to infect other programs to operate. Like other types of **malware**, a virus is deployed by attackers to damage or take control of a computer. Its name comes from the method by which it infects its targets. A biological virus like HIV or the flu cannot reproduce on its own; it needs to hijack a cell to do that work for it, wreaking havoc on the infected organism in the process. Similarly, a computer virus isn't itself a standalone program. It is a code snippet that inserts itself into some other application. When that application runs, it executes the virus code, with results that range from the irritating to the disastrous.

In the early, pre-internet days, viruses often spread from computer to computer via infected floppy disks. Today, viruses spread via the internet. In most cases, applications that have been infected by virus code are transferred from computer to computer just like any other application. Because many viruses include a **logic bomb** — code that ensures that the virus's payload only executes at a specific time or under certain conditions — users or admins may be unaware that their applications are infected and will transfer or install them with impunity. Infected applications might be emailed (inadvertently or deliberately — some viruses actually hijack a computer's mail software to email out

copies of themselves); they could also be downloaded from an infected code repository or compromised app store.

## **2.0 OBJECTIVES**

By the end of this unit, you will be able to:

- explain the concept of computer virus
- mention symptoms of computer virus
- identify the different types of computer virus
- explain infection targets and replication techniques
- state some counter measures.

## **3.0 MAIN CONTENT**

### **3.1 Meaning of Computer Virus and Symptoms**

A computer virus is a form of malicious software that piggybacks onto legitimate application code in order to spread and reproduce itself. In other words, a computer virus is a type of computer program that, when executed, replicates itself by modifying other computer programs and inserting its own code. If this replication succeeds, the affected areas are then said to be "infected" with a computer virus. Computer viruses generally require a host program. The virus writes its own code into the host program. When the program runs, the written virus program is executed first, causing infection and damage.

Virus writers use social engineering deceptions and exploit detailed knowledge of security vulnerabilities to initially infect systems and to spread the virus. The vast majority of viruses target systems running Microsoft Windows, employing a variety of mechanisms to infect new hosts, and often using complex anti-detection/stealth strategies to evade antivirus software. Motives for creating viruses can include seeking profit (e.g., with ransom ware), desire to send a political message, personal amusement, to demonstrate that a vulnerability exists in software, for sabotage and denial of service, or simply because they wish to explore cyber security issues, artificial life and evolutionary algorithms.

Damage is due to causing system failure, corrupting data, wasting computer resources, increasing maintenance costs or stealing personal information. Even though no antivirus software can uncover all computer viruses (especially new ones), computer security researchers are actively searching for new ways to enable antivirus solutions to more effectively detect emerging viruses, before they become widely distributed.

## **Other Malware**

The term "virus" is also misused by extension to refer to other types of malware. "Malware" encompasses computer viruses along with many other forms of malicious software, such as computer "worms", ransomware, spyware, adware, Trojan horses, key loggers, root kits, boot kits, malicious Browser Helper Object (BHOs), and other malicious software. The majority of active malware threats are Trojan horse programs or computer worms rather than computer viruses. The term computer virus, coined by Fred Cohen in 1985, is a misnomer. Viruses often perform some type of harmful activity on infected host computers, such as acquisition of hard disk space or central processing unit (CPU) time, accessing and stealing private information (e.g., credit card numbers, debit card numbers, phone numbers, names, email addresses, passwords, bank information, house addresses, etc.), corrupting data, displaying political, humorous or threatening messages on the user's screen, spamming their e-mail contacts, logging their keystrokes, or even rendering the computer useless. However, not all viruses carry a destructive "payload" and attempt to hide themselves—the defining characteristic of viruses is that they are self-replicating computer programs that modify other software without user consent by injecting themselves into the said programs, similar to a biological virus which replicates within living cells.

## **Computer Virus Symptoms**

How can you tell if a virus has slipped past your defenses? With some exceptions, like ransom ware, viruses are not keen to alert you that they've compromised your computer. Just as a biological virus wants to keep its host alive so it can continue to use it as a vehicle to reproduce and spread, so too does a computer virus attempt to do its damage in the background while your computer still limps along. But there are ways to tell that you've been infected; symptoms include:

- **Speed of the System:** In case a virus is completely executed into your device, the time taken to open applications may become longer and the entire system processing may start working slowly.
- **Self-Execution of Programs:** Files or applications may start opening in the background of the system by themselves and you may not even know about them.
- **Frequent crashes**
- **Pop-up Windows:** One may start getting too many pop-up windows on their screen which may be virus affected and harm the device even more. Unknown or unfamiliar programs start up when you turn on your computer.

- Log out from Accounts: The probability of accounts getting hacked increase and password protected sites may also get hacked and you might get logged out from all of them.
- Mass emails being sent from your email account.
- Changes to your homepage or passwords.

## **3.2 The Different Types of Computer Virus**

### **1. Boot sector virus**

This type of virus can take control when you start — or boot — your computer. One way it can spread is by plugging an infected USB drive into your computer.

### **2. Web scripting virus**

This type of virus exploits the code of web browsers and web pages. If you access such a web page, the virus can infect your computer.

### **3. Browser hijacker**

This type of virus “hijacks” certain web browser functions, and you may be automatically directed to an unintended website.

### **4. Resident virus**

This is a general term for any virus that inserts itself in a computer system’s memory. A resident virus can execute anytime when an operating system loads.

### **5. Direct action virus**

This type of virus comes into action when you execute a file containing a virus. Otherwise, it remains dormant.

### **6. Polymorphic virus**

A polymorphic virus changes its code each time an infected file is executed. It does this to evade antivirus programs.

### **7. File infector virus**

This common virus inserts malicious code into executable files — files used to perform certain functions or operations on a system.

## 8. Multipartite virus

This kind of virus infects and spreads in multiple ways. It can infect both program files and system sectors.

## 9. Macro virus

Macro viruses are written in the same macro language used for software applications. Such viruses spread when you open an infected document, often through email attachments.

## The Top 10 Worst Computer Viruses in History

Once a laughing matter, computer viruses are now a damaging and costly plague on our internet-connected world. Below is a list of the 10 most famous computer viruses in history:

### 1. Mydoom

Is the worst computer virus outbreak in history. Also known as Novarg, this malware is technically a “worm,” spread by mass emailing. At one point, the Mydoom virus was responsible for 25% of all emails sent. Mydoom scraped addresses from infected machines, then sent copies of itself to those addresses. It also roped those infected machines into a web of computers called a botnet that performed distributed denial of service (DDoS) attacks. These attacks were intended to shut down a target website or server.

### 2. Sobig

The 2003 **Sobig** computer virus is actually another worm. It is second only to the **Mydoom** virus in its scope. Several versions of the worm were released in quick succession, named **Sobig**. This cybercriminal program masqueraded as legitimate computer software attached to emails. It disrupted ticketing at **Air Canada** and interfered with countless other businesses. Despite its widespread damage, the creator of the successful bug was never caught.

### 3. Klez

**Klez** is a close third on the list of the worst computer viruses ever created. It infected about 7.2% of all computers in 2001, or 7 million PCs. The Klez worm sent fake emails, spoofed recognised senders and, among other things, attempted to deactivate other viruses. As with other viruses and worms, Klez was released in several variants. It infected files, copied itself, and spread throughout each victim’s network. It hung around for years, with each version more destructive than the last.



#### 4. ILOVEYOU

The year 2000's ILOVEYOU virus worked by sending a bogus "love letter" that looked like a harmless text file. Like **Mydoom**, this attacker sent copies of itself to every email address in the infected machine's contact list. Shortly after its May 4 release, it had spread to more than 10 million PCs. The virus was created by a college student in the Philippines named Onel de Guzman. Lacking funds, he wrote the virus to steal passwords so he could log into online services he wanted to use for free. He reportedly had no idea how far his creation would spread. This virus is also known as **Love letter**.

#### 5. WannaCry

The 2017 **WannaCry computer virus** is ransomware, a virus that takes over your computer (or cloud files) and holds them hostage. The WannaCry ransomware ripped through computers in 150 countries, causing massive productivity losses as businesses, hospitals, and government organisations that didn't pay were forced to rebuild systems from scratch. The malware raged like wildfire through 200,000 computers worldwide. It stopped when a 22-year-old security researcher in the U.K. found a way to turn it off. Computers with out-of-date operating systems were hit especially hard. That's why security experts always recommend **updating your systems frequently**.

#### 6. Zeus

The Zeus computer virus is an online theft tool that hit the web in 2007. A whitepaper by Unisys three years later estimated that it was behind 44% of all banking malware attacks. By then, it had breached 88% of all Fortune 500 companies, 2,500 organisations total, and 76,000 computers in 196 countries. The Zeus botnet was a group of programs that worked together to take over machines for a remote "bot master." It originated in Eastern Europe and was used to transfer money to secret bank accounts. More than 100 members of the crime ring behind the virus, mostly in the U.S., were arrested in 2010. It's not as prominent today, but some of the virus' source code lives on in newer botnet viruses and worms.

#### 7. Code Red

First observed in 2001, the Code Red computer virus was yet another worm that penetrated 975,000 hosts. It displayed the words "Hacked by Chinese!" across infected web pages, and it ran entirely in each machine's memory. In most cases it left no trace in hard drives or other

storage. The virus attacked websites of infected computers and delivered a distributed denial of service (DDoS) attack on the U.S. White House's website, **www.whitehouse.gov**. In fact, the White House had to change its IP address to defend against Code Red.

## 8. **Slammer**

The Slammer worm cost an estimated \$750 million across 200,000 computer users in 2003. This computer virus randomly selected IP addresses, exploiting vulnerabilities and sending itself on to other machines. It used these victim machines to launch a DDoS (Distributed Denial of Service) attack on several internet hosts, significantly slowing internet traffic.

The Slammer worm hit banks in the U.S. and Canada especially hard, taking ATMs offline in many locations. Customers of Toronto's Imperial Bank of Commerce found themselves unable to access funds. The attack reared its ugly head again in 2016, launching from IP addresses in Ukraine, China, and Mexico.

## 9. **CryptoLocker**

CryptoLocker viruses have dipped since their 2017 peak. This malware attacked upwards of 250,000 machines by encrypting their files. It displayed a red ransom note informing users that "your important files encryption produced on this computer." A payment window accompanied the note. The virus' creators used a worm called the Gameover Zeus botnet to make and send copies of the CryptoLocker virus.

## 10. **Sasser**

The Sasser worm was written by a 17-year-old German computer science student named Sven Jaschan. He was arrested at the age of 18 in 2004 after a \$250,000 bounty was posted for the computer virus' creator. A friend of Jaschan tipped authorities that the youth had penned not only the Sasser worm but also the damaging Netsky AC attacks. Jaschan was given a suspended sentence after it was found he was a minor when he wrote the malware. The Sasser worm crashed millions of PCs.

### 3.3 **Operations and functions**

**Virus Parts:** A viable computer virus must contain a **search routine**, which locates new files or new disks that are worthwhile targets for infection. Secondly, every computer virus must contain a routine to copy

itself into the program which the search routine locates. The three main virus parts are:

- **Infection mechanism** (also called 'infection vector'): This is how the virus spreads or propagates. A virus typically has a search routine, which locates new files or new disks for infection.
- **Trigger**: Also known as a logic bomb, this is the compiled version that could be activated any time within an executable file when the virus is run that determines the event or condition for the malicious "payload" to be activated or delivered such as a particular date, a particular time, particular presence of another program, capacity of the disk exceeding some limit, or a double-click that opens a particular file.
- **Payload**: The "payload" is the actual body or data which carries out the malicious purpose of the virus. Payload activity might be noticeable (e.g., because it causes the system to slow down or "freeze"), as most of the time the "payload" itself is the harmful activity, or sometimes non-destructive but distributive, which is called **virus hoax**.

**Virus Phases:** A Virus phase is the life cycle of the computer virus, described by using an analogy to biology. This life cycle can be divided into four phases:

- **Dormant phase**: The virus program is idle during this stage. The virus program has managed to access the target user's computer or software, but during this stage, the virus does not take any action. The virus will eventually be activated by the "trigger" which states which event will execute the virus. Not all viruses have this stage.
- **Propagation phase**: The virus starts propagating, which is multiplying and replicating itself. The virus places a copy of itself into other programs or into certain system areas on the disk. The copy may not be identical to the propagating version; viruses often "morph" or change to evade detection by IT professionals and anti-virus software. Each infected program will now contain a clone of the virus, which will itself enter a propagation phase.
- **Triggering phase**: A dormant virus moves into this phase when it is activated, and will now perform the function for which it was intended. The triggering phase can be caused by a variety of system events, including a count of the number of times that this copy of the virus has made copies of itself. The trigger may occur when an employee is terminated from their employment or after a set period of time has elapsed, in order to reduce suspicion.
- **Execution phase**: This is the actual work of the virus, where the "payload" will be released. It can be destructive such as deleting

files on disk, crashing the system, or corrupting files or relatively harmless such as popping up humorous or political messages on screen.

### 3.4 Infection Targets and Replication Techniques

Computer viruses infect a variety of different subsystems on their host computers and software. One manner of classifying viruses is to analyze whether they reside in **binary executables** (such as .EXE or .COM files), data files (such as Microsoft Word documents or PDF files), or in the **boot sector** of the host's **hard drive** (or some combination of all of these).

#### Resident vs. Non-resident Viruses

A **memory-resident virus** (or simply "resident virus") installs itself as part of the operating system when executed, after which it remains in RAM from the time the computer is booted up to when it is shut down. Resident viruses overwrite interrupt handling code or other functions, and when the operating system attempts to access the target file or disk sector, the virus code intercepts the request and redirects the **control flow** to the replication module, infecting the target. In contrast, a **non-memory-resident virus** (or "non-resident virus"), when executed, scans the disk for targets, infects them, and then exits (i.e. it does not remain in memory after it is done executing).

#### Macro Viruses

Many common applications, such as Microsoft Outlook and Microsoft Word, allow macro programs to be embedded in documents or emails, so that the programs may be run automatically when the document is opened. A **macro virus** (or "document virus") is a virus that is written in a **macro language** and embedded into these documents so that when users open the file, the virus code is executed, and can infect the user's computer. This is one of the reasons it is dangerous to open unexpected or suspicious **attachments** in **e-mails**. While not opening attachments in e-mails from unknown persons or organisations can help to reduce the likelihood of contracting a virus, in some cases, the virus is designed so that the e-mail appears to be from a reputable organisation (e.g., a major bank or credit card company).

#### Boot Sector Viruses

**Boot sector viruses** specifically target the **boot sector** and/or the **Master Boot Record** (MBR) of the host's **hard disk drive**, **solid-state drive**, or removable storage media (flash drives, floppy disks, etc.). The most common way of transmission of computer viruses in boot sector is

physical media. When reading the VBR of the drive, the infected floppy disk or USB flash drive connected to the computer will transfer data, and then modify or replace the existing boot code. The next time a user tries to start the desktop, the virus will immediately load and run as part of the master boot record.

### **Email Virus**

Email viruses are viruses that intentionally, rather than accidentally, uses the email system to spread. While virus infected files may be accidentally sent as email attachments, email viruses are aware of email system functions. They generally target a specific type of email system (Microsoft Outlook is the most commonly used), harvest email addresses from various sources, and may append copies of themselves to all email sent, or may generate email messages containing copies of themselves as attachments.

### **Stealth Techniques**

To avoid detection by users, some viruses employ different kinds of deception. Some old viruses, especially on the DOS (Disk Operating System) platform, make sure that the "last modified" date of a host file stays the same when the file is infected by the virus. This approach does not fool antivirus **software**, however, especially those which maintain and date **cyclic redundancy checks** on file changes. Some viruses can infect files without increasing their sizes or damaging the files. They accomplish this by overwriting unused areas of executable files. These are called *cavity viruses*. For example, the CIH virus, or Chernobyl Virus, infects Portable Executable files. Because those files have many empty gaps, the virus, which was 1 KB in length, did not add to the size of the file. Some viruses try to avoid detection by killing the tasks associated with antivirus software before it can detect them (for example, Conficker). In the 2010s, as computers and operating systems grow larger and more complex, old hiding techniques need to be updated or replaced. Defending a computer against viruses may demand that a file system migrate towards detailed and explicit permission for every kind of file access.

### **Read Request Intercepts**

While some kinds of antivirus software employ various techniques to counter stealth mechanisms, once the infection occurs any recourse to "clean" the system is unreliable. In Microsoft Windows operating systems, the NTFS file system is proprietary. This leaves antivirus software a little alternative but to send a "read" request to Windows files that handle such requests. Some viruses trick antivirus software by intercepting its requests to the operating system. A virus can hide by

intercepting the request to read the infected file, handling the request itself, and returning an uninfected version of the file to the antivirus software. The interception can occur by **code injection** of the actual operating system files that would handle the read request. Thus, an antivirus software attempting to detect the virus will either not be permitted to read the infected file, or, the "read" request will be served with the uninfected version of the same file.

The only reliable method to avoid "stealth" viruses is to "reboot" from a medium that is known to be "clear". Security software can then be used to check the dormant operating system files. Most security software relies on virus signatures, or they employ heuristics. Security software may also use a database of file "hashes" for Windows OS files, so the security software can identify altered files, and request Windows installation media to replace them with authentic versions. In older versions of Windows, file **cryptographic hash functions** of Windows OS (Operating System) files stored in Windows—to allow file integrity/authenticity to be checked—could be overwritten so that the System File Checker would report that altered system files are authentic, so using file hashes to scan for altered files would not always guarantee finding an infection.

### **Self-Modification**

Most modern antivirus programs try to find virus-patterns inside ordinary programs by scanning them for so-called **virus signatures** (a sequence of bytes that an antivirus program looks for because it is known to be part of the virus). If a virus scanner finds such a pattern in a file, it will perform other checks to make sure that it has found the virus, and not merely a coincidental sequence in an innocent file, before it notifies the user that the file is infected. The user can then delete, or (in some cases) "clean" or "heal" the infected file. Some viruses employ techniques that make detection by means of signatures difficult but probably not impossible. These viruses modify their code on each infection. That is, each infected file contains a different variant of the virus.

### **Polymorphic Code**

**Polymorphic Code** was the first technique that posed a serious **threat** to virus scanners. Just like regular encrypted viruses, a polymorphic virus infects files with an encrypted copy of itself, which is decoded by a **decryption** module. In the case of polymorphic viruses, however, this decryption module is also modified on each infection. A well-written polymorphic virus therefore has no parts which remain identical between infections, making it very difficult to detect directly using

"signatures". Antivirus software can detect it by decrypting the viruses using an **emulator**, or by **statistical pattern analysis** of the encrypted virus body. To enable polymorphic code, the virus has to have a **polymorphic engine** (also called "mutating engine" or "mutation engine") somewhere in its encrypted body.

Some viruses employ polymorphic code in a way that constrains the mutation rate of the virus significantly. For example, a virus can be programmed to mutate only slightly over time, or it can be programmed to refrain from mutating when it infects a file on a computer that already contains copies of the virus. The advantage of using such slow polymorphic code is that it makes it more difficult for antivirus professionals and investigators to obtain representative samples of the virus, because "bait" files that are infected in one run will typically contain identical or similar samples of the virus. This will make it more likely that the detection by the virus scanner will be unreliable, and that some instances of the virus may be able to avoid detection.

### **Metamorphic Code**

To avoid being detected by emulation, some viruses rewrite themselves completely each time they are to infect new executables. Viruses that utilize this technique are said to be in **metamorphic code**. To enable metamorphism, a "metamorphic engine" is needed. A metamorphic virus is usually very large and complex. For example, **W32/Simile** consisted of over 14,000 lines of **assembly language** code, 90% of which is part of the metamorphic engine.

### **Vulnerability of Different Operating Systems**

The vast majority of viruses target systems running **Microsoft Windows**. This is due to Microsoft's large market share of desktop computer users. The diversity of software systems on a network limits the destructive potential of viruses and malware. **Open-source** operating systems such as **Linux** allow users to choose from a variety of **desktop environments**, packaging tools, etc., which means that malicious code targeting any of these systems will only affect a subset of all users. Many Windows users are running the same set of applications, enabling viruses to rapidly spread among Microsoft Windows systems by targeting the same exploits on large numbers of hosts.

While Linux and Unix in general have always natively prevented normal users from making changes to the **operating system** environment without permission, Windows users are generally not prevented from making these changes, meaning that viruses can easily gain control of the entire system on Windows hosts. This difference has continued partly due to the widespread use of **administrator** accounts in

contemporary versions like **Windows XP**. In 1997, researchers created and released a virus for Linux—known as "**Bliss**". Bliss, however, requires that the user run it explicitly and it can only infect programs that the user has the access to modify. Unlike Windows users, most Unix users do not **log in** as an administrator, or "**root user**", except to install or configure software; as a result, even if a user ran the virus, it could not harm their operating system. The Bliss virus never became widespread, and remains chiefly a research curiosity. Its creator later posted the source code to **Usenet**, allowing researchers to see how it worked.

### 3.5 Countermeasures

#### i. Antivirus Software

Many users install **antivirus software** that can detect and eliminate known viruses when the computer attempts to download or run the executable file (which may be distributed as an email attachment, or on USB flash drives, for example). Some antivirus software blocks known malicious websites that attempt to install malware. Antivirus software does not change the underlying capability of hosts to transmit viruses. Users must update their software regularly to patch security vulnerabilities ("holes"). Antivirus software also needs to be regularly updated to recognize the latest threats. This is because malicious hackers and other individuals are always creating new viruses.

Examples of Microsoft Windows antivirus and anti-malware software include the optional Microsoft Security Essentials (for Windows XP, Vista and Windows 7) for real-time protection, the **Windows Malicious Software Removal Tool**, and **Windows Defender** (an optional download in the case of Windows XP). Additionally, several capable antivirus software programs are available for free download from the Internet (usually restricted to non-commercial use). Some such free programs are almost as good as commercial competitors. **Secunia PSI** is an example of software, free for personal use, that will check a PC for vulnerable out-of-date software, and attempt to update it. **Ransom ware** and **phishing scam** alerts appear as press releases on the Internet Crime Complaint Center notice board. Ransom ware is a virus that posts a message on the user's screen saying that the screen or system will remain locked or unusable until a **ransom** payment is made. Phishing is a deception in which the malicious individual pretends to be a friend, computer security expert, or other benevolent individual, with the goal of convincing the targeted individual to reveal **passwords** or other personal information.



Other commonly used preventive measures include timely operating system updates, software updates, careful Internet browsing (avoiding shady websites), and installation of only trusted software. Certain browsers flag sites that have been reported to Google and that have been confirmed as hosting malware by Google.

There are two common methods that an antivirus software application uses to detect viruses, as described in antivirus software articles. The first, and by far the most common method of virus detection is using a list of **virus signature** definitions. This works by examining the content of the computer's memory (its Random Access Memory (RAM), and boot sectors) and the files stored on fixed or removable drives (hard drives, floppy drives, or USB flash drives), and comparing those files against a database of known virus "signatures". Virus signatures are just strings of code that are used to identify individual viruses; for each virus, the antivirus designer tries to choose a unique signature string that will not be found in a legitimate program. Different antivirus programs use different "signatures" to identify viruses. The disadvantage of this detection method is that users are only protected from viruses that are detected by signatures in their most recent virus definition update, and not protected from new viruses.

A second method to find viruses is to use a **heuristic algorithm** based on common virus behaviors. This method can detect new viruses for which antivirus security firms have yet to define a "signature", but it also gives rise to more **false positives** than using signatures. False positives can be disruptive, especially in a commercial environment, because it may lead to a company instructing staff not to use the company computer system until IT services have checked the system for viruses. This can slow down productivity for regular workers.

## ii. Recovery Strategies and Methods

One may reduce the damage done by viruses by making regular **backups** of data (and the operating systems) on different media, that are either kept unconnected to the system (most of the time, as in a hard drive), **read-only** or not accessible for other reasons, such as using different **file systems**. This way, if data is lost through a virus, one can start again using the backup (which will hopefully be recent). If a backup session on **optical media** like CD and DVD is closed, it becomes read-only and can no longer be affected by a virus (so long as a virus or infected file was not copied onto the CD/DVD). Likewise, an operating system on a **bootable** CD can be used to start the computer if the installed operating systems become unusable. Backups on removable media must be carefully inspected before restoration.

### iii. Virus Removal

Many websites run by antivirus software companies provide free online virus scanning, with limited "cleaning" facilities (after all, the purpose of the websites is to sell antivirus products and services). Some websites—like Google subsidiary VirusTotal.com—allow users to upload one or more suspicious files to be scanned and checked by one or more antivirus programs in one operation. Additionally, several capable antivirus software programs are available for free download from the Internet (usually restricted to non-commercial use). Microsoft offers an optional free antivirus utility called **Microsoft Security Essentials**, a **Windows Malicious Software Removal Tool** that is updated as part of the regular Windows update regime, and an older optional anti-malware (malware removal) tool **Windows Defender** that has been upgraded to an antivirus product in Windows 8.

Some viruses disable **System Restore** and other important Windows tools such as **Task Manager** and **CMD**. An example of a virus that does this is CiaDoor. Many such viruses can be removed by **rebooting** the computer, entering Windows "safe mode" with networking, and then using system tools or Microsoft Safety Scanner. **System Restore** on **Windows Me, Windows XP, Windows Vista** and **Windows 7** can restore the **registry** and critical system files to a previous checkpoint. Often a virus will cause a system to "hang" or "freeze", and a subsequent hard reboot will render a system restore point from the same day corrupted. Restore points from previous days should work, provided the virus is not designed to corrupt the restore files and does not exist in previous restore points.

### iv. Operating System Reinstallation

Microsoft's **System File Checker** (improved in Windows 7 and later) can be used to check for, and repair, corrupted system files. Restoring an earlier "clean" (virus-free) copy of the entire partition from a **cloned disk**, a **disk image**, or a **backup** copy is one solution—restoring an earlier backup disk "image" is relatively simple to do, usually removes any malware, and may be faster than "disinfecting" the computer—or reinstalling and reconfiguring the operating system and programs from scratch, then restoring user preferences. Reinstalling the operating system is another approach to virus removal. It may be possible to recover copies of essential user data by booting from a **live CD**, or connecting the hard drive to another computer and booting from the second computer's operating system, taking great care not to infect that computer by executing any infected programs on the original drive. The original hard drive can then be reformatted and the OS and all programs installed from original media. Once the system has been restored,

precautions must be taken to avoid re-infection from any restored **executable files**.

### In-Text Questions

1. A virus can remain dormant on your computer, without showing major signs or symptoms; True or False?
2. What is the general term for any virus that inserts itself in a computer system's memory?
3. The type of virus that can take control of the operating system when you start your computer is called -----

### Viruses and the Internet

Before computer networks became widespread, most viruses spread on **removable media**, particularly **floppy disks**. In the early days of the **personal computer**, many users regularly exchanged information and programs on floppies. Some viruses spread by infecting programs stored on these disks, while others installed themselves into the disk **boot sector**, ensuring that they would be run when the user booted the computer from the disk, usually inadvertently. Personal computers of the era would attempt to boot first from a floppy if one had been left in the drive. Until floppy disks fell out of use, this was the most successful infection strategy and boot sector viruses were the most common in the "wild" for many years. Traditional computer viruses emerged in the 1980s, driven by the spread of personal computers and the resultant increase in **bulletin board system (BBS)**, **modem** use, and software sharing. Bulletin board-driven software sharing contributed directly to the spread of **Trojan horse** programs, and viruses were written to infect popularly traded software. **Shareware** and **bootleg** software were equally common **vectors** for viruses on BBSs. Viruses can increase their chances of spreading to other computers by infecting files on a **network file system** or a file system that is accessed by other computers.

**Macro viruses** have become common since the mid-1990s. Most of these viruses are written in the scripting languages for Microsoft programs such as **Microsoft Word** and **Microsoft Excel** and spread throughout **Microsoft Office** by infecting documents and **spreadsheets**. Since Word and Excel were also available for **Mac OS**, most could also spread to **Macintosh computers**. Although most of these viruses did not have the ability to send infected **email messages**, those viruses which did take advantage of the **Microsoft Outlook Component Object Model (COM)** interface. Some old versions of Microsoft Word allow macros to replicate themselves with additional blank lines. If two macro

viruses simultaneously infect a document, the combination of the two, if also self-replicating, can appear as a "mating" of the two and would likely be detected as a virus unique from the "parents".

A virus may also send a **web address link** as an **instant message** to all the contacts (e.g., friends and colleagues' e-mail addresses) stored on an infected machine. If the recipient, thinking the link is from a friend (a trusted source) follows the link to the website, the virus hosted at the site may be able to infect this new computer and continue propagating. Viruses that spread using **cross-site scripting** were first reported in 2002, and were academically demonstrated in 2005. There have been multiple instances of the cross-site scripting viruses in the "wild", exploiting websites such as **MySpace** (with the Samy worm) and **Yahoo**.

#### 4.0 CONCLUSION

Haven read this course and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of the concept of Computer Virus.

## 5.0 SUMMARY

In this Unit, you have learnt the concept of computer virus and symptoms. Also, the different types of computer virus were mentioned, as well as their operations and functions. Infection targets and replication techniques were discussed. Likewise, counter measures were described.

## 6.0 TUTOR-MARKED ASSIGNMENT

1. Which of the following is not a characteristic of computer virus?
2. Which of the following is not a source of the virus entering your system?
3. Another name for Non-Resident virus is -----
4. Which of the following is the worst computer virus outbreak in history?
5. A viable computer virus must contain -----
6. What is the virus which slightly changes its own source code each time it copies itself to avoid detection from antivirus software called?
7. Viruses that rewrite themselves completely each time they are to infect new executables are said to be in -----
8. The actual work of the virus during which the "payload" is released is called -----

## 7.0 REFERENCES/FURTHER READING

- Avoine, G. (2017). *Computer System Security: Basic Concepts and Solved Exercises*. EPFL Press.
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## UNIT 4 VIRUS OPERATIONS AND FUNCTIONS

### CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 Virus Operations and Functions
  - 3.2 Infection Targets and Replication Techniques
  - 3.3 Counter Measures
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Reading

### 1.0 INTRODUCTION

In the early, pre-internet days, viruses often spread from computer to computer via infected floppy disks. Today, viruses spread via the internet. In most cases, applications that have been infected by virus code are transferred from computer to computer just like any other application. Because many viruses include a **logic bomb** — code that ensures that the virus's payload only executes at a specific time or under certain conditions — users or admins may be unaware that their applications are infected and will transfer or install them with impunity. Infected applications might be emailed (inadvertently or deliberately — some viruses actually hijack a computer's mail software to email out copies of themselves); they could also be downloaded from an infected code repository or compromised app store.

### 2.0 OBJECTIVES

By the end of this unit, you will be able to:

- identify some virus operations and functions
- explain infection targets and replication techniques
- state some counter measures.

### 3.0 MAIN CONTENT

#### 3.1 Virus operations and functions

**Virus Parts:** A viable computer virus must contain a **search routine**, which locates new files or new disks that are worthwhile targets for infection. Secondly, every computer virus must contain a routine to copy itself into the program which the search routine locates. The three main virus parts are:

- **Infection mechanism** (also called 'infection vector'): This is how the virus spreads or propagates. A virus typically has a search routine, which locates new files or new disks for infection.
- **Trigger**: Also known as a logic bomb, this is the compiled version that could be activated any time within an executable file when the virus is run that determines the event or condition for the malicious "payload" to be activated or delivered such as a particular date, a particular time, particular presence of another program, capacity of the disk exceeding some limit, or a double-click that opens a particular file.
- **Payload**: The "payload" is the actual body or data which carries out the malicious purpose of the virus. Payload activity might be noticeable (e.g., because it causes the system to slow down or "freeze"), as most of the time the "payload" itself is the harmful activity, or sometimes non-destructive but distributive, which is called **virus hoax**.

**Virus Phases:** A Virus phase is the life cycle of the computer virus, described by using an analogy to biology. This life cycle can be divided into four phases:

- **Dormant phase:** The virus program is idle during this stage. The virus program has managed to access the target user's computer or software, but during this stage, the virus does not take any action. The virus will eventually be activated by the "trigger" which states which event will execute the virus. Not all viruses have this stage.
- **Propagation phase:** The virus starts propagating, which is multiplying and replicating itself. The virus places a copy of itself into other programs or into certain system areas on the disk. The copy may not be identical to the propagating version; viruses often "morph" or change to evade detection by IT professionals and anti-virus software. Each infected program will now contain a clone of the virus, which will itself enter a propagation phase.
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- **Execution phase:** This is the actual work of the virus, where the "payload" will be released. It can be destructive such as deleting files on disk, crashing the system, or corrupting files or relatively harmless such as popping up humorous or political messages on screen.

### 3.2 Infection Targets and Replication Techniques

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The only reliable method to avoid "stealth" viruses is to "reboot" from a medium that is known to be "clear". Security software can then be used to check the dormant operating system files. Most security software relies on virus signatures, or they employ heuristics. Security software may also use a database of file "hashes" for Windows OS files, so the security software can identify altered files, and request Windows installation media to replace them with authentic versions. In older versions of Windows, file **cryptographic hash functions** of Windows OS (Operating System) files stored in Windows—to allow file integrity/authenticity to be checked—could be overwritten so that the System File Checker would report that altered system files are authentic, so using file hashes to scan for altered files would not always guarantee finding an infection.

### **Self-Modification**

Most modern antivirus programs try to find virus-patterns inside ordinary programs by scanning them for so-called **virus signatures** (a sequence of bytes that an antivirus program looks for because it is known to be part of the virus). If a virus scanner finds such a pattern in a file, it will perform other checks to make sure that it has found the virus, and not merely a coincidental sequence in an innocent file, before it notifies the user that the file is infected. The user can then delete, or (in some cases) "clean" or "heal" the infected file. Some viruses employ techniques that make detection by means of signatures difficult but probably not impossible. These viruses modify their code on each infection. That is, each infected file contains a different variant of the virus.

### **Polymorphic Code**

**Polymorphic Code** was the first technique that posed a serious **threat** to virus scanners. Just like regular encrypted viruses, a polymorphic virus infects files with an encrypted copy of itself, which is decoded by a **decryption** module. In the case of polymorphic viruses, however, this decryption module is also modified on each infection. A well-written polymorphic virus therefore has no parts which remain identical between infections, making it very difficult to detect directly using "signatures". Antivirus software can detect it by decrypting the viruses using an **emulator**, or by **statistical pattern analysis** of the encrypted

virus body. To enable polymorphic code, the virus has to have a **polymorphic engine** (also called "mutating engine" or "mutation engine") somewhere in its encrypted body.

Some viruses employ polymorphic code in a way that constrains the mutation rate of the virus significantly. For example, a virus can be programmed to mutate only slightly over time, or it can be programmed to refrain from mutating when it infects a file on a computer that already contains copies of the virus. The advantage of using such slow polymorphic code is that it makes it more difficult for antivirus professionals and investigators to obtain representative samples of the virus, because "bait" files that are infected in one run will typically contain identical or similar samples of the virus. This will make it more likely that the detection by the virus scanner will be unreliable, and that some instances of the virus may be able to avoid detection.

### **Metamorphic Code**

To avoid being detected by emulation, some viruses rewrite themselves completely each time they are to infect new executables. Viruses that utilize this technique are said to be in **metamorphic code**. To enable metamorphism, a "metamorphic engine" is needed. A metamorphic virus is usually very large and complex. For example, **W32/Simile** consisted of over 14,000 lines of **assembly language** code, 90% of which is part of the metamorphic engine.

### **Vulnerability of Different Operating Systems**

The vast majority of viruses target systems running **Microsoft Windows**. This is due to Microsoft's large market share of desktop computer users. The diversity of software systems on a network limits the destructive potential of viruses and malware. **Open-source** operating systems such as **Linux** allow users to choose from a variety of **desktop environments**, packaging tools, etc., which means that malicious code targeting any of these systems will only affect a subset of all users. Many Windows users are running the same set of applications, enabling viruses to rapidly spread among Microsoft Windows systems by targeting the same exploits on large numbers of hosts.

While Linux and Unix in general have always natively prevented normal users from making changes to the **operating system** environment without permission, Windows users are generally not prevented from making these changes, meaning that viruses can easily gain control of the entire system on Windows hosts. This difference has continued partly due to the widespread use of **administrator** accounts in contemporary versions like **Windows XP**. In 1997, researchers created

and released a virus for Linux—known as "Bliss". Bliss, however, requires that the user run it explicitly and it can only infect programs that the user has the access to modify. Unlike Windows users, most Unix users do not **log in** as an administrator, or "root user", except to install or configure software; as a result, even if a user ran the virus, it could not harm their operating system. The Bliss virus never became widespread, and remains chiefly a research curiosity. Its creator later posted the source code to **Usenet**, allowing researchers to see how it worked.

### 3.3 Counter Measures

#### i. Antivirus Software

Many users install **antivirus software** that can detect and eliminate known viruses when the computer attempts to download or run the executable file (which may be distributed as an email attachment, or on USB flash drives, for example). Some antivirus software blocks known malicious websites that attempt to install malware. Antivirus software does not change the underlying capability of hosts to transmit viruses. Users must update their software regularly to patch security vulnerabilities ("holes"). Antivirus software also needs to be regularly updated to recognize the latest threats. This is because malicious hackers and other individuals are always creating new viruses.

Examples of Microsoft Windows antivirus and anti-malware software include the optional Microsoft Security Essentials (for Windows XP, Vista and Windows 7) for real-time protection, the **Windows Malicious Software Removal Tool**, and **Windows Defender** (an optional download in the case of Windows XP). Additionally, several capable antivirus software programs are available for free download from the Internet (usually restricted to non-commercial use). Some such free programs are almost as good as commercial competitors. **Secunia PSI** is an example of software, free for personal use, that will check a PC for vulnerable out-of-date software, and attempt to update it. **Ransom ware** and **phishing scam** alerts appear as press releases on the Internet Crime Complaint Center notice board. Ransom ware is a virus that posts a message on the user's screen saying that the screen or system will remain locked or unusable until a **ransom** payment is made. Phishing is a deception in which the malicious individual pretends to be a friend, computer security expert, or other benevolent individual, with the goal of convincing the targeted individual to reveal **passwords** or other personal information.

Other commonly used preventive measures include timely operating system updates, software updates, careful Internet browsing (avoiding

shady websites), and installation of only trusted software. Certain browsers flag sites that have been reported to Google and that have been confirmed as hosting malware by Google.

There are two common methods that an antivirus software application uses to detect viruses, as described in antivirus software articles. The first, and by far the most common method of virus detection is using a list of **virus signature** definitions. This works by examining the content of the computer's memory (its Random Access Memory (RAM), and boot sectors) and the files stored on fixed or removable drives (hard drives, floppy drives, or USB flash drives), and comparing those files against a database of known virus "signatures". Virus signatures are just strings of code that are used to identify individual viruses; for each virus, the antivirus designer tries to choose a unique signature string that will not be found in a legitimate program. Different antivirus programs use different "signatures" to identify viruses. The disadvantage of this detection method is that users are only protected from viruses that are detected by signatures in their most recent virus definition update, and not protected from new viruses.

A second method to find viruses is to use a **heuristic algorithm** based on common virus behaviors. This method can detect new viruses for which antivirus security firms have yet to define a "signature", but it also gives rise to more **false positives** than using signatures. False positives can be disruptive, especially in a commercial environment, because it may lead to a company instructing staff not to use the company computer system until IT services have checked the system for viruses. This can slow down productivity for regular workers.

## ii. Recovery Strategies and Methods

One may reduce the damage done by viruses by making regular **backups** of data (and the operating systems) on different media, that are either kept unconnected to the system (most of the time, as in a hard drive), **read-only** or not accessible for other reasons, such as using different **file systems**. This way, if data is lost through a virus, one can start again using the backup (which will hopefully be recent). If a backup session on **optical media** like CD and DVD is closed, it becomes read-only and can no longer be affected by a virus (so long as a virus or infected file was not copied onto the CD/DVD). Likewise, an operating system on a **bootable** CD can be used to start the computer if the installed operating systems become unusable. Backups on removable media must be carefully inspected before restoration.

### iii. Virus Removal

Many websites run by antivirus software companies provide free online virus scanning, with limited "cleaning" facilities (after all, the purpose of the websites is to sell antivirus products and services). Some websites—like Google subsidiary VirusTotal.com—allow users to upload one or more suspicious files to be scanned and checked by one or more antivirus programs in one operation. Additionally, several capable antivirus software programs are available for free download from the Internet (usually restricted to non-commercial use). Microsoft offers an optional free antivirus utility called **Microsoft Security Essentials**, a **Windows Malicious Software Removal Tool** that is updated as part of the regular Windows update regime, and an older optional anti-malware (malware removal) tool **Windows Defender** that has been upgraded to an antivirus product in Windows 8.

Some viruses disable **System Restore** and other important Windows tools such as **Task Manager** and **CMD**. An example of a virus that does this is CiaDoor. Many such viruses can be removed by **rebooting** the computer, entering Windows "safe mode" with networking, and then using system tools or Microsoft Safety Scanner. **System Restore** on **Windows Me, Windows XP, Windows Vista** and **Windows 7** can restore the **registry** and critical system files to a previous checkpoint. Often a virus will cause a system to "hang" or "freeze", and a subsequent hard reboot will render a system restore point from the same day corrupted. Restore points from previous days should work, provided the virus is not designed to corrupt the restore files and does not exist in previous restore points.

### iv. Operating System Reinstallation

Microsoft's **System File Checker** (improved in Windows 7 and later) can be used to check for, and repair, corrupted system files. Restoring an earlier "clean" (virus-free) copy of the entire partition from a **cloned disk**, a **disk image**, or a **backup** copy is one solution—restoring an earlier backup disk "image" is relatively simple to do, usually removes any malware, and may be faster than "disinfecting" the computer—or reinstalling and reconfiguring the operating system and programs from scratch, then restoring user preferences. Reinstalling the operating system is another approach to virus removal. It may be possible to recover copies of essential user data by booting from a **live CD**, or connecting the hard drive to another computer and booting from the second computer's operating system, taking great care not to infect that computer by executing any infected programs on the original drive. The original hard drive can then be reformatted and the OS and all programs installed from original media. Once the system has been restored,

precautions must be taken to avoid re-infection from any restored **executable files**.

### In-Text Questions

1. A virus can remain dormant on your computer, without showing major signs or symptoms; True or False?
2. What is the general term for any virus that inserts itself in a computer system's memory?
3. The type of virus that can take control of the operating system when you start your computer is called -----

### Viruses and the Internet

Before computer networks became widespread, most viruses spread on **removable media**, particularly **floppy disks**. In the early days of the **personal computer**, many users regularly exchanged information and programs on floppies. Some viruses spread by infecting programs stored on these disks, while others installed themselves into the disk **boot sector**, ensuring that they would be run when the user booted the computer from the disk, usually inadvertently. Personal computers of the era would attempt to boot first from a floppy if one had been left in the drive. Until floppy disks fell out of use, this was the most successful infection strategy and boot sector viruses were the most common in the "wild" for many years. Traditional computer viruses emerged in the 1980s, driven by the spread of personal computers and the resultant increase in **bulletin board system (BBS)**, **modem** use, and software sharing. Bulletin board-driven software sharing contributed directly to the spread of **Trojan horse** programs, and viruses were written to infect popularly traded software. **Shareware** and **bootleg** software were equally common **vectors** for viruses on BBSs. Viruses can increase their chances of spreading to other computers by infecting files on a **network file system** or a file system that is accessed by other computers.

**Macro viruses** have become common since the mid-1990s. Most of these viruses are written in the scripting languages for Microsoft programs such as **Microsoft Word** and **Microsoft Excel** and spread throughout **Microsoft Office** by infecting documents and **spreadsheets**. Since Word and Excel were also available for **Mac OS**, most could also spread to **Macintosh computers**. Although most of these viruses did not have the ability to send infected **email messages**, those viruses which did take advantage of the **Microsoft Outlook Component Object Model (COM)** interface. Some old versions of Microsoft Word allow

macros to replicate themselves with additional blank lines. If two macro viruses simultaneously infect a document, the combination of the two, if also self-replicating, can appear as a "mating" of the two and would likely be detected as a virus unique from the "parents".

A virus may also send a **web address link** as an **instant message** to all the contacts (e.g., friends and colleagues' e-mail addresses) stored on an infected machine. If the recipient, thinking the link is from a friend (a trusted source) follows the link to the website, the virus hosted at the site may be able to infect this new computer and continue propagating. Viruses that spread using **cross-site scripting** were first reported in 2002, and were academically demonstrated in 2005. There have been multiple instances of the cross-site scripting viruses in the "wild", exploiting websites such as **MySpace** (with the Samy worm) and **Yahoo**.

### SELF-ASSESSMENT EXERCISE

1. Before computer networks became widespread, viruses were written to infect -----
  - a. Network files.
  - b. Popularly traded software.
  - c. Modems.
  - d. Popular personal computers.
  
2. Which of the following is not a source of the virus entering your system?
  - a. Smart phones.
  - b. Email attachments.
  - c. USB drive.
  - d. Social media scam links.
  
3. Which of the following is the worst computer virus outbreak in history?
  - a. Sobig
  - b. Trojan
  - c. Mydoom



d. Zeus

4. The actual work of the virus during which the "payload" is released is called -----

a. Propagation phase

b. Triggering phase

c. Execution phase

d. All of the above

#### **4.0 CONCLUSION**

Having read this course and successfully completed the assessment and self-assessment test, it is assumed that you have attained understanding of virus operations and functions.

#### **5.0 SUMMARY**

In this Unit, you have learnt about virus operations and functions. Infection targets and replication techniques were discussed. Likewise, counter measures were described.

#### **6.0 TUTOR-MARKED ASSIGNMENT**

Discuss the following:

a) Computer Care.

b) Anti-Viruses and Virus prevention.

#### **7.0 REFERENCES/FURTHER READING**

Avoine, G. (2017). *Computer System Security: Basic Concepts and Solved Exercises*. EPFL Press.

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