



NATIONAL OPEN UNIVERSITY OF NIGERIA

**Faculty of Agricultural Sciences,
Department of Economics and Extension
Programme: Hospitality and Tourism Management**

COURSE TITLE:

Computer Appreciation and Application to Hospitality and Tourism

COURSE CODE: HMT 206

CREDIT UNITS: (2 Units)



Computer Appreciation and Application to Hospitality and Tourism (2 Units)

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HMT206 COURSE GUIDE

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Introduction

This course, COMPUTER APPRECIATION is a compulsory course, which carries two (2) credit units. It is prepared and made available to all degree course students offering Hospitality and Tourism related Programme in the Faculty of Agricultural Sciences, Department Economics and Extension at the Nation Open University of Nigeria. It has to do with the application of computer principles to the operations of tourism and hospitality industry. This course material is useful in your academic pursuit as well as in your workplace as managers and administrators.

What You will Learn in this Course

This course consists of five modules which are sub-divided into 20 units. This course guide tells you what the course is all about. What course materials you will be using and also suggests some general guidelines for the amount of time you are likely to spend on each unit of the course in order to complete it on schedule. It also gives you guidance in respect of your Self- Assessment Exercises (SAEs) which will be made available in the assignment file. Please attend those tutorial sessions. The course will introduce you to the fundamentals of computer appreciation.

Course Aim

The main aim of this course is to arm you with adequate information on the concept of research and methodology in hospitality and tourism management. The course also aims at making you have a greater understanding of the fundamentals of computer appreciation as applicable to hospitality and tourism management. This will prepare the student for a future career in hospitality and related disciplines.

Course Objectives

To achieve the aim set out, the course has a set of objectives which are set out as intended learners' outcome under each unit. You should read these objectives before you study the unit. After going through this course, you should be able to discuss:

- IT in Tourism and Hospitality Industry
- Conceptual Foundations of IT
- History of Computers
- Functional Components of Computer
- Characteristics of Computers
- Problem Solving and Computer Programming

- Types of Programming Languages
- Algorithms, Flowcharts and Pseudo-codes
- Introduction to Computer Networks
- Internet Technology
- Fundamentals of websites
- Web Browsers and Search Engines
- Number Base Arithmetic
- Microsoft Windows OS
- Problem Solving in OS
- Access R Programming Environment etc.

Working through the Course

This course involves that you devote a lot of time to read and study the contents. Each unit contains self-assessment exercises for this course and at certain points in the course you would be required to submit assignments for assessment purposes. At the end of this course, there is a final examination. I would therefore advice that you attend the tutorial sessions where you would have the opportunity of comparing knowledge with your colleagues.

Course Materials

You will be provided with the following materials

- Course guide
- Study units
- References
- Assignments
- Presentation schedule

STUDY UNITS

There are five modules of 20 units in this course, which should be studied carefully.

Assessment

There are two components of assessment for this course:

- The Tutor Marked Assignment (TMA)
- The end of course examination.

Tutor-Marked Assignment

The TMA is the continuous assessment component of your course. It accounts for 30% of the total score. You will be given four TMA's by your facilitator to answer before you can sit for the final examination.

Final Examination and Grading

This examination concludes the assessment for the course. The examination will account for 70% of total score. You will be informed of the time for the examination.

Summary

This course intends to provide you with underlying knowledge of computer appreciation for the study of Hospitality Management and Tourism.

HMT 206: Computer Appreciation and Application to Hospitality and Tourism

MODULE 1
INTRODUCTION TO INFORMATION TECHNOLOGY

Course Writing Template for Course Writers

UNIT 1: IT IN TOURISM AND HOSPITALITY INDUSTRY

Unit Structure

- 1.1 Introduction
- 1.2 Learning Outcomes
- 1.3 Definition of Concepts
 - 1.3.1 Tourists
 - 1.3.2 Visitors
 - 1.3.3 Domestic and International Tourism

- 1.3.4 Tourism Products
- 1.3.5 IT as a Driver of Tourism and Hospitality Industry
- 1.4 E-Tourism
- 1.5 Application of IT in Tourism and Hospitality Industry
 - 1.5.1 Hotel Reservation and Confirmations
 - 1.5.2 Car / Airline Booking Reservation and Confirmations
 - 1.5.3 Database Technology and Big Data
 - 1.5.4 Travel Advice
 - 1.5.5 Vouchers and Ticket Productions
 - 1.5.6 Marketing and Competition Research
 - 1.5.7 Accounting and Billing of Customers
- 1.6 Summary
- 1.7 Glossary
- 1.8 References/Further Readings
- 1.9 Possible Answers to Self-Assessment Exercises



1.1 Introduction

The UNIT 1 of this course HMT 206 (Computer Appreciation and Application to Hospitality and Tourism) focuses mainly on giving a general overview of Information Technology (IT) in the field of Tourism and Hospitality Industry. We shall begin by defining the important concepts related to the subject matter.



1.2 Learning Outcomes

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

- Explain a number of important concepts related to Tourism and Hospitality Industry, such as Tourist, Visitor, Tourism Product, et cetera.
- Diagrammatically present the different sectors of Tourism and Hospitality Industry.
- Discuss the importance of Information Technology, and how it drives the growth of industries, particularly the Tourism and Hospitality industry.
- Explain the general concept of E-Tourism.
- Outline and discuss at least seven applications of IT in Tourism and Hospitality Industry



1.3 Definition of Concepts

- 1.3.1 Tourists: According to Hall (2008), tourists are individuals who voluntarily leave their normal place of residence or familiar locality, to visit another environment, where such persons engage in or will usually engage in different activities.
- 1.3.2 Visitors: According to Holloway & Taylor (2006), the term visitors refer to persons who are involved in tourism. There are two classes of visitors. Temporary visitors are ones staying at least 24 hours in a destination, while leisure visitors are ones travelling for recreation, health, sport, holiday, study or religious purposes.
- 1.3.3 Domestic and International Tourism: Yuksel (2004) classified tourism into domestic and international tourism. Domestic tourism refers to travel that is exclusively undertaken within the national boundaries of the traveller's home country, while the latter refers to travel beyond the borders of one's home country.
- 1.3.4 Tourism Products: The major functions of Tourism and Hospitality Industry is to serve travellers. The success factor depends on the positive inter-relationships of

all sectors, and the ability of the operators to ensure that travellers enjoy the best experience within the period they are engaged in tourism. Four basic sectors, which serve their varied products, are shown in the following diagram (Fig. 1.1).

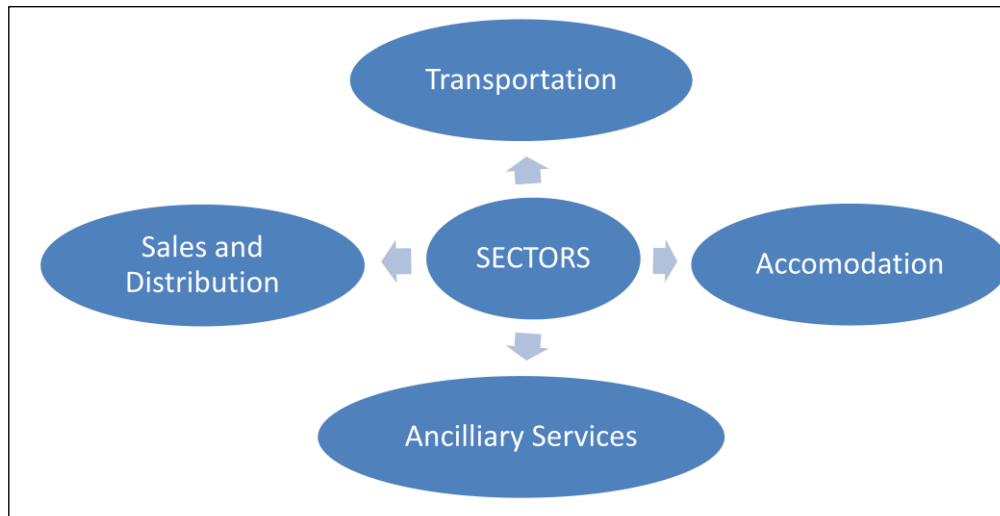


Fig. 1.1: Basic Sectors of Tourism and Hospitality

It is obvious that there cannot be tourism without transportation, since tourists need efficient and effective transportation in order to transit from one location to another. Secondly, as they get to the tourist destination, they require accommodation throughout their stay. Third, tourists require a number of ancillary services (for example, Internet access) in order to have a very nice stay in the tourist location. Last, the Sales and Distribution is necessary in order to ensure that tourists get things that might interest them to buy, before, during and even after their trips.

1.3.5 IT as a Driver of Tourism and Hospitality Industry: It is very necessary to mention that Information Technology is a very important tool for driving Tourism and Hospitality Industry activities. Each of the four sectors listed in the diagram, and many more, require the power of Information Technology, to ensure that tourists receive the best of services as they move from their point of departure to their destination, and back home. Hence, the need for this course is established.

Self-Assessment Exercises 1

Mention three important Tourism Products sectors which could be driven by IT.

1.4 E-Tourism

The term E-Tourism is defined as the application of Information and Communication Technology to drive the various sectors of the tourism industry. Alternatively, it is also defined as the digitization of all the various processes that enable organizations to maximize their effectiveness and efficiency in tourism, travel, hospitality and catering industries.

1.5 Application of IT in Tourism and Hospitality Industry

In this section of this lecture note, we shall outline a number of areas of applications of Information Technology in Tourism and Hospitality Industry.

1.5.1 Hotel Reservation and Confirmations

A tourist could use IT enabled web applications to book for hotel accommodation and related tourists products during a trip. This could be done through a number of intermediaries, such as travel agents, airlines, and so on, or could be done directly in contact with the hotels.

1.5.2 Car / Airline Booking Reservation and Confirmations

Web-based applications can also be used to book for cars and flights during tours. These are possible through the use of the Internet.

1.5.3 Database Technology and Big Data

Travel companies have access to large scale customer data. This data which could be stored as databases, organized collection of data, could be tourists' basic personal information, or specialized to give such information as preferred airline seats, in-flight-entertainment preferences, customer's preferred meals, and so on. When tourism operators appropriately use such databases, it helps in serving tourists better.

1.5.4 Travel Advice

Travel advice is very important to tourists. Such advice could be accessed by tourists through the web, or as emails. Travel advice helps the tourists to make decisions on how to travel, when to travel, security related issues in an environment, and so on.

1.5.5 Vouchers and Ticket Productions

Information Technology is also instrumental to the seamless generation and printing of vouchers and ticket, especially during tourist trips.

1.5.6 Marketing and Competition Research

Information Technology is a very important tool that enables industry players to complete favourably in serving the public, thus retaining their customers.

1.5.7 Accounting and Billing of Customers

The accounting departments of today cannot do without the use of Information Technology. This involves deployment of computer hardware and software towards accounting, billing, and other related activities in the financial sectors.

Self-Assessment Exercises 2

1. Mention the types of Customer Data that could be useful for driving a Tourism and Hospitality Industry.
2. What is the name of an organized storage of Data?



1.6 Summary

This unit is an introduction to the use of Information Technology, in driving industries especially the area of Tourism and Hospitality. A number of concepts were defined and discussed in line with the unit objectives. The Self-Assessment questions were also answered.

1.7 Glossary

Database A structured or organized set of data stored in a computer or a media.



1.8 References/Further Readings

Hall, Michael (2008). *Tourism Planning: Policies, Processes and Relationships*, 2nd Edition. Harlow: Prentice Hall

Holloway, J.C, with Taylor, N. (2006). *The Business of Tourism*, 7th Edition. London: FT/Prentice Hall

Atila Yuksel (2004). Shopping Experience Evaluation: A Case of Domestic and International Visitors. *Tourism Management* 25(6):751-759.



1.9 Possible Answers to SAEs

Answers to SAEs 1

Three important Tourism Products sectors are any three of these: (a). Transportation, (b). Accommodation, (c). Sales and Distribution, and (d). Ancillary Services.

Answers to SAEs 2

1. Examples of such data are Name of Customer, Phone Number, E-Mail Address, Number of Times Travelled, State of Origin, et cetera.

2. It is called Database

UNIT 2: CONCEPTUAL FOUNDATIONS OF IT

Unit Structure

- 2.1 Introduction
- 2.2 Learning Outcomes
- 2.3 Demystifying IT Concepts
 - 2.3.1 CPU
 - 2.3.2 Bit
 - 2.3.3 ROM and RAM
 - 2.3.4 Algorithm
 - 2.3.5 Hardware and Software

- 2.3.6 ISP
- 2.3.7 USB
- 2.3.8 CAPTCHA
- 2.3.9 Search Engine
- 2.3.10 Operating System (OS)
- 2.3.11 Kbps
- 2.3.12 Computer Virus
- 2.3.13 URL
- 2.3.14 Internet
- 2.4 Practical Demonstrations of Storage Size Conversion
 - 2.4.1 Convert from Bytes to Gigabytes
 - 2.4.2 Convert from Bytes to Megabytes
 - 2.4.3 Convert from Megabytes to Terabytes
 - 2.4.4 Convert from Gigabytes to Bytes
 - 2.4.5 Convert from Terabytes to Gigabytes
- 2.5 Summary
- 2.6 Glossary
- 2.7 References/Further Readings
- 2.8 Possible Answers to Self-Assessment Exercises



2.1 Introduction

In order to have a strong grip of Information Technology and its application in Hospitality and Tourism Industry, it is very necessary for a student to know and master a number of key concepts. Knowledge of these concepts, including their definitions and illustrations will go a long way to help students to make meaningful progress in the rest of the document, and the course in general. This is the main focus of this unit.



2.2 Learning Outcomes

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

- Define a number of key terms in IT, some of which are CPU, Bit, ROM, RAM, USB, CAPTCHA, et cetera.
- Illustrate those terms to reveal understanding.
- Explain how those terms are applied in daily usage.
- Define memory units such as Bytes, Megabytes, Gigabytes, and Terabytes.
- Convert from one memory unit to another.



2.3 Demystifying IT Concepts

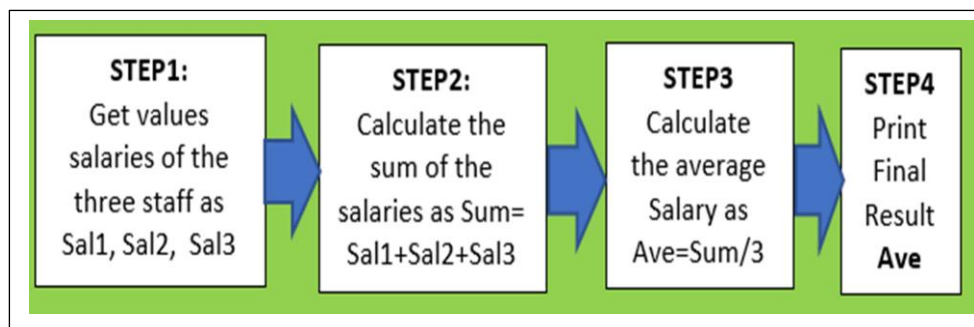
2.3.1 CPU: The acronym CPU stands for the Central Processing Unit. It is the processing section that acts as the brain of the computer. It is the CPU that processes the digital instructions provided by users to the computer.

2.3.2 Bit: The term is an abbreviation for “binary digit,” and is defined as the smallest recognizable unit of memory in a computer. There are two binary digits, which are 0 and 1, representing the two possible states of the bit. The binary digits constitute the lowest level of the computer language commonly known as the machine language. The data processed by the computer can also be generalized in terms of bundles of bits as shown in Table 2.1.

Bundles of Bits	Value
1 Byte	8 Bits
1 Kilobyte (KB)	1,024 bytes
1 Megabyte (MB)	1,024 kilobytes → 1024 x 1024 bytes
1 Gigabyte (GB)	1,024 megabytes → 1024 x 1024x 1024 bytes
1 Terabyte (TB)	1,024 gigabytes → 1024 x 1024x 1024 x 1024 bytes

2.3.3 ROM and RAM: These are two types of computer internal memories. ROM stands for Read-Only Memory, while RAM stands for Random Access Memory. There are a number of differences between the two. For instance, ROM can only be read from, and contains permanently stored instructions by the computer manufacturer. The instructions are to help the computer start properly. On the other hand, RAM is a form of fast memory that stores data and instructions that is being processed by the computer. One important characteristics of RAM is that its content gets wiped out the moment the computer system is switched off.

2.3.4 Algorithm: This is defined as a step by step procedure or guide to solving a particular computational problem. For instance, imagine being given an assignment in a classroom to solve the problem of calculating the average salary of three staff. A simple algorithm for solving this problem could be depicted using the diagram (Fig. 2.1):



2.3.5 Hardware and Software: The term hardware encompasses the physical components of a computer. Examples of hardware components of a computer are the keyboard, monitor, disk drive, cables, mouse, et cetera. The term software represents

programs or instructions that drive the behaviour of the computer in doing what is required. Based on this definition, it is obvious that hardware can be touched physically, unlike software.

2.3.6 ISP: The acronym ISP stands for Internet Service Provider. This is defined as an organization or company in charge of providing Internet connectivity.

2.3.7 USB: This stands for Universal Serial Bus. This is a standard connector that allows users to seamlessly attach external devices such as mouse, scanners, printers, modems, webcams, and other hardware components to the computer. A number of operating systems such as Microsoft Windows and Macintosh support USB.

2.3.8 CAPTCHA: The term stands for "Completely Automated Public Turing test to tell Computers and Humans Apart.". This is a test commonly used to separate humans from automated computer responses. A CAPTCHA could be an image test, or just a simple mathematics problem, which a human can read or solve, but an automated computer response would fail. One of the major usefulness of CAPTCHA is to stop computer hackers from using a program to automatically access an email or bank account.

2.3.9 Search Engine: A search engine is a program which is used to look up and locate up information on the web. The strategy used by search engines is to look at many web pages, with the aim of finding out matches to the input supplied by user. Search engines return results ranked in terms of relevancy and popularity. A number of search engines are in use, some of which are Google, Bing, Ask.com, Yahoo!, and so on.

2.3.10 Operating System (OS) – The term Operating System (OS) is defined as a software that manages computer's resources, and also provides a platform for users to be able to execute their programs. The OS is a specialized program that belongs to the category known as system software. It manages other software. This is quite unlike application software that is developed by programmers to solve specific problems of users. Examples of common OS are listed in the following Table 2.2:

Table 2.2: List of Common OS

S/N	OS
1	Microsoft Windows
2	Mac OS X
3.	Linus
4.	Solaris
5.	BSD
6.	Google's Android
7.	Apple's iOS

2.3.11 Kbps: The unit Kilobits per second is a measure of data transfer speed. The prefix kilo- signifies a multiplier value of 10^3 , which implies that 1 kilobit = 10^3 bits = 1000 bits. The unit symbol for kilobit is kbit or kb. For instance, 1 Kbps is 1,000 bits per second. A modem could have a transmission capacity of 28.8 Kbps.

2.3.12 Computer Virus: This is a malicious program that alters the data or information on a computer. The process of achieving such mischievous or destructive goal is usually in an invisible manner. Computer viruses could infect storage devices such as hard disk, floppy disk, and so on, and could subsequently spread to other parts of the computer system or be transferred to other computers. Antivirus is a special kind of program used to eliminate computer viruses (Qingyi, 2022).

2.3.13 URL: The acronym URL stands for Uniform Resource Locator. It is a group of textual characters used for identifying resources on the Internet. A typical URL consists of three major parts. These are:

- a. The Protocol,
- b. The server name and address,
- c. The path of the resource.

The protocol describes the type of item and is always followed by a colon (:). Examples of protocols are http, https, ftp, and so on. On the other hand, the server name and address points to the computer where the information is stored on the Internet, and is preceded by two slashes (//). Finally, the path shows where an item is stored on the

server and what the file is called. The single slash (/) is used to segment the locations; each segment of the location is preceded by a single slash (/). For example, URL for the Nigerian Army, Department of Army Logistics information is https://army.mil.ng/?page_id=607, while that of the NYSC, for NYSC Bye-laws (Revised 20011) is <https://www.nysc.gov.ng/byelaw.html>.

2.3.14 Internet: The term Internet represents a system of worldwide interconnected computer networks. In other words, the Internet is a worldwide network of computers. For the computers on the Internet to be able to communicate, they use what is known as protocols or rules of communication. The known protocol suite for the Internet is known as TCP/IP which stands for Transmission Control Protocol / Internet Protocol. Every computer on the Internet is assigned a unique identifier known as IP address, which is usually made up four numbers separated by a dot. Example of an IP address is 115.90.22.6. A DNS (Domain Name Server), directory of domain names that align with IP addresses, is a special computer that is used to translate a domain name into the appropriate IP Address, to enable users locate computers by their more friendly names.

Self-Assessment Exercises 1

2.4

The f

1. The acronym CAPTCHA stands for what?
2. In an IP address, the adjacent numbers are separated by what?

} unit to

another. These are solved in this section.

- a. Convert 65,022,323,789 bytes to Gigabytes
- b. Convert 65,022,323,789 bytes to Megabytes
- c. Convert 8,715,679 Megabytes to Terabytes
- d. Convert 87 Gigabytes to Bytes
- e. Convert 82 Terabytes to Gigabytes

HINT: To solve these problems, the following graphical guide (Fig. 2.3) could be very useful.

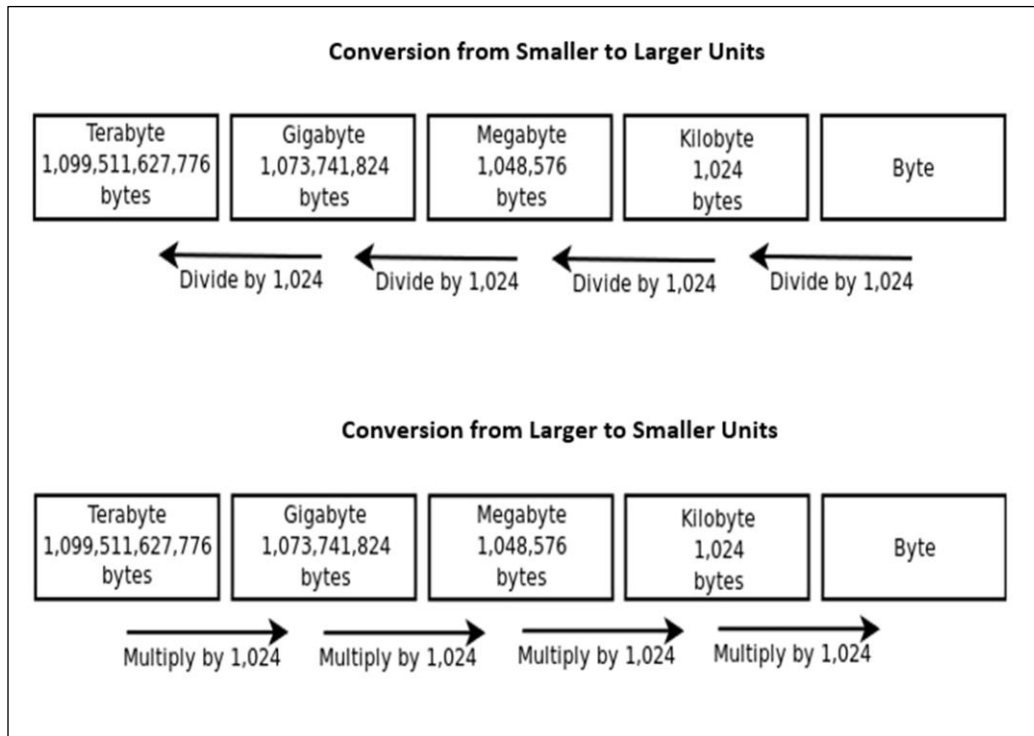


Fig. 2.3: Memory Conversion Guide

2.4.1 Convert from Bytes to Gigabytes

Convert 65,022,323,789 bytes to Gigabytes

To solve this, student should divide by 1024 three times.

Which is $65,022,323,789 \text{ bytes} / (1024 \times 1024 \times 1024) = 60.55\text{GB}$

2.4.2 Convert from Bytes to Megabytes

Convert 65,022,323,789 bytes to Megabytes

To solve this, student should divide by 1024 two times.

Which is $65,022,323,789 \text{ bytes} / (1024 \times 1024) = 62,010 \text{ MB}$.

2.4.3 Convert from Megabytes to Terabytes

Convert 8,715,679 Megabytes to Terabytes

To solve this, student should divide by 1024 two times

Which is $8,715,679 \text{ Megabytes} / (1024 \times 1024) = 8.31\text{TB}$

2.4.4 Convert from Gigabytes to Bytes

Convert 87 Gigabytes to Bytes

To solve this, student should multiply by 1024 three times.

Which is $87 \text{ Gigabytes} \times 1024 \times 1024 \times 1024 = 93,415,538,688 \text{ Bytes}$.

2.4.5 Convert from Terabytes to Gigabytes

Convert 82 Terabytes to Gigabytes

To solve this, student should multiply by 1024 once.

Which is $82 \text{ Terabytes} \times 1024 = 83,968 \text{ GB}$.

Self-Assessment Exercises 2

1. Arrange in ascending order of memory size - Megabyte, Terabyte, Byte, Gigabyte.



2.5 Summary

This Unit provided an unambiguous foundation on Information Technology, beginning with the outline and study of key terms. Some of these terms are URL, Computer Virus, CAPTCHA, et cetera. Practical solutions on conversion from one memory unit to another were also demonstrated.

2.6 Glossary

GB: Gigabyte

TB: Terabyte



2.7 References/Further Readings

Qingyi Z, Pingfan X, Xuhang L, Chenquan G (2022), "Dynamical Behavior of Hybrid Propagation of Computer Viruses", *Security and Communication Networks*, vol. 2022, ID 2576685, pp. 1-15.



2.8 Possible Answers to SAEs

Answers to SAEs 1

1. CAPTCHA stands for "Completely Automated Public Turing test to tell Computers and Humans Apart."
2. Full Stop

Answers to SAEs 2

1. Byte, Megabyte, Gigabyte, Terabyte

UNIT 3: HISTORY OF COMPUTERS

Unit Structure

- 3.1 Introduction
- 3.2 Learning Outcomes
- 3.3 The Abacus
 - 3.3.1 Practical Demonstration of Number Representation in Abacus
- 3.4 The Napier Bones
 - 3.4.1 Practical Demonstration of Multiplication Using Napier Bones
- 3.5 Pascaline Arithmetic Machine
- 3.6 The Difference Engine
- 3.7 Analytical Engine
- 3.8 Ada Lovelace Program

- 3.9 Mark I
- 3.10 Generations of Computers
 - 3.10.1 First Generation Computers
 - 3.10.2 Second Generation Computers
 - 3.10.3 Third Generation Computers
 - 3.10.4 Fourth Generation Computers
 - 3.10.5 Fifth Generation Computers
- 3.11 Summary
- 3.12 Glossary
- 3.13 References/Further Readings
- 3.14 Possible Answers to Self-Assessment Exercises



3.1 Introduction

A number of events and inventions have taken place over the years, in the evolution and development of computing. This unit presents a chronology of events, and steps taken in development of computing, all of which culminated to the current level of advancements in Computing and Information Technology.



3.2 Learning Outcomes

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

- Discuss Abacus and Napier Bones, and practically demonstrate their usage in mathematical calculations.
- Discuss computing historical efforts; Pascaline Arithmetic Machine, Difference Engine and Analytical Engine.
- Discuss the role of Ada Lovelace in Computer Programming.
- Discuss the Generations of Computers from the first to the current generation.



3.3 The Abacus

The history of computing has been said to begin with the birth of abacus. In fact, many people view abacus as the first computer. This computing device was a wooden rack having a number of metal rods with beads mounted on them. The abacus operator moves the beads in line with some rules so as to perform arithmetic calculations. A number of historical facts point to the fact that Abacus was invented about 4000 years ago. Many also believe that it was invented by the Chinese, while others think it was invented by Babylonians. Abacus is still used in China and some other Asian countries such as Russia, Japan, et cetera. A pictorial representation of abacus is shown in the following figure (Fig. 3.1). As shown in the diagram, there are two compartments of the beads. The upper compartment has two beads per column, while the lower compartments consist of five beads per column. When you combine the two compartments, it implies that there are seven beads per column. The value of each bead picked varies, from right towards the left. Thus, at the rightmost column is a unit that is from 1-9. The next column has place value of ten. The next to that has place value of one hundred, and so on.

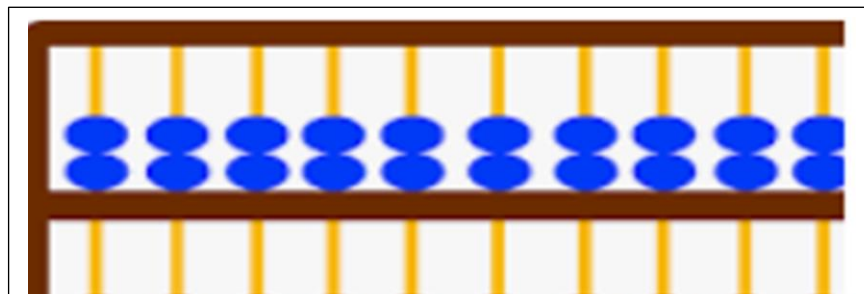


Fig. 3.1: A pictorial representation of abacus

3.3.1 Practical Demonstration of Number Representation in Abacus

Representing the numbers in abacus is very interesting, and is as follows. Each of the two top-level beads have actual values 5 each, making $5 + 5$, which is 10, while each of the 5 lower-level beads have actual values of 1 each, making a total of $1+1+1+1+1 = 5$. To represent a number is achieved by taking three possible steps:

- a. Spread the number, so that each digit is represented using a particular column of abacus, moving from LHS towards RHS. For instance, if one wishes to represent a number 25265028, it means that the 8 will be represented in the rightmost column, 2 on the next column by the left, and so on until all the digits are covered.
- b. To represent a number 5 from top compartment, simply press down one bead.
- c. To represent a number from lower compartment, simply push up the number of beads required. Example if I wish to represent a number 2 from the lower compartment, I would simply push up two beads.
- d. For example, the number 1532786 can be represented in abacus as follows (Fig. 3.2):



Fig. 3.2: Representation of 1532786 in abacus

Self-Assessment Exercises 1

1. In Abacus, each of the two top-level beads have actual values of ____ each, making ____ + ____ which is ____.

3.4 The Napier Bones

The Napier Bones was a manually-operated calculating device invented by John Napier between 1550 and 1617. The calculating tool uses 9 different ivory strips also known as bones, which are marked with numbers used to effect multiplication and divisions. The Napier Bones is adjudged as the first computational machine to use the decimal points. The following diagram shows the structure and contents of the Napier Bones. There are a total of ten bones, numbered from left to right in columns. For instance, Bone 0 consists of cells [1,2,3,4,5,6,7,8,9], Bone 1 is made up of cell contents numbered [2,3,4,5,6,7,8,9], while Bone 2 is made up of cell contents [4,6,8, Diag. (1,0), Diag. (1,2)...Diag. (1,8)] where Diag. represent diagonals or numbers placed in left and right positions respectively. A sample diagram is shown in Fig. 3.3. We shall demonstrate practically how this calculating device works.

1	1	2	3	4	5	6	7	8	9	
2	/	2	4	6	8	10	12	14	16	18
3	/	3	6	9	12	15	18	21	24	27

Fig. 3.3: Sample Diagram of Napier Bones

3.4.1 Practical Demonstration of Multiplication Using Napier Bones

Suppose we wish to multiply 7345 by 8 using Napier Bones, the following steps would be taken, using Fig. 3.4 as a reference:

- a. First, write 8 at the leftmost position, then place the relevant bones in the order 7, 3, 4 and 5 as follows to form the number 7345.

1	7	3	4	5	
2	1 4	6	8	1	0
3	2 1	9	1	2	1
4	2 8	1	2	6	2
5	3 5	1	5	2	0
6	4 2	1	8	2	4
7	4 9	2	1	2	8
8	5 6	2	4	3	2
9	6 3	2	7	3	6




Fig. 3.4: Napier Bones Solution for Multiplying by 7345

- b. The computation proceeds from the right-hand side towards the left, starting with the rightmost bone in the row determined by the multiplier. In this case, the last digit in the 8th row of the 5-bone is 0. Therefore, we write down 0.
- c. Now sum the two adjacent numbers in the same row to the left giving $2 + 4 = 6$ as the next digit.
- d. Thus, we now have 60 as the current value.
- e. Next sum the two adjacent numbers in the same row to the left giving $4 + 3 = 7$ as the next digit.
- f. Thus, we now have 760 as the current value.
- g. Next sum the two adjacent numbers in the same row to the left giving $6 + 2 = 8$ as the next digit.
- h. Thus, we now have 8760 as the current value.
- i. Finally, the last adjacent number in the same row to the left is 5, which is the next digit.
- j. Thus, we now have 58760 as the current value.
- k. This is obviously the result of 8×7345 as can be confirmed using a calculator.
- l. It is important to mention that whenever there is a carry forward, such a carry forward is also added appropriately to get the next left-most digit in that order.
- m. There is more to the Napier bones, but what has been discussed suffices for its introduction.

Self-Assessment Exercises 2

1. _____ is adjudged as the first computational machine to use the decimal points.

3.5 Pascaline Arithmetic Machine

The Pascaline Arithmetic Machine was invented between 1642 and 1644 by a French mathematician-philosopher Blaise Pascal. This machine is believed to be the first mechanical and automatic calculator. Etienne, the father of Blaise Pascal was a well-known tax calculating officer, and his job was often overwhelming. He and his team usually worked tirelessly computing tax levies using abacus and other manual calculating means. Fortunately, in the year 1642, his son Blaise designed the Pascaline Arithmetic Machine to help speed up the process. The machine was a wooden box with a series of gears and wheels, which could only perform addition and subtraction. Pascal received a patent on this invention on May 22, 1649. A picture of the Pascaline is shown in Fig. 3.5 (Jose Sola *et al.*, 2021).

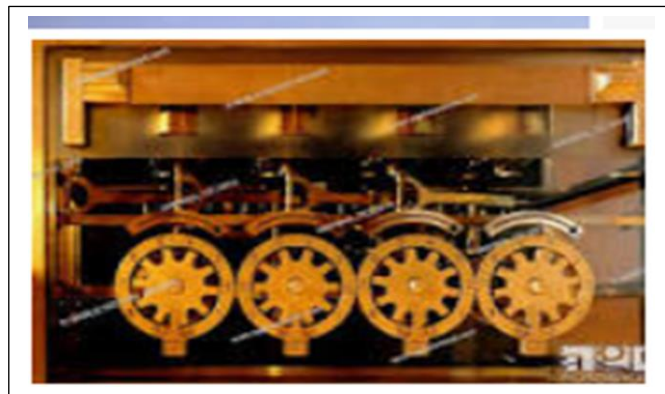


Fig. 3.5: Picture of Pascaline Arithmetic Machine

3.6 The Difference Engine

The Difference Engine was designed in the early 1820s by Charles Babbage who is also known as the "Father of Modern Computer". It was a mechanical computer which has the capability to perform simple calculations. It was a steam driven machine which

could solve tables of numbers, such as logarithm tables. Babbage first conceived the idea of building a mechanical calculator for mathematical tables between 1812 and 1813. He then built a small calculator that could perform mathematical computations of up to eight decimals. After obtaining government grant in 1823, he then came up with the Difference Engine, which could handle as much as 20-decimal capacity. A picture of the Difference Engine according to Swaine and Freiburger (2017) is shown in Fig. 3.6.

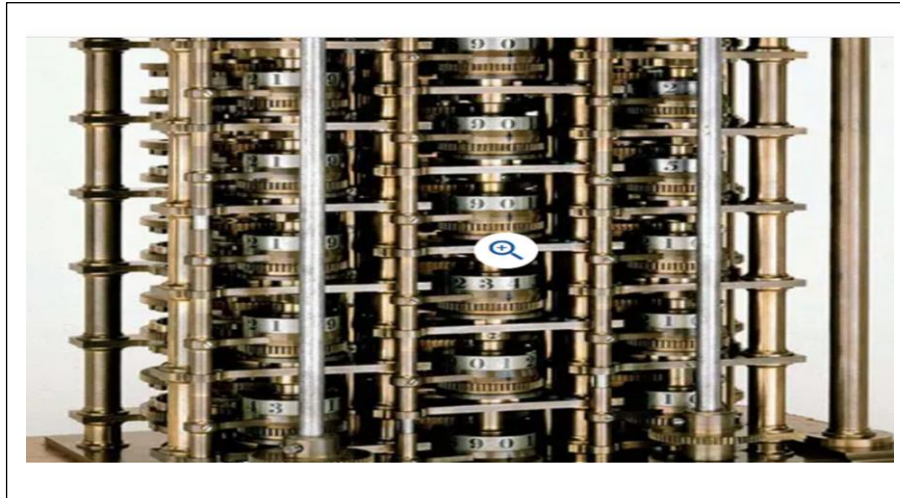


Fig. 3.6: Picture of Difference Engine

3.7 Analytical Engine

A further improvement on the Difference Engine was the invention of the Analytical Engine. This calculating machine which was also developed by Charles Babbage in 1830 was a mechanical computer. It used punch-cards as input, and has the capability of not only solving complex mathematical problems, but also was able to store data and instructions in what has come to be known as a permanent memory.

3.8 Ada Lovelace Program

Ada Lovelace an acclaimed Mathematician, in the year 1843 translated Charles Babbage's documentation on Analytical Engine into her own annotations, thereby practically demonstrating how a calculation could be automated using a sequence of instructions. This was the first ever computer program.

3.9 Mark I

The next major milestone in the evolution or development of computing took place in the year 1937 when Howard Aiken envisioned the building of a machine that could handle the calculations involving large numbers. This led to the invention of Mark I in year 1944. This machine was built as a partnership between IBM and Harvard. Mark I is known as the first programmable digital computer.

3.10 Generations of Computers

In the study of the evolution of Computing, it is very important to explore the Generations of Computers. A generation of computers refers to a season or period within which there were specific improvements in computer technology. The major generations of computers are outlined in Fig. 3.7.

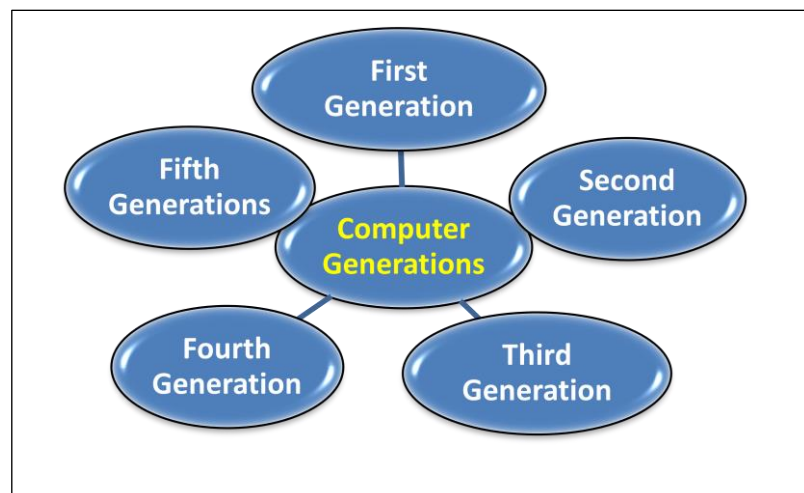


Fig. 3.7: Generations of Computers

3.10.1 First Generation Computers

Computers of the First Generation are characterized as follows.

- a. They are computers within the years in bracket 1946-1959.
- b. First generation computers were slow, huge and expensive.
- c. First generation computers used vacuum tubes as the basic components of CPU and memory.
- d. These computers depended heavily on batch processing, with punch cards as major input medium.
- e. The major output and input devices in this generation were magnetic tape and paper tape respectively.
- f. Examples of first generation computers are:
 - ENIAC (Electronic Numerical Integrator and Computer)
 - EDVAC (Electronic Discrete Variable Automatic Computer)
 - UNIVAC I (Universal Automatic Computer)
 - IBM-701 and 650

3.10.2 Second Generation Computers

Computers of the Second Generation (2G) are characterized as follows.

- a. They are computers within the years bracket 1959 and 1965
- b. The 2G computers used transistors which were cheap, compact and consume less power.
- c. The 2G Computers were obviously faster than the first generation computers.
- d. The 2G computers used magnetic cores as primary memory and magnetic disc and tapes as secondary storage.
- e. The major programming languages used in 2G computers were Assembly language as well as other languages such as COBOL and FORTRAN.
- f. The 2G Computers also made use of Batch processing.
- g. Examples of 2G computers are:
 - IBM 1620 and 7094
 - CDC 1604 and 3600
 - UNIVAC 1108

3.10.3 Third Generation Computers

Computers of the Third Generation are characterized as follows.

- a. The 3G Computers used Integrated Circuits (ICs) rather than transistors as in 2Gs.
- b. The obvious advantage of this is that just a single IC could pack a large number of transistors.
- c. Thus, 3G Computers have increased power and reduced cost.
- d. The 3G Computers are also more reliable and efficient.
- e. Because the 3G computers compact the ICs, they are smaller in size.
- f. The 3G Computers used remote processing and time-sharing Operating System.
- g. Just like the 2G Computers, the 3G computers could be programmed using several high-level programming languages such as FORTRON, COBOL, Pascal, et cetera.
- h. Examples of 3G computers are:
 - IBM-360 series
 - Honeywell-6000 series.
 - TDC-316

3.10.4 Fourth Generation Computers

Computers of the Fourth Generation are characterized as follows.

- a. They are computers within the years bracket 1971 and 1980
- b. The 4G Computers used very large scale integrated (VLSI) circuits
- c. A VLSI is a single chip that contains several millions of transistors among other circuit elements.
- d. Because of the VLSI, the 4G Computers are more compact and powerful.
- e. Moreover, the 4G computers are fast and affordable.
- f. The 4G Computers can handle real time and network / distributed processing.
- g. The modern programming languages such as C and C++, and dBase were also used in 4G Computers.
- h. Examples of 4G computers are:
 - DEC 10
 - STAR 1000

- Super Computers such as CRAY-1 and CRAY-X-MP.

3.10.5 Fifth Generation Computers

Computers of the Fifth Generation are characterized as follows.

- They are computers within the years bracket 1980 till date.
- The VLSI technology used in 4G was replaced with the Ultra Large Scale Integration (ULSI).
- The ULSI technology in 5G made it absolutely possible for the production of microprocessor chips with ten million electronic components to be achieved.
- This generation computers used Artificial Intelligence (AI) software.
- The 5G Computers could be used to program robots.
- Modern programming languages such as C, C++, Java, .Net, Python, et cetera. are used in the 5G Computers.
- Examples of computers in this era are:
 - Desktop
 - Laptops
 - Notebooks
 - Ultrabooks
 - Chromebooks

Self-Assessment Exercises 3

The acronym VLSI stands for _____ while ULSI stands for _____



3.11 Summary

The focus of this unit is on the history of computers. Studied here are Abacus and its practical demonstration, plus Napier Bones and its demonstration. Others are Pascaline Arithmetic Machine, the Difference Engine, Analytical Engine, role

of Ada Lovelace in Programming, and Mark 1. Others are the Computer Generations from 1 to 5.

3.12 Glossary

5G Fifth Generation
AI Artificial Intelligence



3.13 References/Further Readings

Jose Sola, Gloria del Río-Cidoncha and Veronica Galiano-Delgado (2021).

Blaise Pascal's Mechanical Calculator: Geometric Modelling and Virtual Reconstruction, *Machines* 9(7), pp.136.

Swaine, M. R. and Freiberger P.A. (2017, June 28). Difference Engine. Encyclopedia Britannica. <https://www.britannica.com/technology/Difference-Engine>, Accessed July 21, 2022.



3.14 Possible Answers to SAEs

Answers to SAEs 1

1. In Abacus, each of the two top-level beads have actual values of 5 each, making $5 + 5$ which is 10.

Answers to SAEs 2

1. Nappier Bones is adjudged as the first computational machine to use the decimal points.

Answers to SAEs 3

1. The acronym VLSI stands for Very Large Scale Integration while ULSI stands for Ultra Large-Scale Integration.

UNIT 4: FUNCTIONAL COMPONENTS OF COMPUTER

Unit Structure

- 4.1 Introduction
- 4.2 Learning Outcomes
- 4.3 Basic Components of Computer
- 4.4 Block Diagram of Computer System
- 4.5 Input Unit
- 4.6 Central Processing Unit (CPU)
 - 4.6.1 Control Unit
 - 4.6.2 Memory Unit
- 4.7 Output Unit
 - 4.7.2 Printer
 - 4.7.3 Speakers
 - 4.7.4 Projector
- 4.8 Summary

- 4.9 Glossary
- 4.10 References/Further Readings
- 4.11 Possible Answers to Self-Assessment Exercises



4.1 Introduction

The computer system consists of various components all of which work together to ensure that there is effective functioning of the entire system. A typical computer system has at least five basic components which help in ensuring that the process of accepting data, processing data, and displaying the output resulting from the processing is achieved. We shall study the basic components of a computer system vis-à-vis their functions. For a better understanding of studies on components of the computer system, it is usually necessary to use block diagrams to explain the functionalities of the system. Block diagrams were used in this unit.



4.2 Learning Outcomes

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

- Enumerate and explain the functional components of the computer
- Present the components of the computer by block a diagram.
- Give examples of devices of each component type of the computer.
- Discuss the component parts of the CPU, such as Memory, Control and ALU.
- Sketch diagrams of some example devices.
- Differentiate Impact from Non-Impact Printers.



4.3 Basic Components of a Computer

Components of a Computer System are defined as the primary elements which make the functioning of the electronic device smooth and faster. The five basic components of a computer system are:

- a. Input Unit
- b. Output Unit
- c. Memory Unit
- d. Control Unit
- e. Arithmetical and Logical Unit (ALU)

It is important to mention that in most cases, the following equation (Equation 4.1) is used to represent the relationship between the CPU and its components.

$$CPU = Control Unit + Main Memory + ALU \quad (4.1)$$

In other words, the CPU (Central Processing Unit) consists of the Control Unit, the Main Memory and the Arithmetic and Logic Unit (ALU). Some text books or researchers simply refer to CPU as the Processing Unit. Some other authors take the CPU to be just Control Unit and ALU, and take Processing Unit to be Control Unit, ALU and Main Memory. This clarification is made so that a student will not be confused in the event of meeting such expressions elsewhere.

4.4 Block Diagram of Computer System

The block diagram of the components of a computer is shown in Fig. 4.1.

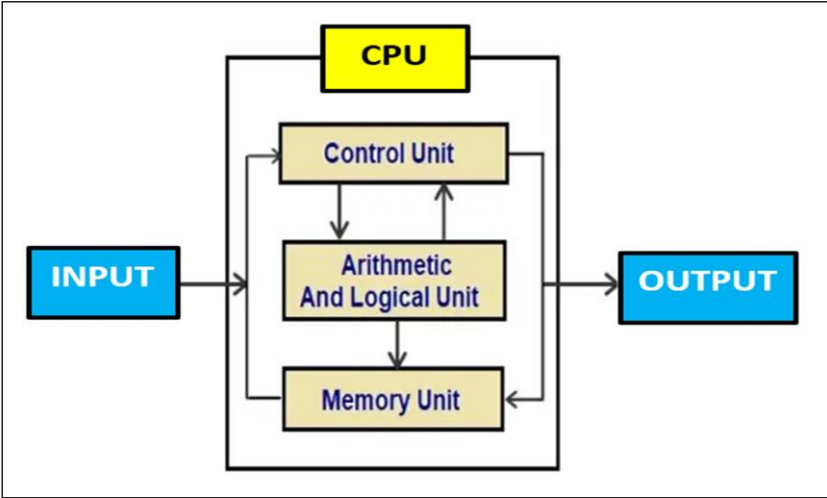


Fig. 4.1: Block Diagram of Computer Components

As shown in the diagram, data to be processed enters the computer system through the Input Unit. It then gets processed in the CPU. The result comes out through the Output Unit. The direction of movement has been depicted using arrows. Each of these units will be discussed in further details here.

4.5 Input Unit

Every data received by the computer enters through the input unit. The input unit consists of different devices that help to put data into the computer system. Thus, these devices act as go-in-between or mediators between the users and the computer system. The data that is entered into the system through the input unit must be recognized by the system, which then processes it to give rise to output or information. The major functions of the input unit are summarized as follows:

- a. Accept the data to be processed as entered by user.
- b. Convert the accepted data into machine-readable form.
- c. Transmit the machine-readable data into the main memory of the computer.

In summary, the Input Unit simply connects the user and the computer. Examples of devices that make up the Input Unit are mouse, keyboard, light pen and joystick, among others. Some of these are discussed in succeeding sections.

4.5.1 Mouse

A mouse is also known as a pointing device. A mouse can be clicked on various icons and links to trigger important system events. Mouse can also be used to open various files and programs. A mouse has 3 buttons on the top and one trackball at the bottom, for selecting and moving the mouse around, as shown in Fig. 4a.



Fig. 4a: Picture of a Mouse

4.5.2 Keyboard

This device comprises of keys and each key denotes an alphabet, a number, commands, or special characters, which are transmitted to a computer, instructing it to take various actions. The keyboard is no doubt a modified version of typewriter keys. Laptop keyboards have function keys F1, F2, ..., F12 that can be programmed and re-programmed to take various functions.

4.5.3 Joystick

The Joystick device comprises a stick which is attached at an angle to the base to ensure it can be effectively moved and controlled (Atiqur, 2014). This device is mostly useful in movement control in video games. Other places where Joystick is made use of are:

- Cockpit of an aeroplane
- Wheelchairs
- Cranes, et cetera.

The picture of a particular kind of Joystick is shown in Fig. 4b.



Fig. 4b: Picture of a Joystick

4.5.4 Light Pen

The Light Pen is an input device that can be directly moved over the device's screen. It is light-sensitive and can be used to insert a signature electronically as shown in Fig. 4c.



Fig. 4c: Picture of Light Pen

4.5.5 Other Input Devices

Other input devices are as follows:

- a. Barcode Reader
- b. Graphics Tablet
- c. Web Camera
- d. Touch Screen

Self-Assessment Exercises 1

1. Which of the following Input Devices can be very useful in displaying images in Video Conferencing: Barcode, Web Camera, and Keyboard?

4.6 Central Processing Unit (CPU)

The Central Processing Unit (CPU) is the brain of the computer. This is because it works the same way a human brain works in some respects. Just like the human brain controls all human activities, the CPU also controls all tasks performed in a computer system. It is the CPU that performs all the arithmetical and logical operations in the computer. Facts and functions related to Control and Memory units of the CPU are presented in succeeding subsections.

4.6.1 Control Unit

The following are facts / functions related to the Control Unit.

- a. The Control unit controls all the activities and operations of the computer system.
- b. The Control Unit may not be visible or touchable like the Input / Output Units. Thus, the control unit performs its functions inside the system.
- c. The memory unit usually sends a set of codes to the control unit, which is converted into instructions, and then the instructions finally converted to control signals.
- d. The resulting control signals help in setting priorities and time table (or schedule) of system activities.
- e. In other words, the control unit coordinates the tasks inside the computer with the corporation of the input and output units.

4.6.2 Memory Unit

The following are facts / functions related to the Memory Unit.

- a. All the data and instructions being processed or to be processed in the computer are stored in the memory unit.
- b. In a similar way, the data that has been processed, or the result gotten is also stored in the memory unit.
- c. This implies that the memory unit acts as a warehouse for all the data.
- d. It is the responsibility of the memory unit to keep, or quickly transmits data as may be required in any part of the computer system as demanded by the Control unit.
- e. The Main memory gets erased once the power is switched off, and is therefore commonly referred to as temporary memory.
- f. It is the RAM part of the Main memory that is directly accessible by the Control Unit, and is commonly used for reading and writing purposes (recall Section 2.3.3).

- g. There are two major types of computer memory commonly referred to as the Primary (Main memory of the CPU being discussed) and Secondary (Auxiliary) memory, external to the CPU as defined.
- h. The Secondary memory supports the Main memory and, unlike the Primary memory, stores data in a more permanent medium.
- i. This implies that stored data or information on the Auxiliary memory can be accessed in future, unlike RAM that gets wiped off when power goes off.
- j. The Secondary Memory is also called the permanent memory.
- k. An example of Secondary Memory is the hard disk.

Self-Assessment Exercises 2

Which of the following (RAM and ROM) can retain its content when electrical power is put off from the device?

4.7 Output Unit

The Output Unit is the direct opposite of the Input Unit. Thus, it is used to bring out the outcome of system processing. The following are facts / functions related to the Output Unit.

- a. The numerous data processed in the computer system give rise to the information, also known as the output.
- b. These outputs are sent to the Output Unit.
- c. Most Output Units can present things in human understandable or readable format. For instance, when system displays result on the screen, it could be understood by human beings.
- d. Some output unit could display the output data / information in softcopy while others could be in hardcopy.
- e. Apart from soft or hardcopy, there are other media of output, such as sound, et cetera.
- f. There are many types of output devices as will be outlined.

4.7.1 Monitor

This is another name for screen or VDU (Visual Display Unit). This output device displays all the texts, graphics, icons, et cetera, on the screen. There are many types of monitors, some of which will be outlined here.

- a. Cathode Ray Tube (CRT) Monitors is a technology used in early monitors. It uses fired beams of electrons to create images on the screen.
- b. Flat Panel Monitors are monitors that are lightweight and take less space. They consume less power compared to CRT monitors. One advantage of this is that they do not provide harmful radiation.
- c. Touch Screen Monitors enable users to interact with the computer by using a finger or stylus instead of using a mouse or keyboard. When users touch the screen using their fingers, it leads to an event which is forwarded to the controller for processing.
- d. LED (light-emitting diode) Monitor is a flat screen computer monitor, which uses LED display.
- e. OLED (organic light-emitting diode) Monitor is a flat organic light-emitting display technology, which is more efficient and has a better refresh rates feature compared to the LED display.
- f. DLP (Digital Light Processing) Monitor was developed by Texas Instruments. The monitor uses the technique of projecting images from a monitor onto a big screen.
- g. Plasma Screen Monitor makes use of thin, flat-panel. It is thinner and its images are brighter than those previously discussed.

4.7.2 Printer

A Printer is a device which makes a hardcopy of the graphical or textual content of the original document. There are many types of printers, some of which will be outlined here.

- a. Two major classes of printers are Impact and Non-Impact Printers.

- b. The Impact Printer is further divided as follows.
 - Character Printer
 - Line Printer

- c. The Non-Impact Printers is further divided as follows.
 - Laser Printer
 - Inkjet Printer

- d. The Impact Printer makes use of a hammer or print head in order to print something on the paper. In this case, the hammer or print head pushes or presses an ink ribbon against the paper to create an image.

- e. Character printer prints a single character at a time following a single stroke of the print head or hammer.

- f. On the other hand, a Line printer has the ability to print one line at a time. For instance, a high-speed impact printer could print 500 to 3000 lines per minute.

- g. Non-impact printers do not print by striking print head or hammer on ink ribbon. Rather, they print characters and images without direct physical contact between the paper and the printer.

- h. Such printers are known as page printers since they can print a full page at a time.

- i. Examples of common non-impact printers are Laser printer and Inkjet printer.

- j. A LaserJet printer is a non-impact printer that prints characters using a laser beam. Rather than using liquid ink for printing, the laser printers use powdered toner, and could produce quality print objects with a resolution of over 600 dots per inch (dpi).

- k. The Inkjet Printer is a non-impact printer that prints outputs by spraying fine, ionized drops of ink. Here, the print head has tiny nozzles to spray the ink and the printer head moves to and fro as it sprays ionized drops of ink on the paper, which is fed through the printer.

4.7.3 Speakers

A speaker is a device that enables users to listen to sound which emanate as output from the computer system. The following are facts / functions related to Speaker as an Output Device.

- a. Speakers are used to connect to a computers system so as to generate sound.
- b. Some speakers could connect to any kind of sound system, while some others can only be connected to computers.
- c. When using computer speaker, it is the sound card that creates a signal that is used to produce sound.
- d. The major objective of speakers is to offer audio output for the listener through the conversion of electromagnetic waves into sound waves.
- e. Speakers could be amplified.
- f. Speakers that could increase their sound are commonly known as active speakers.
- g. The passive speakers are those speakers that cannot be amplified.

- h. Speakers usually come in pairs, such that they can jointly produce what is known as stereo sound. That means, the left and right speakers produce audio through two separate channels.
- i. Examples of categories of speakers are Loud Speakers, Floor Standing Speakers, Bookshelf Speakers, Ceiling Speakers, Satellite Speakers, Bluetooth Speakers, et cetera.

4.7.4 Projector

A projector is device which presents an image or video onto a projection screen. These projectors are used in lecture auditoriums in schools, training centres, et cetera. Projectors are also used in movie theatres for the display of the videos or lighting, in churches and mosques, among others. If a projector is connected to a computer, then the image/video displayed on the screen is the same as the one displayed on the computer screen.

Self-Assessment Exercises 3

List two types of Impact Printers.

4.8 Summary

The focus of this chapter is on the functional components of computers. The Basic Components of the computer were outlined, and a block diagram was used to show them. Several devices of Input unit were briefly discussed. The Memory and Control units were outlined as component parts of the CPU. The Output unit was also discussed, with specific examples as printers, speakers, projector, et cetera. Self-assessment questions were also presented and answered.

4.9 Glossary

CPU Central Processing Unit

LED Light-emitting diode

4.10 Reference

Atiqur R. (2014). Design and Development of Special Purpose Joystick, *International Journal of Engineering and Technical Research* 3(5), 1275-1288



4.11 Possible Answers to SAEs

Answers to SAEs 1

1. Answer is Web Camera

Answers to SAEs 2

1. Answer is ROM

Answers to SAEs 3

1. Two types of Impact Printers are Line Printer and Character Printer.

MODULE 2

BASICS OF COMPUTER PROGRAMMING

Course Writing Template for Course Writers

UNIT 1: CHARACTERISTICS OF COMPUTERS

Unit Structure

- 1.1 Introduction
- 1.2 Learning Outcomes
- 1.3 High Speed
- 1.4 High Accuracy and Reliability
- 1.5 Diligence
 - 1.5.1 Example of a DO Loop statement is as follows
 - 1.5.2 Example of a FOR... NEXT statement is as follows
 - 1.5.3 Example of a WHILE ... LOOP statement is as follows
- 1.6 Memory
- 1.7 Programmability
- 1.8 Automation
- 1.9 Learnability
- 1.10 Versatility
- 1.11 Zero Emotion
- 1.12 Consistency
- 1.13 Flexibility
- 1.14 Summary
- 1.15 Glossary

1.16 References/Further Readings

1.17 Possible Answers to Self-Assessment Exercises



1.1 Introduction

A number of key concepts and characteristics of Computers will be studied in this section of this lecture note. The following diagram (Fig. 1.1) summarizes major characteristics of a computer.

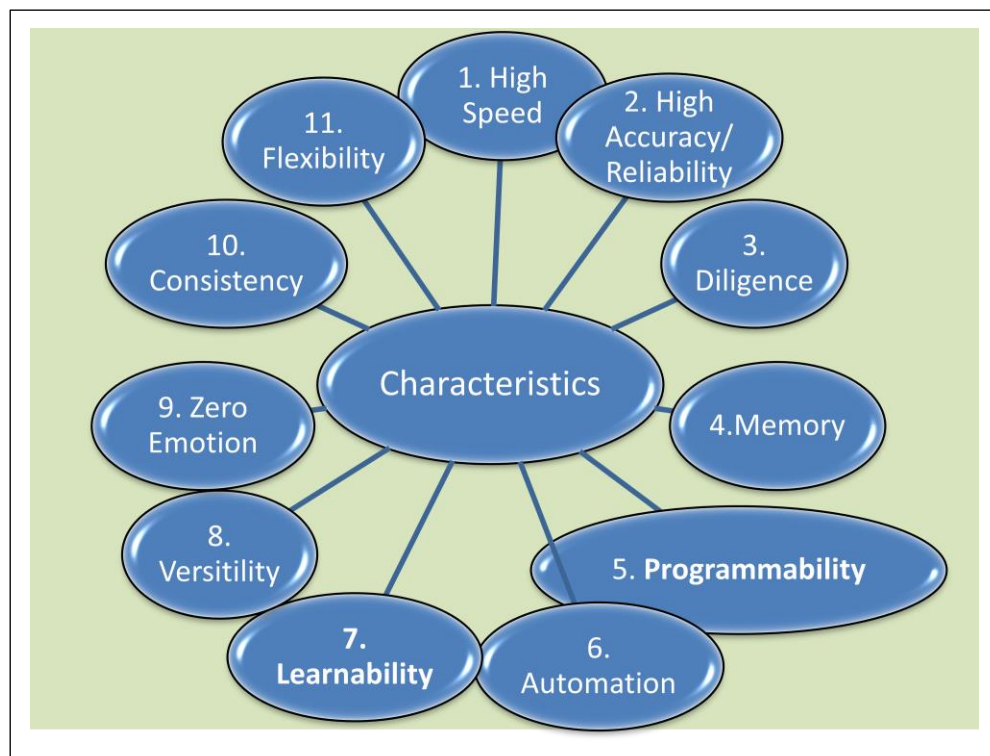


Fig. 1.1: Major Characteristics of a Computer



1.2 Learning Outcomes

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

- Enumerate major characteristics of Computers.
- Explain the High Speed and Diligence characteristics of Computers
- Explain the High Accuracy and Reliability characteristics of Computers
- Explain the Memory and Programmability characteristics of Computers
- Explain the Automation and Learnability characteristics of Computers
- Explain the Versatility and Zero Emotion characteristics of Computers
- Explain the Consistency and Flexibility characteristics of Computers
- Discuss DO LOOP, FOR NEXT and WHILE LOOP statements



1.3 High Speed

Computers take instructions and are able to execute tasks at such a very high speed, compared to the humans. Computers have the ability to execute millions (1,000,000s) of instructions per second. It is not strange for computers to take microseconds and nanoseconds to deal with tasks. Important information to note about the Speed of Computers is as follows:

- a. First of all, what is computer speed? Computer speed has to do with how much time a computer uses to complete a task.
- b. For instance, when you turn on your computer, how much time it takes to come up depends on the general speed of the computer. Computers are very fast, compared to the time it takes for human beings to solve a problem.
- c. The speed of a computer is affected by various types of computer hardware that is housed in the computer. Some of these are Microprocessor (Juan, 2022), RAM, and Storage Unit.

- d. The Microprocessor is a CPU chip that controls the whole functioning of the computer system. In other words, using the latest microprocessors such as CORE i3, CORE i5, CORE i7, and so on could speed up the way the system operates, while use of old CPUs could also make the system relatively slow.
- e. The Random Access Memory (RAM) could also affect the system speed. This is because small sized RAM could slow down the system speed, because it might force more reliance on slower auxiliary storage for memory space.
- f. To improve the system speed, it is advisable that system should maintain a minimum working RAM size from at least 4 GB to 8 GB.
- g. The auxiliary storage device could also act as an important speed factor of a computer, for being the permanent store of needed data that must be fetched. Thus, the system speed is affected by the hard disk.
- h. There are several reasons why speed is of essence in computer systems. One is that it makes execution of instructions faster.
- i. Computer speed is measured in Hertz.
- j. A CPU speed of 3.50 to 4.2 GHz is appreciable.

1.4 High Accuracy and Reliability

The accuracy of a system is the measure of the extent to which its output is free from error. Reliability is a measure of its consistency over time, repeatedly doing the same thing, yielding the same results, without breaking down. Human beings may make mistakes due to a number of factors such as:

- a. Environmental Distractions
- b. Lack of know-how of the problem.
- c. Difficulty of the calculation.
- d. Overload of the data or information emanating from the problem being solved.
- e. Inability to deal with all options and factors related to the problem being solved.

On the other hand, Computers are able to handle instructions plus data in order to generate the output in a very accurate manner. It is therefore possible to say that Computers could perform calculations with 100% accuracy.

1.4.1 Facts about Computer Accuracy and Reliability

Important information to note about the Computer Accuracy is as follows:

- a. Accuracy is an important feature of computers, and has to do with correctness of results arising from tasks or calculations handled by the computer.
- b. Accuracy of computers is not in any way comparable to that of humans, as computers can be quite accurate, as long as correct instructions and right data are fed into it.
- c. Note that there is a term “garbage in, garbage out”, which means that if you give a system wrong data or instruction, you will get inaccurate result. In the absence of this, the computer will always give you an accurate result.
- d. Suppose a programmer was required to multiply three numbers as $X = 20 \times 10 \times 2$ but mistakenly issued the command $X=20 -10 -2$, the result will be 8 instead of 400. Though a desired step was not used, nevertheless, the calculator device will still bring a result commensurate with the instruction given.
- e. The computer is 100% accurate. However, the computer being a machine is completely dependent on humans, and such could be a form of limitation.
- f. The computer has high reliability in that it will produce the same result for a given set of instructions every time that same set of instructions is feed into the computer, without breaking down so quickly. This is irrespective of the number of times that is done.
- g. The life span of a computer is usually taken to be three years.

Self-Assessment Exercises 1

Computer Speed is measured in what unit?
--

1.5 Diligence

The attribute of diligence is the ability of a computer to perform millions of tasks or calculations with the same consistency and accuracy. In other words, computers do not feel any fatigue, and neither do they get distracted unlike human beings. Important information to note about the Diligence of Computers is as follows:

- a. The concept of diligence means that computers can perform repetitive instructions over and over again.
- b. In computer programming, this is implemented using what is known as Loop statement.
- c. A Loop statement could take a number of forms; For Next statements, Do Loop Statement, While Loop Statement, and so on.

1.5.1 Example of a DO Loop statement

```
DO
    Statement 1
    Statement 2
    Statement 3
    .....
    Statement N
LOOP WHILE Condition
```

In the above, the system will execute all the statements 1 to N repetitively, while a particular condition is still valid.

1.5.2 Example of a FOR... NEXT statement

```
FOR x = 1 to 20 NEXT
    Statement 1
    Statement 2
    Statement 3
    .....
```

Statement N

In the above, the system will execute all the statement 1 to N repetitively, for values of x = 1 till after x = 20 before it stops.

1.5.3 Example of a WHILE ... LOOP statement

```
WHILE Condition
    Statement 1
    Statement 2
    Statement 3
    .....
    Statement N
LOOP
```

In the above, the system will execute all the statement 1 to N repetitively, but must test the condition at start, unlike the other options where the conditional testing takes place after at least one round of execution. In all, it is obvious that computers could execute instructions in a very repetitive manner. This is what is known as diligence in computing.

Self-Assessment Exercises 2

List three common types of looping constructs.

1.6 Memory

One of the strongest points in terms of characteristics of a computer is its ability to store instructions, data and information in memories, and to retrieve it whenever needed. This is unlike human beings who could forget things, especially at old age. Computers have built-in memory known as primary memory where it keeps instructions and data being processed, as well as Secondary storage, which might be removable devices such as CDs, pen drives, et cetera, used for storing data and information for later use.

1.7 Programmability

Computers have the ability to allow for humans to program them. This begins with the development of algorithms, which are then translated into instructions that could be understood and executed by the machine. Here are some important information to note about Programming and Programmability:

- a. A Computer Program is a specific set of instructions that guide a computer to solve problems.
- b. John von Neumann in the year 1945 outlined the concept of programming modern computers using a sequence of instructions that the computer follows.
- c. For computer to be programmed, a programming language must be used.
- d. The programming language closest to the hardware is called machine language, and this consists of a series of 0's and 1's, known as binary digits.
- e. Programming in machine language could be very tedious.
- f. The other types of programming languages are assembly language and high level language.
- g. Assembly language makes use of mnemonics for machine language, while high level programming languages make use of normal human language like words.
- h. Usually, the raw code is known as the source code.
- i. Unfortunately, computers do not execute the high-level languages directly. Rather, they first compile into executable codes before execution takes place.
- j. After execution, this results in the output of the result.
- k. Computer programs could be characterized as interactive or batch in terms of whether they are executed in an interactive manner, or as a single batch submitted just once.
- l. Interactive programs receive data from an interactive user a number of times and then respond immediately to execute, while batch programs can be started at once with both the code and data submitted.

- m. An example of a batch programming job is payroll, which involves the computation of salaries, payments to individual staff accounts, and printing of the pay slips all at the same time.

Self-Assessment Exercises 3

An example of batch programming task used in companies is _____

1.8 Automation

Computer performs all the tasks automatically. It performs tasks without manual intervention.

1.9 Learnability

Modern computers can now learn. This is based on the technology of Artificial Intelligence and Machine Learning.

1.10 Versatility

Computers are very versatile. This implies they are capable of performing different kinds of works with same accuracy and efficiency. The technique of computer modelling makes it possible for a particular problem to be tackled in different scenarios.

1.11 Zero Emotion

Computers can solve very tedious problems without exhibiting any form of emotion. This is quite unlike human beings who could get angry, get tired, or exhausted.

1.12 Consistency

Computers are very consistency in problem solving.

1.13 Flexibility

Computers are also flexible. For instance, they can process various types of data, without confusion. It is also possible to re-program computers using alternative programming languages.

Self-Assessment Exercises 4

A modern computational technique where computers can learn is known as what?

1.6 Summary

The focus of this chapter is on the Characteristics of computers. A total of eleven characteristics were studied. These are High Speed, High Accuracy and Reliability, Memory, Programmability, Automation, Learnability, Versatility, Zero Emotion, Consistency, Flexibility, and Diligence. The characteristics of Diligence was further demonstrated in more practical terms using three methods - DO LOOP, FOR NEXT and WHILE LOOP statements. Self-assessment questions were also presented and answered.

1.7 Glossary

LOOP A repetitive type of statement or activity.

1.8 Reference

Juan L. (2022), "Implementation of Embedded Microprocessor in Optimal Teaching of Physical Health in the Internet Era", *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 4193644, pp. 15.

1.9 Possible Answers to SAEs

Answers to SAEs 1

Hertz

Answers to SAEs 2

DO... LOOP, FOR ... NEXT and WHILE ... LOOP.

Answers to SAEs 3

Use of Payroll Systems for Salary Payment

Answers to SAEs 4

Machine Learning

UNIT 2: PROBLEM SOLVING AND COMPUTER PROGRAMMING

Unit Structure

- 2.1 Introduction
- 2.2 Learning Outcomes
- 2.3 What is a Problem?
- 2.4 How human beings solve Problems
- 2.5 Overview of Computer-Based Problem Solving
- 2.6 Stages of Computer-Based Problem-Solving
 - 2.6.1 Problem Understanding and Analysis
 - 2.6.1.1 Objectives Specification
 - 2.6.1.2 Specifying the Output
 - 2.6.1.3 Input Requirement Specification
 - 2.6.1.4 Processing Requirements Specifications
 - 2.6.1.5 System Feasibility Documentation
- 2.7 Summary
- 2.8 Glossary
- 2.9 References/Further Readings
- 2.10 Possible Answers to Self-Assessment Exercise(s) within the content



2.1 Introduction

The power of computing cannot be overemphasized. It has been said that problem solving is the core of computer science. The aim of this unit is to demystify the essence and steps used in solving problems using computers.



2.2 Learning Outcomes

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

- Discuss the general concept of Problem Solving.
- Discuss how human beings solve problems
- Discuss how computers solve their problems.
- Enumerate the stages of problem solving.
- Discuss Problem Understanding and Analysis.
- Explain Objectives Specification
- Explain the process of Specifying the Output.
- Explain Input Requirement Specification
- Explain Processing Requirements Specifications
- Discuss System Feasibility Documentation.



2.3 What is a Problem?

A problem is a task that requires solution. Take a look at the following four simple problems.

- a. Get the dimensions of a Rectangle, and use them to calculate the area of the Rectangle.
- b. For each student in a class of 20 students, list their names, their corresponding matric numbers, and their scores in a class test. Calculate the average score.
- c. Crosscheck the names of all the 10 patients of XYZ Hospital, then from there, create two different data sheets. The first is a datasheet for all the males, while the second datasheet contains all the female patients.
- d. You are given two figures representing a land space in a market place. First one is a circle of radius 20 meters, while the second one is a square of size 15meters. Which one would the buyer take, if his interest is on buying the one that has a larger land space.

We can see that the issues listed above are problems that demand solutions. Though they are simple in nature, we can use them to discuss problem solving. First, we give an overview of how human beings solve problems, and then proceed to how computational solutions could be achieved.

Self-Assessment Exercises 1

Mention two reasons why the computer can solve problems more than a typical human being.

2.4 How human beings solve Problems

Take a second look at the four simple problems above. It is obvious that there is a need to first understand the theoretical foundation of a problem. For instance, Problem A cannot be solved, unless the solver knows the formula for area of a Rectangle as $\text{Area} = \text{Length} \times \text{Width}$. Solving problems also require critical thinking, and ability to itemize the steps to be used. In Computer Science, this is Algorithmic Design as we shall see in next sections. An algorithm is a set of steps taken to solve a problem. For instance, Problem C may require a number of steps as shown in Fig. 2A.

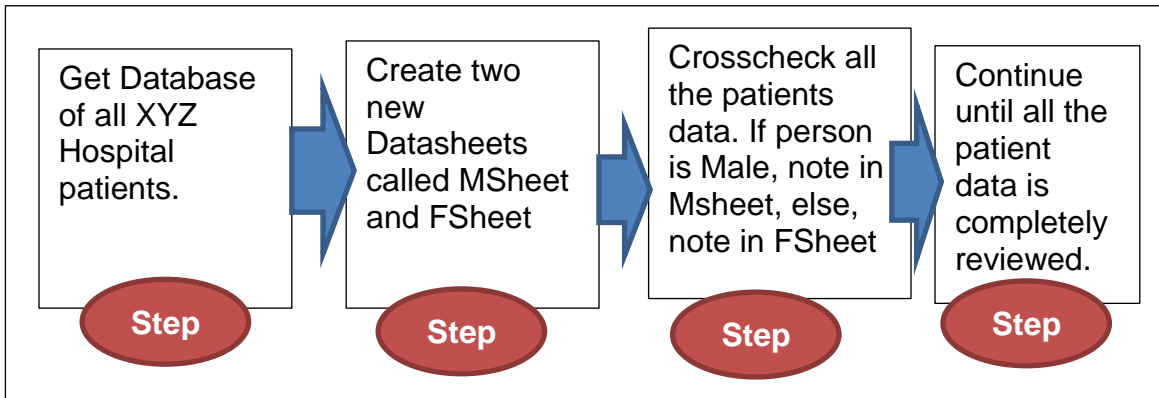


Fig. 2A: Sample Steps for solving the Hospital Problem.

It is obvious that data is required to solve a problem. Data is defined as unprocessed facts. For instance, for one to calculate the area of a rectangle, it is needed that the values of Length and Width should be made available. After processing, it is also necessary that there will be result. This is what is known as Output or Information when computer is used to solve a problem. By now, a student should be able to distinguish between the terms Data and Information. We shall now study how problem solving is done in Computer Science.

Self-Assessment Exercises 2

After Data is Processed, it gives rise to _____

2.5 Overview of Computer-Based Problem Solving

Unlike human problem solving outlined above, Computer based problem solving is a systematic process which involves the design, and implementation of computer programs in order to solve problems. A program is a set of instruction given to a computer, as steps it should take to solve a problem. Such instructions must be in a medium it understands, and such a medium is what is known as a programming language. A person who writes the computer program is known as a programmer.

A Computer Software is a collection of computer instructions. Note that the instructions given to a computer must be specified for solving the problem, and usually, after its creation, the software should be error free and well documented. In order to ensure it is error-free, the programmer performs what is known as testing and debugging. Debugging involves searching and eliminating errors in a program.

Self-Assessment Exercises 3

----- is a person who writes the computer programs.

2.6 Stages of Computer-Based Problem-Solving

The six major chronological steps in computer-based problem solving are shown in Fig. 2B.

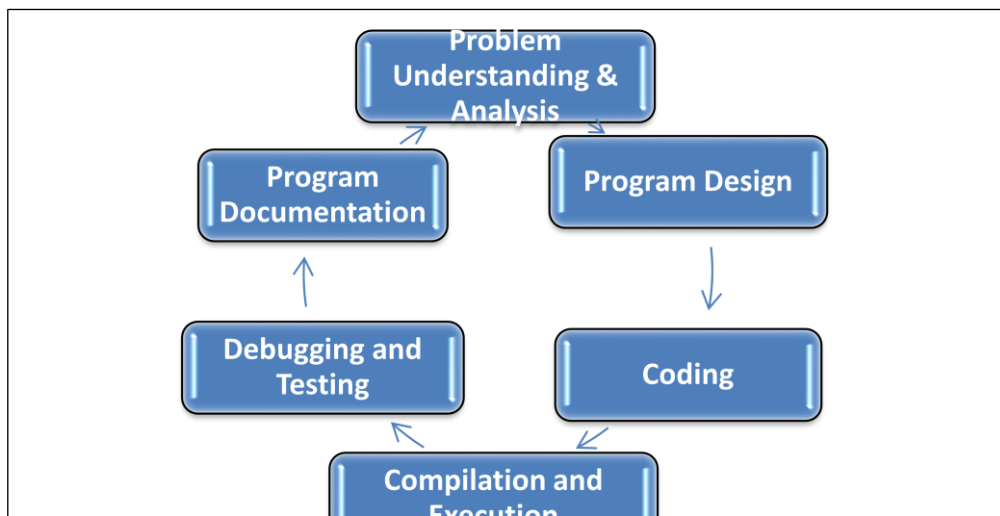


Fig. 2B: Chronology of Steps for Computer-Based Problem Solving

2.6.1 Problem Understanding and Analysis

Problem analysis is a key process in computer-based solutions to problems. At this stage, the programmer takes time to understand the nitty-gritty of the problem being solved. A problem being solved is comparable to a mountain. To level a difficult mountain, you may become overwhelmed if you attempt to do everything at once. But if you carefully demarcate the mountain into parts, and deal with each of the component parts one after the other, you will find it quite easy to level the whole mountain after a while. In a similar way, during problem understanding and analysis, a programmer carefully studies the problem, defines the problem, and decomposes or breaks down the problem into smaller parts. By so doing, the programmer is able to fully identify the possible inputs, processes and outputs associated with the issue being solved. The problem understanding and analysis stage is made up of a number of sub-tasks as shown in the following pyramidal diagram in Fig. 2C:

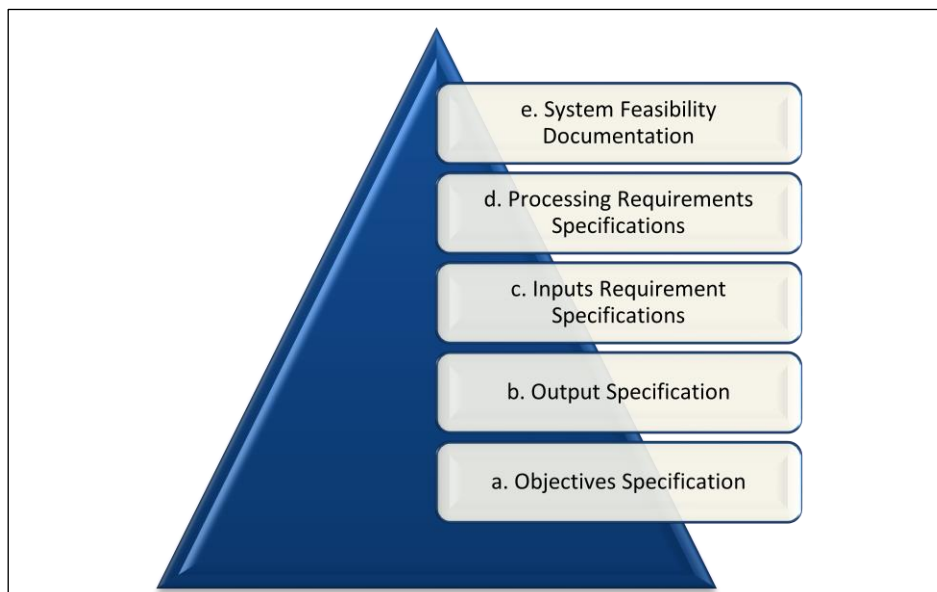


Fig. 2C: Sub-Tasks in Problem Understanding and Analysis

2.6.1.1 Objectives Specification

This preliminary step in computer-based problem solving involves a clear study and clarification of the problem being solved. The different sets of objectives of the problem are clearly outlined in a very unambiguous manner. If this step is ignored, there could be possibility of attempting to solve a problem, only to discover that the problem was not actually solved. So, it is always important to state the objectives clearly. During objectives analysis, the programmer ensures that the sub systems that make up the larger system are discovered one by one, and plans clearly made for their solutions.

2.6.1.2 Specifying the Output

It is necessary to clearly identify the outputs that ought to emanate from solving a particular problem. One way to achieve this is to prepare some output forms and standard formats for displaying result. Example, in the problem of calculation of Area of a rectangle, a programmer will clearly identify the output as the Area, while the inputs are Length and Width.

2.6.1.3 Input Requirement Specification

The specification of program inputs and requirements is very important. A very common saying in Information Technology is “Garbage in is Garbage out”. Thus, it is always important to carefully identify the inputs, and not only the inputs, but the type of inputs. There are many data types, some of which are listed in Table 2A.

Table 2A: Examples of Common Data Types

Data Type	Sample	Representation
Integers	500	Number of Students in a University
Float	87,778.90	Amount in Naira for paying school fees
Alphabetic/ String	National Open University of Nigeria	Name of a Place, Institution, Person, et cetera

2.6.1.4 Processing Requirements Specifications

The Processing Requirement Specification gives an idea of the process that converts program inputs into desired outputs. For example, in trying to solve a problem with the computer, there could be requirements such as:

- a. Size of the Memory in MB or GB required for program to work optimally.
- b. Version of a particular programming language needed.
- c. Actions that must be taken in order to ensure error avoidance.

These and many others are examples of processing requirements.

2.6.1.5 System Feasibility Documentation

Feasibility study is a key step at the analysis stage. Studies are done here to be sure that the solution being proffered is in order. Feasibility Studies is aimed at ensuring:

- a. That the proposed solution is not only standard, but is also as scientific as possible.
- b. That the proposed solution can be tackled using computers.
- c. That the solution step is not too expensive compared to the budget earmarked for it.
- d. That the tools, for example Programming languages to be used, are not outdated.

After all these analyses mentioned, there should be a clear documentation for future references.

Self-Assessment Exercises 4

The acronyms MB and GB for memory units stand for what?



2.6 Summary

The focus of this unit is on Problem Solving. It began with learning how human beings solve problems, and then understanding how computers solve their problems. The stages of problem solving were enumerated. Main emphasis was on Problem Understanding and Analysis. The five sub-steps studied are Objectives Specification, Specifying the Output, Input Requirement Specification, Processing Requirements Specifications and System Feasibility Documentation. Self-assessment questions were also presented and answered.

2.7 Glossary

Garbage In	The input into the System
Garbage Out	The resulting output from the system.



2.8 References/Further Readings

Fathy, E (2022). A new method for solving the linear programming problem in an interval-valued intuitionistic fuzzy environment, *Alexandria Engineering Journal* 61(12), pp. 10419-10432



2.9 Possible Answers to SAEs

Answers to SAEs 1

Computers have large memory, and do not get tired unlike human beings.

Answers to SAEs 2

Information

Answers to SAEs 3

Programmer

Answers to SAEs 4

MB stands for Megabyte, while GB stands for Gigabyte.

UNIT 3: TYPES OF PROGRAMMING LANGUAGES

Unit Structure

- 3.1 Introduction
- 3.2 Learning Outcomes
- 3.3 Important Facts on Computer Programs
 - 3.3.1 Understanding Translators
 - 3.3.2 The Interpreter
 - 3.3.3 The Compiler
- 3.4 Types of Programming Languages
 - 3.4.1 Low Level Language
 - 3.4.2 Assembly Language
 - 3.4.3 High Level Language
- 3.5 List of High-Level Programming Languages
- 3.6 Summary
- 3.7 Glossary
- 3.8 References/Further Readings
- 3.9 Possible Answers to Self-Assessment Exercises.



3.1 Introduction

Programming Language is a tool for instructing the computer on the steps for solving a problem. A program is a set of instructions that are put together, which instructs the computer. A programmer is a person who writes computer programs.



3.2 Learning Outcomes

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

- Discuss Important Facts on Computer Programs.
- Define Language Translator
- Explain how the Interpreter works.
- Explain how the Compiler works.
- Present figures showing how the Interpreter and Compiler work.
- Discuss the three types of programming languages - Low Level Language, Assembly Language and High-Level Language.
- List, at least 21, High-Level Programming Languages.
- Do a comparative analysis of the types of programming languages in terms of advantages and disadvantages of each.



3.3 Important Facts on Computer Programs

The following facts should be known about computer programs:

- a. To efficiently and effectively communicate with computer, one needs to use a programming language which computer can understand and process.
- b. Just like human languages, a programming language consists of a set of characters and symbols. It also consists of defined rules known as syntax of the language.
- c. Computer programmers have to master the syntax, in order to write statements which will make meanings to the computers.
- d. In the course of writing the computer program, a programmer ensures that the program is without errors and ambiguities. The process of searching for errors and eliminating them during the process of programming is known as debugging.
- e. When a programmer finishes writing a program, it is supplied to the computer to act on it. This is known as running of the program. Another name for running a program is execution.
- f. An error that has such a serious implication, to the extent that it could halt the execution of the program is known as an exception.
- g. The original program written by a programmer is known as the Source Code or Raw Code. In most cases, the computer may not understand this raw code.

3.3.1 Understanding Translators

To ensure that computer understands and successfully executes the raw code, there is a specialized program known as Translator that converts the Raw Code into a format known as Executable Code, which computer understands and executes. There are two types of translators. These are Compiler and Interpreters.

3.3.2 The Interpreter

An interpreter translates the source code one line at a time, while a compiler translates several or the whole lines of codes at same time. The following diagram (Fig. 3.1) shows the operation of a typical interpreter.

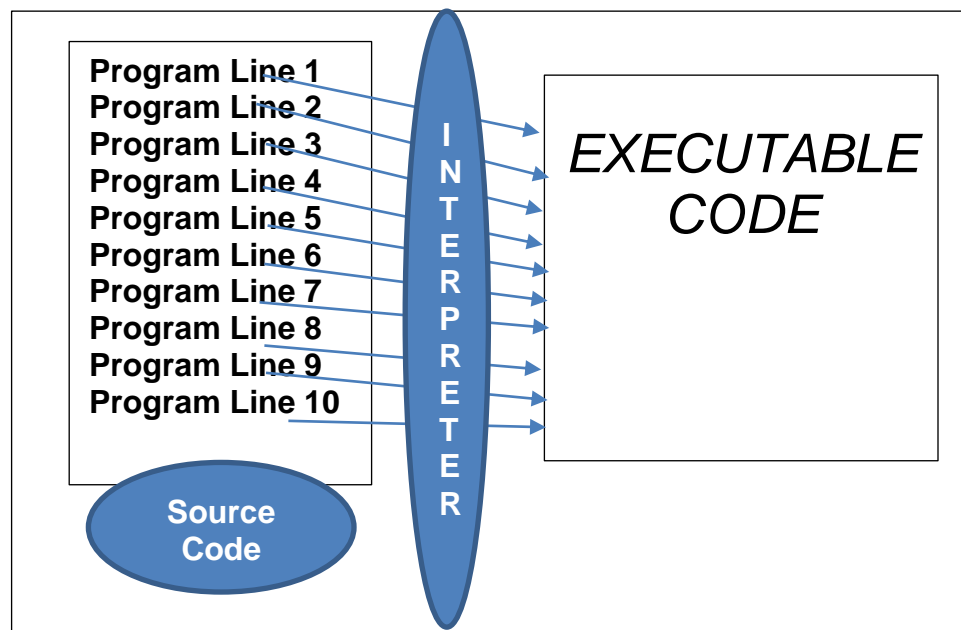


Fig. 3.1: Operation of Interpreter

As shown, the source code consists of 10 statements or lines of codes. These were translated line by line. This simply depicts the working of an interpreter.

3.3.3 The Compiler

On the other hands, the following diagram (Fig. 3.2) shows a typical operation of a compiler.

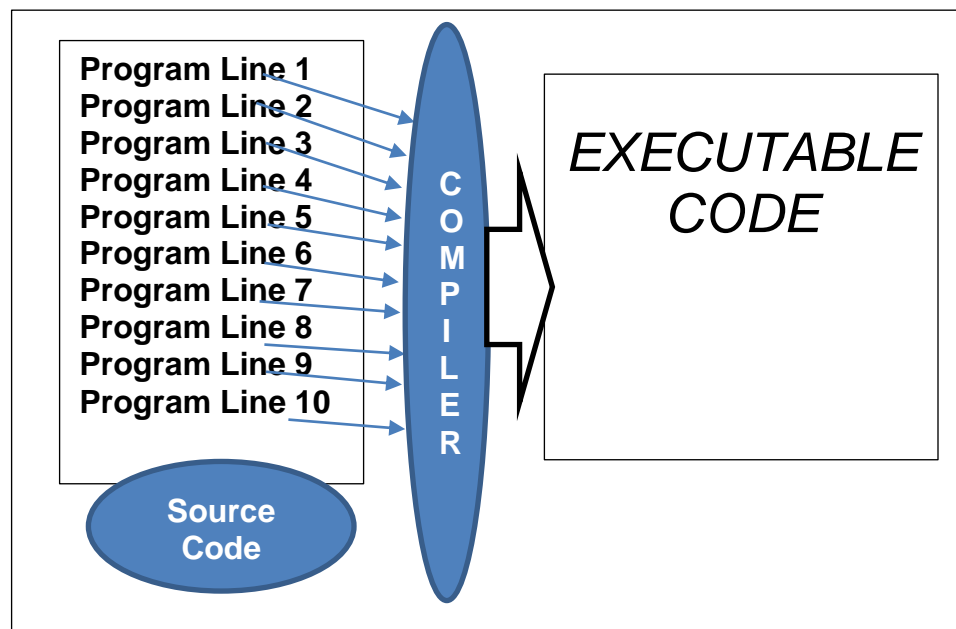


Fig. 3.2: Operation of Compiler

As shown, the source code consists of 10 statements or lines of codes. However, these 10 lines were translated together once, instead of line by line. This depicts the working of a typical compiler.

Self-Assessment Exercises 1

Mention two types of translators

3.4 Types of Programming Languages

In terms of levels, there are three major types of Programming Languages as shown in the following diagram (Fig. 3.3).

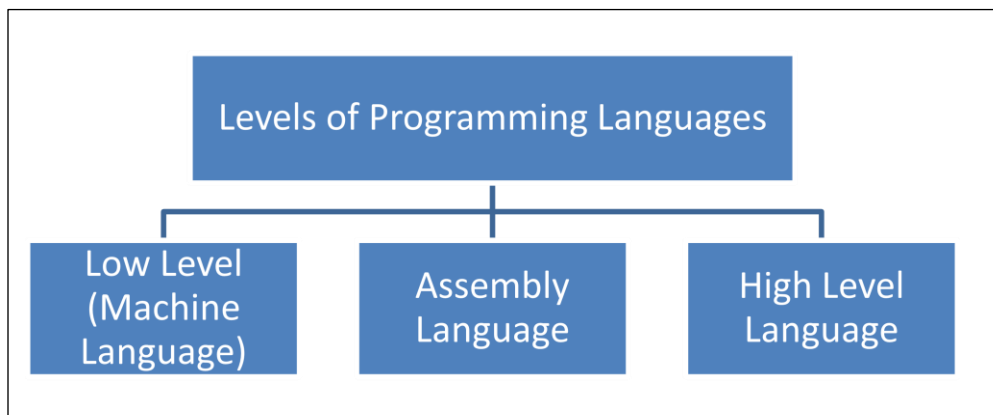


Fig. 3.3: Three Types of Programming Languages

3.4.1 Low Level Language

A low level language is defined as a programming language that is much closer to the hardware. Some of the facts about this category of computer language are as follows:

- a. Because low level language is very close to the hardware, it is therefore usually referred to as Machine Language.
- b. Machine Languages are usually written in binary notations, that is 0s and 1s.
- c. Because they are written in 0s and 1s, it is obvious that machine languages are very tedious, difficult, error prone, and time consuming.

- d. Machine language is the lowest level language that computer understands, and executes directly without any form of translation.
- e. In machine language, binary digits are used to form the instructions. For instance, in a particular machine language, the combination '00010100101101010101010100' could have a meaning understood by a computer.
- f. Though very tedious, this language is the fastest of the three in terms of execution, simply because there is no need for translation.
- g. There are a number of advantages and disadvantages of machine language, as shown in Table 3.1.

Table 3.1: Advantages and Disadvantages of Machine Language

S/N	Advantages of Machine Language	Disadvantages of Machine Language
1.	Machine language is translation free as it is the only language that computer understands directly. It is therefore said to be translation free.	Machine languages are known to be machine dependent. This creates a lot of issues, since a program developed for one machine may not run on another one.
2.	Machine language has high speed of execution because it is translation free. This is because translation time is avoided.	Machine Language is error prone and tedious because it makes use of 0s and 1s.
3.		Moreover, Machine Language could be very complex to program and key

		into the machine.
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3.4.2 Assembly Language

The Assembly Language was developed to reduce the complexity and tedious experiences inherent in machine languages. Some of the facts about assembly language are as follows:

- a. In assembly language, rather the use of binary digits 0s and 1s, programmers use of mnemonics.
- b. Mnemonics are nothing but abbreviated letters or acronyms, which have specific meanings.
- c. Examples are ADD, MULT, SUBT, and so on which represent instructions to Add, Multiply and Subtract respectively, that would have been otherwise written in their exact 1s and 0s sets.
- d. Examples of sample instructions in Assembly Language are shown in Table 3.2.

Table 3.2: Sample Instructions in Assembly Language

S/N	CODE	EXPLANATION
1	ADD X, Y	This statement instructs the computer to add the two variables X and Y.
2.	MULT X, Y	This statement instructs the computer to multiply the two variables X and Y.
3.	SUBT X,Y	This statement instructs the computer to subtract Y from X.

- e. It is obvious that an assembly language is easier to learn than machine language.
- f. However, in order for computer to understand an assembly language, a special program known as an assembler is used to convert assembly language into machine language.
- g. An assembly language is slower than Machine language in processing, majorly due to the need for translation.
- h. There are a number of advantages and disadvantages of assembly language, as shown in Table 3.3.

Table 3.3: Advantages and Disadvantages of Assembly Language

S/N	Advantages of Assembly Language	Disadvantages of Assembly Language
1.	Because Assembly language uses mnemonic codes which are very easy to remember, it is easier to write assembly language codes than machine language codes.	Just like machine language, the assembly language is machine dependent. This implies that a program written for a given computer system may not execute on another one. This usually creates a lot of problems.
2.	Again, it is also more error free to code in assembly language, than when one writes programs in machine language.	Moreover, due to the machine dependency issue, programmers will keep learning and reprogramming codes every time they come across

		new machines. This is very time consuming and time wasting.
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3.4.3 High Level Language

High level language is much closer to human language. For instance, a number of high-level programming languages use English Language. This makes it very possible for programmers to develop software in speedy manner, unlike in cases of machine and assembly languages. Some of the facts about high level language are as follows:

- a. High Level languages are more or less independent of the particular type of computer.
- b. Because of this reason of independence, high level programming languages are said to be more portable, in the sense that a particular program written for one computer type can easily be made to run on another computer type.
- c. High level languages have very well developed syntax rules, which make for ease of learning.
- d. High level programming languages are however slower in execution than the assembly and machine language counterparts.
- e. To convert high level language codes to machine language, a compiler or interpreter should be used.
- f. Examples of high level programming languages are Java, Fortan, C++, Python, Javascript, and so on.
- g. There are a number of advantages and disadvantages of high level languages, as shown in Table 3.4

Table 3.4: Advantages and Disadvantages of High-Level Languages

S/N	Advantages of High-Level Language	Disadvantages of High-Level Language
1.	Because High level language uses English like words, they are easier to understand than the other two lower-level languages.	Due to the fact that high level languages are away from hardware, their ability to access and control hardware is relatively difficult.
2.	Programs written in high level language are machine independent, thus such programs are said to be portable. Thus, they can easily be executed on any type of computer.	High level program codes execute slowly, compared with the codes written in assembly and machine languages.
3.	Because high level languages have very easy to understand syntax, it is also easy to debug to ensure that errors are traced and	

	removed.	
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Self-Assessment Exercises 2

Which of the types of programming languages is nearest to the hardware?

3.5 List of High-Level Programming Languages

We will list and study at least twenty-one (21) programming languages in this section of this lecture note.

1. BASIC

The name of this programming language was coined as acronym from “Beginner’s All-purpose Symbolic Instruction Code”. It was developed at Dartmouth in 1964 by two computer scientists named John George Kemeny and Thomas Eugene Kurtz. The major aim of this language is to simplify computer programming in such a way that even non-science or non-experts could conveniently program the computers. There are a number of versions that emanated from the original language, for instance QBasic, Visual Basic, et cetera.

2. Lisp

The name of this programming language was coined as acronym from “List Processing Language”. It is widely believed that Lisp is about the second-oldest high-level programming language in use today. The major strength of Lisp is its ability to handle and support list related data structures. Examples of lists are:

- a. MaritalStatus = ('Married', 'Single', 'Divorced', 'Widow', 'Widower')
- b. FiveStates = ('Lagos', 'Enugu', 'Kano', 'Borno', 'Kogi')
- c. Cars = ('Mecedes', 'Toyota Corolla', 'Honda CRV')

3. Pascal

Pascal is a programming language that is very suited for structured programming. It was invented by a Swiss computer scientist called Niklaus Wirth. The name of this programming language was named after a French mathematician and philosopher Blaise Pascal.

4. Python

It is a high-level programming language which was first released in 1991 by a Dutch computer programmer called Guido van Rossum. Some of the areas of strength of Python are:

- a. Object Oriented Programming
- b. Data Sciences Computations
- c. Its codes are very reusable.
- d. It has the ability to handle functional programming. This is a programming method that uses functions to solve problems.

Python is an open community-based language, whose progressive improvements are coordinated by a group known as the Python Software Foundation.

5. Erlang

The Erlang Programming Language was developed by Ericsson. The open-source version of this programming language was released in the year 1998. Some of the strengths of this language are:

- a. It is a concurrent programming language, which implies it can be used to write programs that can handle many tasks at the same time.
- b. It is used for programming real time systems.
- c. It is used to handle fault-tolerant tasks.

6. Haskell

This programming language was named after the acclaimed logician Haskell Curry. Some of the strengths of Haskell are:

- a. It is a functional programming language. This means it can handle computations using complex functions.
- b. It is also able to handle pattern matching problems very effectively.
- c. Strength of Haskell is in solving problems using recursive techniques. Recursion is a technique in computer science for solving problems through defining an initial problem which calls itself repeatedly until the problem is finally solved.

7. Ada

The programming language Ada was developed by a team of Computer Scientists led by Jean Ichbiah. It is a structured programming language that is close to Pascal. Ada is an internationally standardised programming language, suited for mission-critical systems, for instance developing systems for travelling to the moon or other planets.

8. ALGOL

The programming language ALGOL was developed in the 1950s. The name is coined from the term “Algorithmic Language”. Just like the name suggests, its strength is in algorithm development, testing and implementations.

9. C

The C programming language was developed by Dennis Ritchie at the Bell Telephone Laboratories. Some of the facts about C are:

- a. The Language C is a general-purpose programming language.
- b. It is also cross-platform, which means it can be used to solve problems on different computer platforms and operating systems.
- c. It is very much in use in academic environments for teaching programming languages.
- d. Moreover, C also influenced the development of other related programming languages such as C++ and C#.

10. C++

The C++ programming language was developed by Bjarne Stroustrup of Bell Labs.

Other facts about C++ are:

- a. C++ is an extension of the C language.
- b. C++ is commonly referred to as a middle programming language, because it consists of a combination of high-level and low-level language features.
- c. The name C++ was finally given to it in the year 1983.
- d. C++ is a multi-paradigm programming language, being able to solve computational problems in diverse areas.

11. C#

The name of the programming language C# is pronounced as “C Sharp”. Other facts about C# language are:

- a. C# is a multi-paradigm programming language.
- b. C# supports object-oriented programming.

12. COBOL

The name of this programming language was coined as acronym from “Common Business-Oriented Language”. COBOL as a programming language was purposely designed for the business and finance domain. COBOL is an old programming language, though COBOL 2002 standard supports object-oriented programming.

13. FORTRAN

The name of this programming language FORTRAN was coined from the term “Formula Translation”. Other facts about the programming language are:

- a. FORTRAN is very good in solving numerical computational problems.
- b. It was developed at IBM
- c. It is very popular in the field of high-performance computing.
- d. FORTRAN is a compiled programming language.

- e. Some of the versions of FORTRAN are FORTRAN 95, FORTRAN 2003, et cetera.
- f. The version FORTRAN 2003 is object-oriented.

14. Java

It is a general-purpose computer programming language that is versatile and object-oriented. Other facts are as follows:

- a. Java is a cross platform programming language.
- b. For instance, Java code can run on all platforms that support Java without the necessity for recompilation.

15. MATLAB

The name of this programming language MATLAB was coined from the term “Matrix Laboratory”. Other facts about the programming language are:

- a. MATLAB is a numerical computing environment
- b. MATLAB is a programming language that enables matrix computations.
- c. MATLAB was created by a company known as MathWorks.

16. PHP

PHP is a programming language used for general purpose scripting. Other facts are:

- a. PHP is used for creating dynamic web pages.
- b. The term dynamic means that the web page created with PHP is not static.

17. HTML

The name of this computer language HTML was coined from the term “Hypertext Markup Language”. Other facts about the programming language are:

- a. HTML is the most prominent Markup language that is used for web pages.
- b. A Markup language is used in creating tags.
- c. In HTML, tags are designated in between special angular brackets. Example <HEAD> is a head tag.

18. Prolog

Prolog is a general-purpose programming language, whose name was derived from the name “Programming Logic”. Other facts are:

- a. Prolog is used in artificial intelligence
- b. Prolog is also used in computational linguistics.
- c. Some of the dialects of Prolog are Strawberry Prolog and Visual Prolog.
- d. Prolog is a compiled logic-based programming language.

19. Smalltalk

Smalltalk is an object-oriented programming language. Other facts are as follows:

- a. The names of the computer scientists who developed Smalltalk are Alan Kay, Adele Goldberg, Dan Ingalls, Scott Wallace and Ted Kaehler.
- b. The programming language was developed at Xerox PARC.
- c. VisualWorks is an implementation of Smalltalk.

20. Visual Basic

Visual Basic is an event-driven programming language. This implies that it tracks events, for instance a click of a button or mouse, and responds very quickly in line with the action defined for the event. Other facts are:

- a. Visual Basic is commonly known as VB.
- b. VB has a very interesting integrated development environment (IDE).
- c. An IDE is an environment for easy development of software products.
- d. VB inherits a number of features from BASIC.
- e. VB is good for graphical software development.
- f. Its graphical development features make it easy for beginners to learn VB.

21. Modula-2

This programming language was created by Niklaus Wirth, just like Pascal. It was created in the year 1978.

Self-Assessment Exercises 3

Name three multipurpose programming languages.



3.6 Summary

The focus of this unit is on Types of Programming Languages. The areas covered are Important Facts on Computer Programs, Understanding Translators, two of which are the Interpreter and the Compiler. Other things covered are types of Programming Languages, three of which are Low Level Language, Assembly Language and High Level Language. Finally, a list of 21 High-Level Programming Languages was studied. There were also self-assessment exercises.

3.7 Glossary

IDE Integrated Development Environment.



3.8 References/Further Readings

NIL.



3.9 Possible Answers to SAEs

Answers to SAEs 1

Compiler and Interpreter

Answers to SAEs 2

Machine Language

Answers to SAEs 3

C, C++, C#, Java and Prolog

UNIT 4: ALGORITHMS, FLOWCHARTS AND PSEUDOCODES

Unit Structure

- 4.1 Introduction to Algorithms Design
- 4.2 Learning Outcomes
- 4.3 Facts about Algorithms
- 4.4 Guidelines for Algorithms Development
- 4.5 Practical Demonstrations -1
- 4.6 Algorithm Tracing
- 4.7 Flowchart Design
- 4.8 Standard Flowchart Symbols
 - 4.8.1 Terminal Symbol
 - 4.8.2 The Input/ Output Symbol
 - 4.8.3 Process Symbol
 - 4.8.4 Decision Symbol
 - 4.8.5 Flow Lines Symbol
 - 4.8.6 Connector Symbol
- 4.9 Practical Demonstrations -2
- 4.10 Advantages and Disadvantages of Flowchart
 - 4.10.1 Advantages of Flowchart
 - 4.10.2 Disadvantages of Flowchart
- 4.11 Pseudocodes
- 4.12 Practical Demonstrations -3
- 4.13 Summary

- 4.14 Glossary
- 4.15 References/Further Readings
- 4.16 Possible Answers to Self-Assessment Exercises



4.1 Introduction

One of the major steps in computer programming is the design of algorithms. As already defined in earlier sections of this lecture note, an algorithm is a chronology of steps on how a problem is solved. It is necessary to be thorough in algorithms design, as this will give a programmer the ability to code effectively. This is because it is the algorithm that a programmer transforms into the code that is executed by the computer.



4.2 Learning Outcomes

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

- Discuss some facts about algorithms
- Discuss guidelines for algorithms development
- Demonstrate algorithm development
- Perform simple Algorithm Tracing
- Discuss Flowchart Design
- Discuss Standard Flowchart Symbols such as Terminal Symbol, Input/ Output Symbol, Process Symbol, Decision Symbol, Flow Lines Symbol, Connector Symbol.
- State the Advantages and Disadvantages of Flowchart.
- Discuss Pseudocodes

- Perform Practical Demonstrations on Pseudocodes



4.3 Facts about Algorithms

Here are some facts about an algorithm.

- To effectively design an algorithm, a Programmer requires a pen and pencil, and should be ready to write down facts related to the task ahead.
- There are a number of ways of designing an algorithm. It could be in text format, or drawn in pictorial format as will be explained further.
- Algorithms in standard pictorial format is what is usually called Flow Chart, while an algorithm in textual format is known as Pseudo code.
- One much disciplined type of programming is what is known as structured programming.
- In structured programming, a designer breaks (divides) a given task into several sub-tasks known as modules.
- The resulting modules are then further divided into sub-modules, until division is no more necessary. The major essence of dividing a program into modules (functions) is to ensure that the given programming task is broken into small, independent and manageable tasks.
- Modularization could be done in a “top-down” fashion as shown in Fig. 4A.

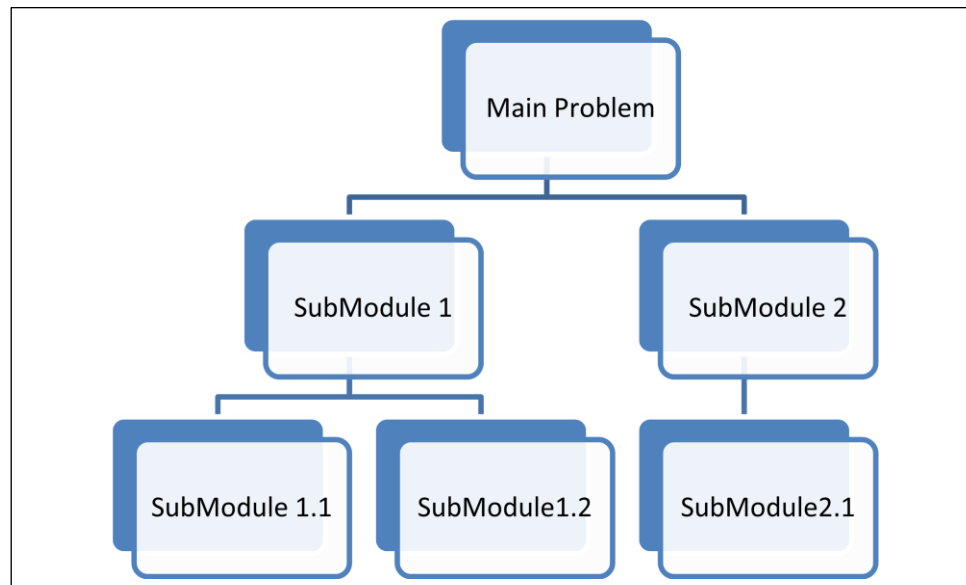


Fig. 4A: Top-Down Modularization Diagram

- h. As shown in Fig. 4B, a journey from Point A to B may be done through several options or paths X, Y or Z, but one path Y may be the most cost effective, or fastest among the three.

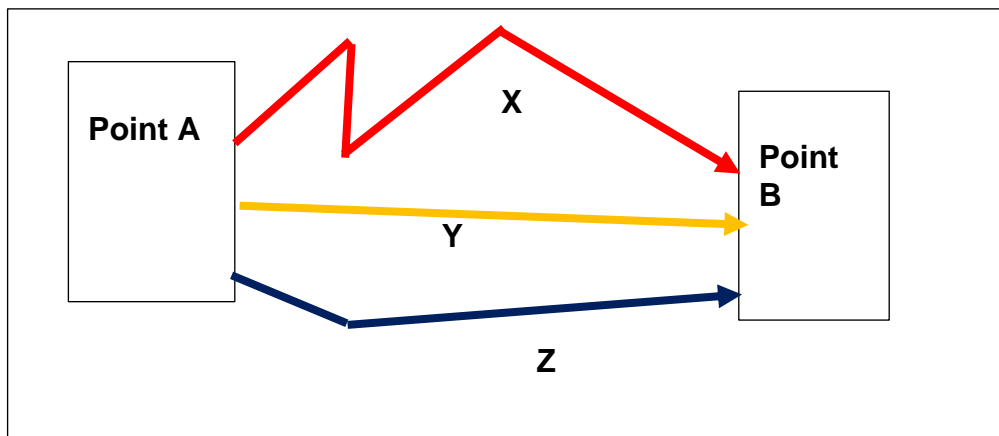


Fig. 4B: Showing Possible Paths from A to Z

In a similar way, there may be more than one algorithm for solving a problem, but one may be most effective among all the possible options. Therefore, at advanced levels, programmers usually perform what is known as algorithm analysis to determine the most optimal among all the possible options. However, algorithm analysis is beyond the level of this course, and will not be covered.

Self-Assessment Exercises 1

It is possible for many algorithms to solve one problem, however, their performances or speed may vary (YES/NO).

4.4 Guidelines for Algorithms Development

As already stated, an algorithm is usually written in a normal English language, before the programmer uses it to write a program. Though it looks very informal, there are some important guidelines to bear in mind.

- a. An algorithm should be numbered from the first step to the last one.
- b. An algorithm should be given a heading to avoid ambiguity or confusion.
- c. Numbering the algorithms could be in a numeric order, or using the word Step 1, Step 2, ... and so on, as demonstrated in Fig. 4C.

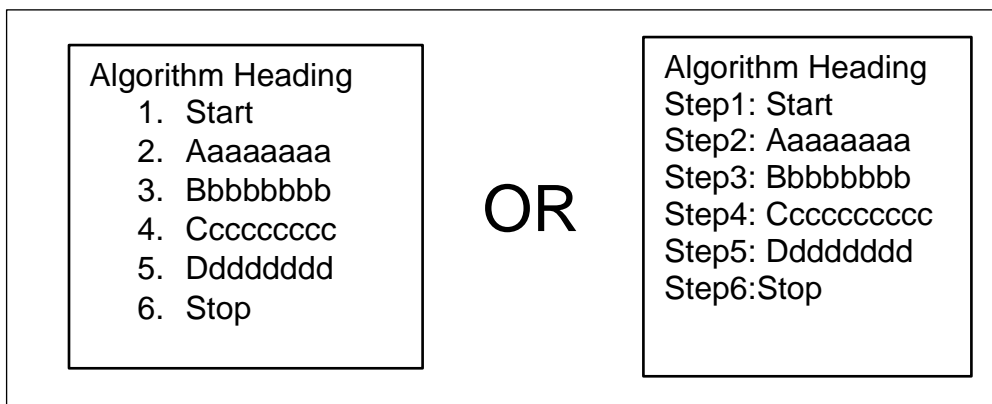


Fig. 4C: Demonstrating Algorithmic Step Numbering

- d. The algorithm should be enclosed by Start (or Begin) and Stop (or End).
- e. The stages where inputs are accepted or entered into the computer should be indicated with the words such as Input, Read, Enter, Key In, Obtain, and so on.
- f. The stages where outputs or results are expected from the computer should be indicated with the words such as Print, Display, Show, Write, and so on.
- g. The stages where calculations are to be done should be indicated with the words such as Compute, Calculate, and so on.

Self-Assessment Exercises 2

Other possible expressions for Display of output are_____

4.5 Practical Demonstrations - 1

The following questions will be used to demonstrate a simple algorithm.

Question 1: Write an algorithm to calculate the area of a rectangle.

Solution:

Algorithm to Calculate area of Rectangle

Step 1: Start

Step 2: Input Length

Step 3: Input Width

Step 4: Calculate Area as Length multiplied by Width

Step 5: Print Area

Step 6: Stop

Question 2: Write an algorithm to compute the average score of three tests.

Solution:

Algorithm to Compute the Average Score in 3 Tests

Step 1: Start

Step 2: Input Score1, Score2, Score3

Step 3: Calculate Sum as $\text{Score1} + \text{Score2} + \text{Score3}$

Step 4: Calculate Average as Sum divided by 3.

Step 5: Print Average

Step 6: Stop

4.6 Algorithm Tracing

The process of testing an algorithm usually involves first attempting to trace the flow of the algorithm with simple data. Through this step, a programmer is expected to discover if there is any error in the algorithm, even before writing the actual program itself. We will attempt to trace one of the algorithms with simple data.

Question 3: Using simple data, perform a trace on the algorithm to compute average score.

Solution:

First, we generate a simple data for use. Let us assume that the values of the scores in the three tests are 55, 81 and 70 respectively. The trace operation is as follows.

Step 1: We Start

Step 2: Score1 = 55, Score2=81, Score3=70

Step 3: Sum = 56+81+70. Therefore Sum = 207

Step 4: Average =207/3. Therefore Average = 69.

Step 5: Average is printed.

Step 6: Stop

Self-Assessment Exercises 3

In order to have an idea of the possible outcomes of an algorithm, an analyst should perform _____

4.7 Flowchart Design

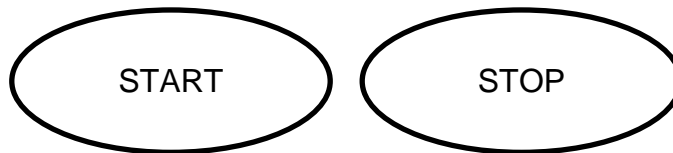
A flowchart is a pictorial form of algorithm, using standard symbols. That is to say that a flowchart is a graphical design that explains the sequence of operations to be performed in order to solve a particular problem. It follows that the first task is therefore to master the standard flowchart symbols, which are used in the designing of flowchart diagrams.

4.8 Standard Flowchart Symbols

We shall outline the different flowchart symbols here.

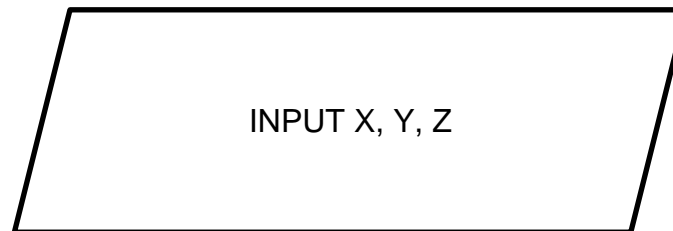
4.8.1 Terminal Symbol

The terminal symbol is used to designate the Start or Stop stages of the flowchart. The oval symbol is used for terminal symbol as shown below.



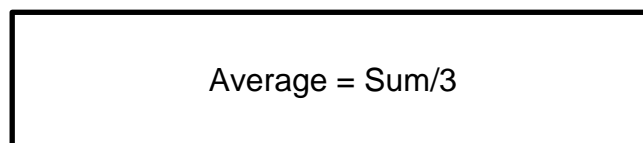
4.8.2 The Input/ Output Symbol

The parallelogram symbol is used to designate the Input or Output stages of the flowchart as shown below.



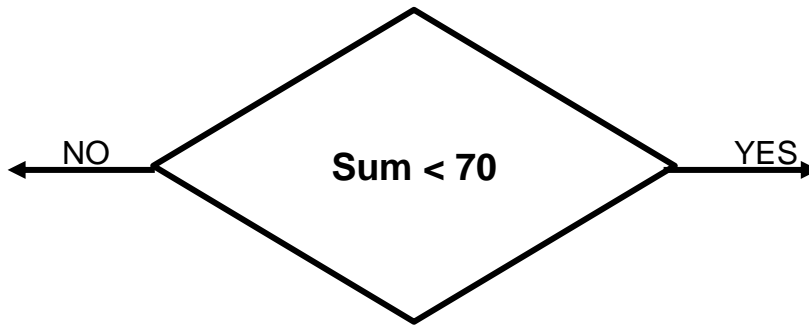
4.8.3 Process Symbol

The rectangle symbol is used in this case to indicate points where some processes take place. An instance is where calculations, additions, subtractions, et cetera, take place. This is shown in the following diagram.



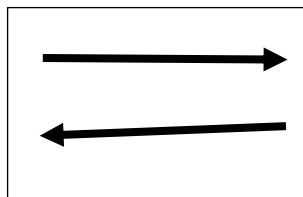
4.8.4 Decision Symbol

The diamond shape is used to indicate points where some forms of decisions take place. An instance is a point where a decision is made if Sum is less than 70 as shown in the following diagram.



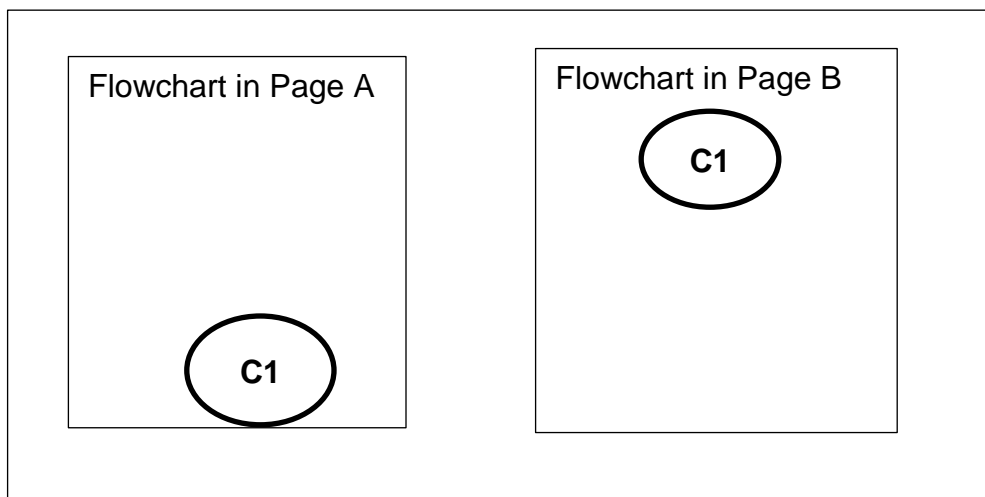
4.8.5 Flow Lines Symbol

The arrows are used to show the direction of flow. It is important to ensure that the arrow has a pointed end, as shown below.



4.8.6 Connector Symbol

There are cases where one is drawing a flowchart, and a page is not enough to contain the entire diagram. In such a case, connector symbol is used to connect the different pages of the same diagram. A round circle is used to designate a connector. Example:



As shown in the diagram, each of the connectors has similar labels C1 to indicate that both flowcharts A and B are connected, and thus flowing from the first one A to second one B respectively.

Self-Assessment Exercises 4

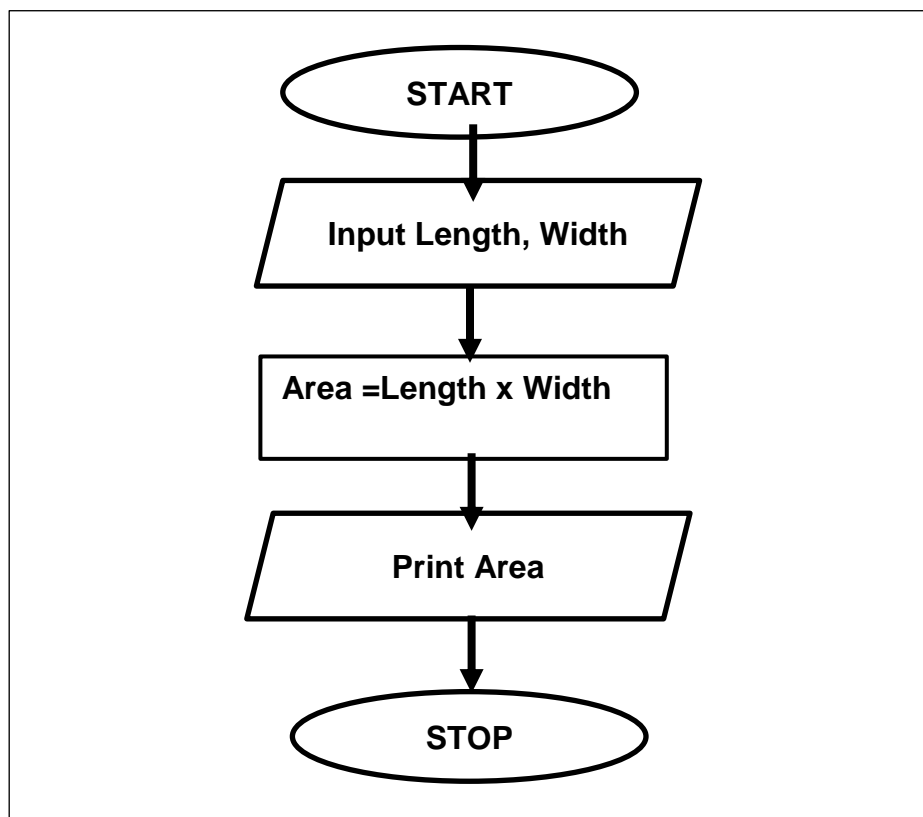
Which flowchart symbol is used to connect the different pages of the same diagram?

4.9 Practical Demonstrations - 2

The earlier questions used to demonstrate algorithms will now be used to demonstrate a simple flowchart.

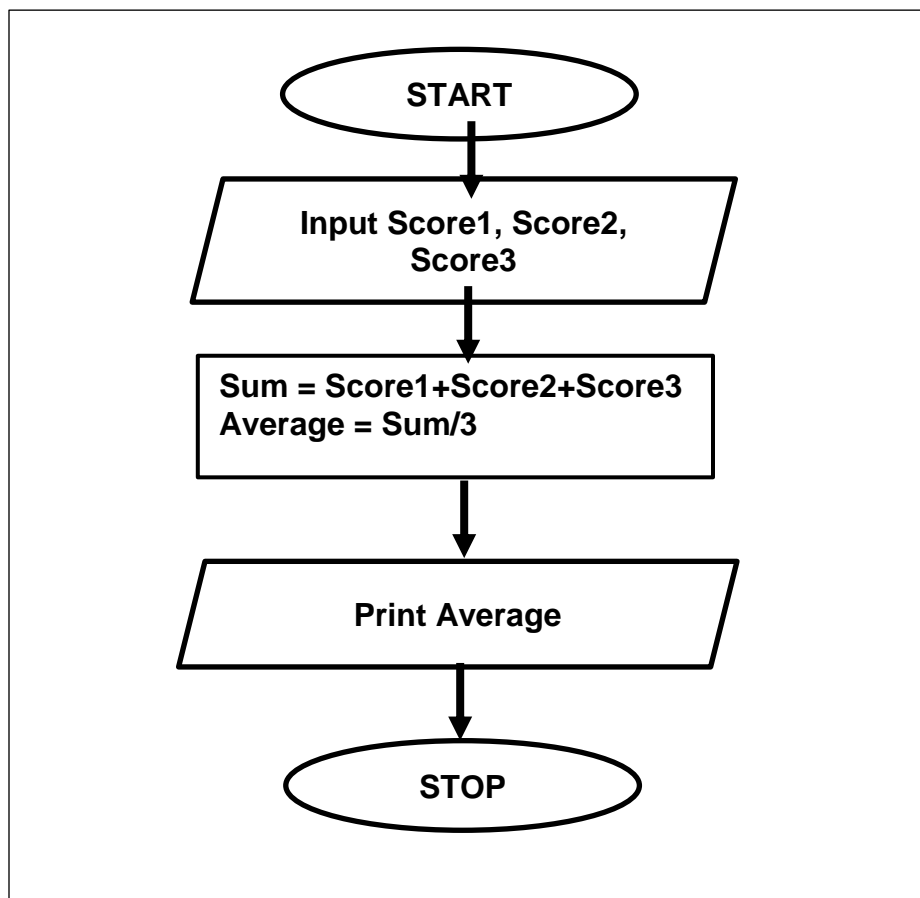
Question 3: Draw a flowchart to calculate the area of a rectangle.

Solution:



Question 4: Write an algorithm to compute the average score of three tests.

Solution:



4.10 Advantages and Disadvantages of Flowchart

There are a number of advantages and disadvantages of flowcharts as will be outlined here.

4.10.1 Advantages of Flowchart

- a. Flowcharts can be used to effectively clarify the flow of a solution. This is because a picture could clarify things better than texts.
- b. Flowchart can also be used to show the flow of the logic of the problem solution.
- c. Flowcharts can help to make the coding process easier.
- d. Flowcharts help in making program documentation very understandable.
- e. Flowchart is a standard diagram, and is language independent. Thus, other programmers outside one's domain or locality can still understand the flow.

4.10.2 Disadvantages of Flowchart

Some of the disadvantages of Flowchart are as follows:

- a. As the size of a flowchart grows, it may become very complex and less understandable.
- b. There are a number of programming constructs that may not have standard symbols for effective expression in flowcharts. Examples are looping, recursion, et cetera. These concepts are beyond the focus of this lecture note.
- c. Modification of large flowcharts may also sometimes be difficult,

4.11 Pseudocodes

Before ending this unit, it is important to touch on Pseudocode. As the name suggests, a Pseudocode is a form of algorithm that is close to a code, but not exactly a computer code. The prefix "Pseudo" stands for "Imitation". In other words, unlike an ordinary algorithm that could be written in normal English Language, a Pseudocode is written in some standard keywords, and assignment statements, though not a real code. The following comparative table will clarify this.

S/N	Normal Algorithm	Pseudocode
1.	Sum A and B to give C	$C = A + B$
2.	Calculate Average of Two Scores Sc1, Sc2	Average = $(Sc1 + Sc2)/2$

Note that there are some similarities between pseudocodes, flowchart and ordinary algorithms. For instance, Pseudocode should be enclosed in between START (or BEGIN) and STOP (or END). Again, just like the algorithm rules mentioned earlier, Pseudocodes can also use the keywords like INPUT, READ, GET, et cetera, at stages of collecting inputs, and PRINT, WRITE, et cetera, for outputting results.

4.12 Practical Demonstrations - 3

The following questions will be used to demonstrate a simple pseudocode.

Question 5: Write a Pseudocode to calculate the area of a rectangle.

Solution:

Pseudocode to Calculate area of Rectangle

Step 1: Start

Step 2: READ Length

Step 3: READ Width

Step 4: Area = Length x Width

Step 5: PRINT Area

Step 6: Stop

Question 6: Write a Pseudocode to compute the average score of three tests.

Solution:

Pseudocode to Compute the Average Score in 3

Tests

Step 1: Start

Step 2: READ Score1, Score2, Score3

Step 3: Sum = Score1+ Score2+Score3

Step 4: Average = Sum / 3.

Step 5: PRINT Average

Step 6: Stop

4.13 Summary

The focus of this unit is on Algorithms, Flowcharts and Pseudocodes. The areas covered are Facts about Algorithms, Guidelines for Algorithms Development and Practical Demonstrations regarding these. In this unit we also covered Simple Algorithm Tracing and Flowchart Design. The Standard Flowchart Symbols are Terminal Symbol, Input/ Output Symbol, Process Symbol, Decision Symbol, Flow Lines Symbol and Connector Symbol. Also in this unit are Advantages and Disadvantages of Flowchart.

We also studied Pseudocodes and Practical Demonstrations on Pseudocodes. A number of Self-Assessment exercises were done.

4.14 Glossary

Flowchart A standard diagram that depicts the flow of problem solution.

4.15 Reference

NIL

4.16 Possible Answers to SAEs

Answers to SAEs 1

YES.

Answers to SAEs 2

Print, Display, Show, Write, and so on

Answers to SAEs 3

Tracing

Answers to SAEs 4

The Connector Symbol

MODULE 3
NETWORKS AND INTERNET

Course Writing Template for Course Writers

UNIT 1: INTRODUCTION TO COMPUTER NETWORKS

Unit Structure

- 1.1 Introduction
- 1.2 Learning Outcomes
- 1.3 Definition of Computer Network
- 1.4 Benefits of Computer Networks
- 1.5 Classification of Networks:
 - 1.5.1 Network Types based on Coverage
 - 1.5.1.1 Some of the facts about a PAN
 - 1.5.1.2 Some of the facts about a LAN
 - 1.5.1.3 Some of the facts about a MAN
 - 1.5.1.4 Some of the facts about a WAN
 - 1.5.1.5 Some facts about the Internet
- 1.6 Network Topology
 - 1.6.1 Point to Point Topology
 - 1.6.2 Bus Topology
 - 1.6.3 Star Topology
 - 1.6.4 Ring Topology
 - 1.6.5 Tree Topology
 - 1.6.6 Mesh Topology
- 1.7 Summary
- 1.8 Glossary

1.9 Reference

4.10 Possible Answers to Self-Assessment Exercises



1.1 Introduction

The Tourism and Hospitality Industry has a number of products and services. Those that patronize those services may be located in different parts of the country, and possibly in different countries of the world. Communications through computing and mobile devices are inevitable in today's business transactions. These commercial activities are enabled because computers are connected through networks. The focus of this section of HMT 206 lecture note is on Computer Networks. We begin by defining the subject matter, and exploring Computer Networks in more details.



1.2 Learning Outcomes

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

- Discuss the concept of Computer Networks.
- Define Computer Network.
- Outline the Benefits of Computer Networks.
- Classify Computer Networks.
- Explain the Network Types based on Coverage, particularly LAN (Local Area Network), MAN (Metropolitan Area Network), WAN (Wide Area Network), et cetera.
- Briefly discuss the Internet as a network of networks.

- Discuss Network Topology, particularly Point to Point Topology, Bus Topology, Star Topology, Ring Topology, Tree Topology and Mesh Topology.
- Answer the Self-Assessment exercises.



1.3 Definition of Computer Network

A Computer Network is a system of interconnected computers and other computerized devices. One of the major benefits of computer networks is to facilitate information sharing among them. Computers in a network could connect to each other by physical means using cables. Computers can also be connected to each other using wireless media.

1.4 Benefits of Computer Networks

Some of the benefits of Computer Networks are as follows:

- a. Resource Sharing: Examples of resources that can be shared are printers, scanners, programs, et cetera.
- b. Data and Information Sharing in facilitated in a computer network
- c. Video Conferencing
- d. Instant Messaging, such as WhatsApp and Google Messenger
- e. Sending and Receiving e-mails

Self-Assessment Exercises 1

Mention two messaging platforms you have used through the network.

1.5 Classification of Networks

Computer networks can be classified in a number of ways, but here are two criteria. The first is Network Types based on Coverage, while the second is based on Network Topology. Network Coverage classifies network in terms of the size of area it has covered, while Topology classifies the network in terms of the way the computers are arranged within the network. In this lecture note, we shall study both the coverage and topology at the introductory level.

1.5.1 Network Types based on Coverage

There are five main types of Computer Networks based on coverage. These are:

- a. Personal Area Network (PAN)
- b. Local Area Network (LAN)
- c. Metropolitan Area Network (MAN)
- d. Wide Area Network (WAN)
- e. The Internet

1.5.1.1 Some of the facts about a PAN

- a. The PAN is the smallest computer network, after Body Area Network.
- b. Simple connections such as Bluetooth or infra-red enabled devices could be used to build a PAN.
- c. The coverage area may just be within 10 meters radius.
- d. In PAN, the personal devices belonging to a single person can just be connected to each other to form a network.

1.5.1.2 Some of the facts about a LAN

- a. In LAN, systems are connected in a small network like in a building or within an office space.
- b. A LAN can be formed when just two or more personal computers or Laptops are connected.
- c. Connection could be through physical wires or cables.
- d. Connection can also be through wireless.

- e. Data transfer rate through the LAN is usually fast compared to other networks.

1.5.1.3 Some of the facts about a MAN

- a. A MAN is a network that can be connected within a city.
- b. An example of MAN is a cable TV Connection
- c. MAN could be used to connect people with various organizations

1.5.1.4 Some of the facts about a WAN

- a. A WAN is a network that has no geographic limits, such as one that covers a country.
- b. Telephone lines connections, which could be used by computers through modems, is an example of WAN.

1.5.1.5 Some facts about the Internet

The Internet is the biggest network in the world. Some of the facts about an Internet are:

- a. The Internet is commonly referred to as "the Net".
- b. It is a world wide area network (WWAN).
- c. In other words, it is a network of networks where computers are linked to other computers all over the world.

Self-Assessment Exercises 2

The internet is said to be a WWAN. Write this acronym in full.

1.6 Network Topology

The topology of a computer network has to do with the architectural shape of the resulting connection. A number of topologies will be drawn in this section.

1.6.1 Point to Point Topology

This is a situation where two computers are connected directly, one to another. The diagram of Point-to-Point topology is shown as follows (Fig. 3.1).

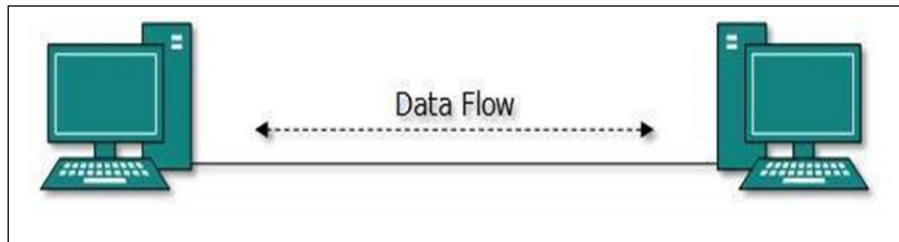


Fig. 3.1: Point to Point Topology

1.6.2 Bus Topology

This is a type of connectivity where there is one major cable known as bus, and all the computers are connected one by one on both sides of that cable. The bus ends at a point known as terminator. The diagram of Bus Topology is shown in the following diagram (Fig. 3.2).

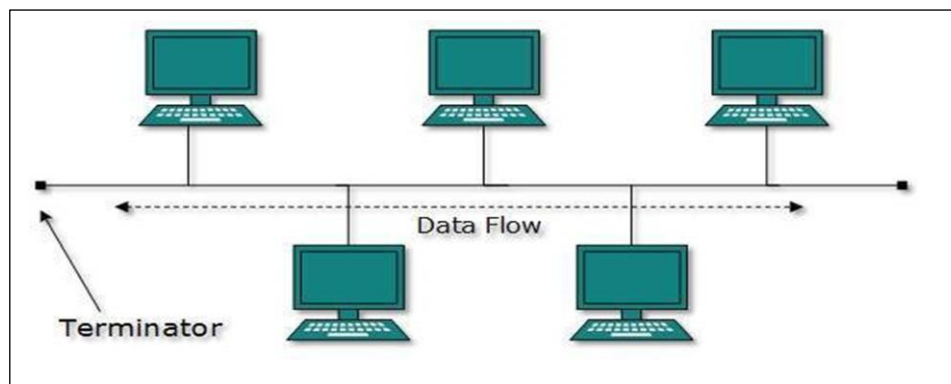


Fig.3.2: Bus Topology

1.6.3 Star Topology

This is a connection type where the different computers are connected to a single central device at the middle. Thus, the resulting network takes the shape of a star. In a star topology, the central device is called a hub. The diagram of a star topology is shown as follows (Fig. 3.3):

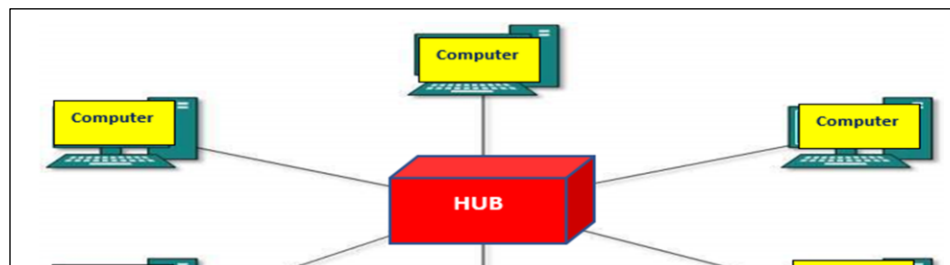


Fig. 3.3: Star Topology

1.6.4 Ring Topology

This is a network where the different computers are connected in a ring format. The diagram of a ring topology is shown as follows (Fig. 3.4).

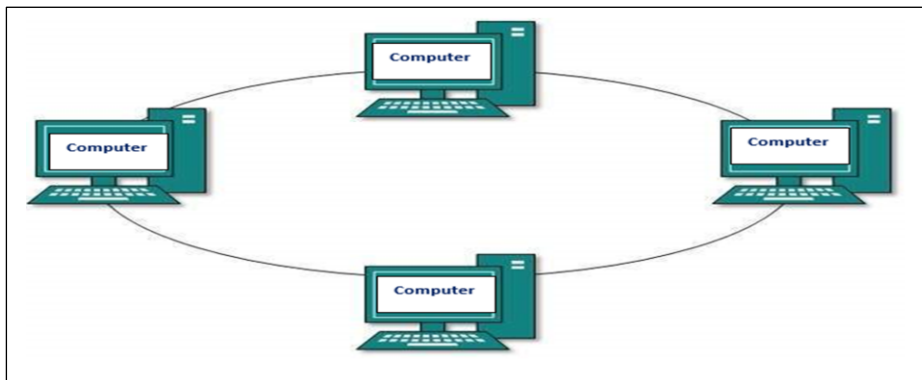


Fig. 3.4: Ring Topology

1.6.5 Tree Topology

This is a network where the different computers are connected in a tree format. The diagram of a tree topology is shown as follows (Fig. 3.5):

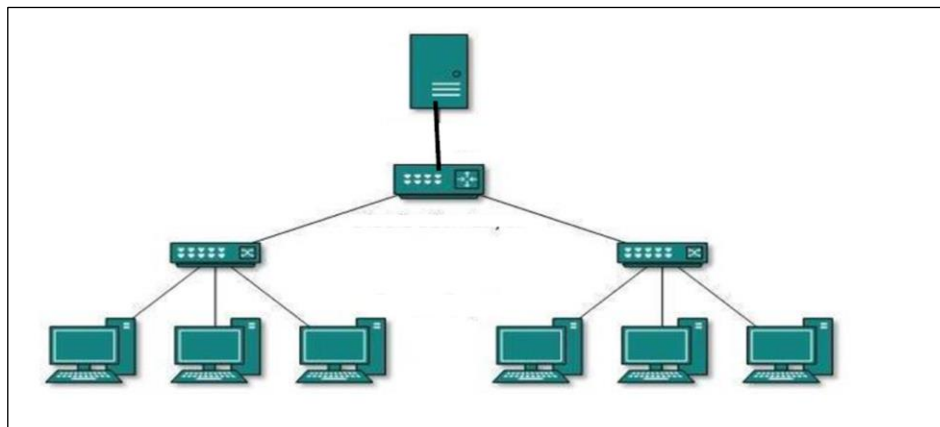


Fig. 3.5: Tree Topology

1.6.6 Mesh Topology

The mesh topology is a type of network topology where any particular host (system) in the network is connected to one or multiple hosts. A mesh could be termed full or partial. For instance, the following diagram (Fig. 3.6) shows a full mesh.

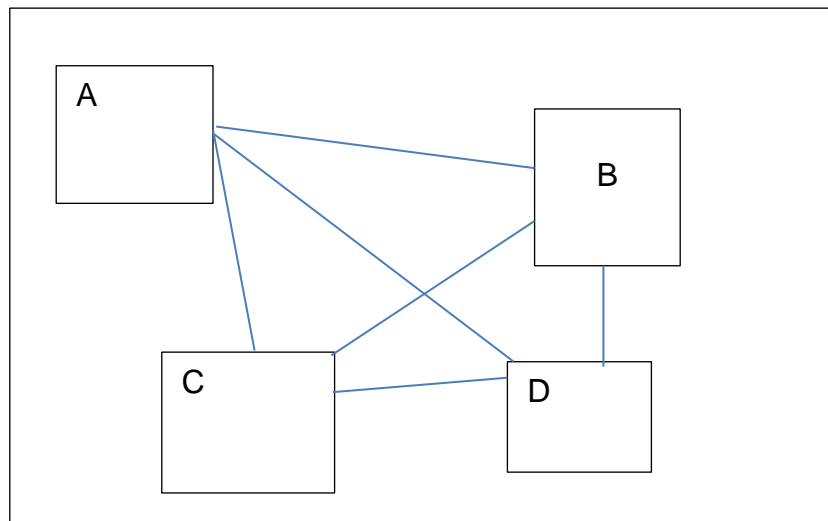


Fig. 3.6: Diagram of Full Mesh

As shown in the figure above, a full mesh has every network host connected to every other one. For instance, Computer A is connected to every other network computers B, C, and D. In a similar way, Computer B is connected to every other computer A, C, and D, and so on. The importance of mesh network is that there are many other alternative links, to a particular host. Thus, in case a particular network link malfunctions, the whole network will still communicate.

Self-Assessment Exercises 3

A network topology where every network host is connected to every other one is known as what?

1.7 Summary

The focus of this unit is on Computer Networks. The areas covered are Definition of Computer Network, Benefits of Computer Networks, and Classification of Networks. We also covered Network Types based on Coverage, which explored PAN, LAN, MAN, WAN and the Internet. Then we studied Network Topology which explored Point to Point Topology, Bus Topology, Star Topology, Ring Topology, Tree Topology and Mesh Topology. A number of Self-Assessment exercises were done.

1.8 Glossary

LAN Local Area Network

MAN Metropolitan Area Network

WAN Wide Area Network

1.9 Reference

NIL

1.10 Possible Answers to SAEs

Answers to SAEs 1

WhatsApp and Google Messenger

Answers to SAEs 2

WWAN stands for world wide area network.

Answers to SAEs 3

Mesh Topology

UNIT 2: INTERNET TECHNOLOGY

Unit Structure

- 2.1 Introduction
- 2.2 Learning Outcomes
- 2.3 Important Internet Terms
 - 2.3.1 Internet Service Provider (ISP)
 - 2.3.2 IP Address
 - 2.3.3 HTTP and HTTPS
 - 2.3.4 Encryption and Authentication
 - 2.3.5 World Wide Web versus Internet
 - 2.3.6 Firewall
- 2.4 History of Internet
 - 2.4.1 Role of Academics and Government
 - 2.4.2 Cold War as Catalyst
 - 2.4.3 Role of ARPANET
 - 2.4.4 Role of TCP/IP
- 2.5 Benefits of the Internet
 - 2.5.1 Instant and E-mail Messaging
 - 2.5.2 Geographic Mapping and Directions
 - 2.5.3 Online Shopping
 - 2.5.4 Bill Payments
 - 2.5.5 Online Banking
 - 2.5.6 Online Selling
 - 2.5.7 Work from Home

- 2.5.8 Entertainment
- 2.5.9 Cloud computing
- 2.5.10 Career building
- 2.6 The Intranets
 - 2.6.1 Important Facts about Intranet
 - 2.6.2 Benefits of the Intranet
 - 2.6.3 Disadvantages of Intranet
 - 2.6.4 Examples of Intranet:
 - 2.6.4.1 Educational Intranet
 - 2.6.4.2 Real Estate Intranet
 - 2.6.4.3 Health Care Intranet
 - 2.6.4.4 Transportation Intranet
- 2.6 Summary
- 2.7 Glossary
- 2.8 References/Further Readings
- 4.9 Possible Answers to Self-Assessment Exercises



2.1 Introduction

The Internet is a global network that connects billions upon billions of computers and other intelligent devices across the world with each other and to the World Wide Web. This is achieved through interconnections using standard internet protocol suite called TCP/IP which connects these billions of computers worldwide. Internet is set up by using cables and wireless technologies. Today, the Internet is the fastest means of transmitting or exchanging data and information between computers across the globe. The easiest way to explain the Internet is to refer to it as "the network of networks." The Internet is therefore the connection of computer networks around the world into a single entity. Some people may view the Internet as one gigantic computer. This is erroneous. It is rather made up of numerous networked computers connected together.



2.2 Learning Outcomes

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

- Discuss Internet Technology.
- Discuss important Internet Terms such as Internet Service Provider (ISP), IP Address, HTTP and HTTPS, Encryption versus Authentication, World Wide Web versus the Internet and Firewall.
- Discuss the History of the Internet.
- Discuss the Role of Academics and Government in the history of the Internet.

- Discuss the roles of Cold War as Catalyst, ARPANET and TCP/IP in the history of the Internet.
- Explain the Benefits of the Internet, such as Instant and E-mail Messaging, Geographic Mapping and Directions, Online Shopping, Bill Payments, Online Banking, Online Selling, Work from Home, Entertainment, Cloud computing and Career building.
- Define Intranet.
- Discuss the Benefits of the Intranet, Disadvantages of Intranet and Examples of Intranet.
- Explain specific benefits of intranets, such as Educational Intranet, Real Estate Intranet, Health Care Intranet and Transportation Intranet.
- Do the Self-Assessment exercises given.



2.3 Important Internet Terms:

In order to ensure an understanding of the subject matter, it is necessary to define some important terms or concepts related to the Internet.

2.3.1 Internet Service Provider (ISP)

An ISP is a company that provides Internet access to subscribers or customers. Most of the time, it is simply referred to as “the provider.” ISPs may transmit data through a number of technologies such as:

- a. Dial-up Technology
- b. Cable modem
- c. Wireless
- d. Dedicated high-speed interconnects.

The ISPs also provide customers with the ability to communicate with one another using Internet email accounts. ISPs also provide other services such as telephone and

television services, et cetera. Another name for Internet service provider is Internet access provider (IAP).

2.3.2 IP Address

Every computer or device that connects to the internet has a unique address for effective identification. This unique address known as Internet Protocol (IP) address is used to identify computers on the Internet. In most cases, IP addresses are assigned automatically. An IP address could look like this: 200.88.19.22.

In a similar way, apart from computers, every smart device such as smartphone, and other mobile devices that access the internet is also assigned an IP address for tracking purposes. Such IP addresses could be assigned permanently, or may change occasionally. In any case, the IP address must be a unique identifier. In other words, wherever a user browses, sends an e-mail or instant message, the person's IP address serves as the equivalent of an automobile license plate number to enforce accountability and traceability.

2.3.3 HTTP and HTTPS

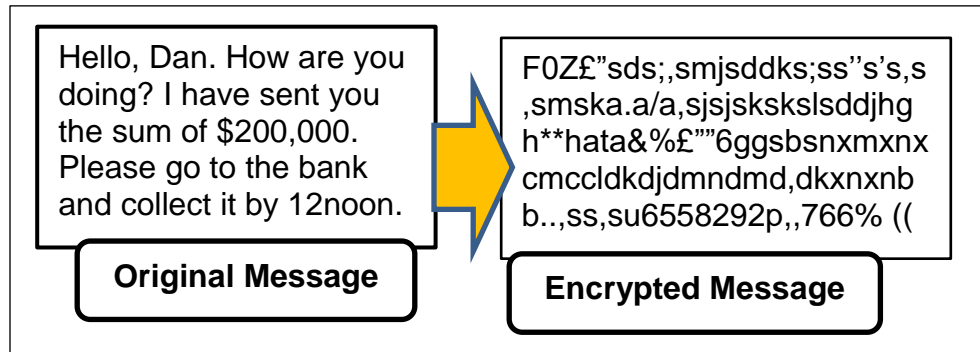
The acronym HTTP stands for Hypertext Transfer Protocol. This is defined as a set of rules or data communication standard of web pages. When a web page has this prefix, it can be successfully displayed by a web browser.

The acronym HTTPS is an improvement on HTTP, and stands for Hypertext Transfer Protocol Secure. Thus, HTTPS indicates that the web page has been shielded with a special layer of encryption in order to secure the users' personal information and passwords. The caution is that whenever you log in to the net for online shopping and other critical transactions, such as banking, ensure that the website being accessed is secure before entering your credit card information details. Look out for https in the URL in use.

2.3.4 Encryption and Authentication

Encryption is a security technique which involves the mathematical scrambling of data and information so that it is meaningless to unauthorized persons. Encryption uses complex mathematical formulas to turn private data into meaningless form, which can only be turned meaningful using the decryption key for authorized users.

Example is shown in the following figure:



Encryption is very important in Internet message transmission, to ensure that unauthorized persons are not able to perceive the content of the sent message.

2.3.5 World Wide Web versus the Internet

Most people assume that the words web and The Internet mean the same thing, but this is an erroneous assumption. In fact, they are quite different. The World Wide Web or simply the web, are the hyperlinked pages one sees when the person’s device is online using HTTP. On the other hand, the Internet is the network of connected computers that the web, emails, files and a number of other resources travel across. There are other services available on the Internet besides the web.

2.3.6 Firewall

A firewall is defined as a network security device that monitors incoming and outgoing network traffic, and in the process, makes the right decision, on whether to allow a particular traffic or to block it. This decision is usually based on some security rules. Some other important facts related to firewall are:

- a. Firewalls are known to be the first line of defence in network security.
- b. Firewalls establish a barrier between secured and trusted internal networks and the untrusted external networks, such as the Internet.
- c. A firewall can be any of the three types - hardware, software, or both.

Self-Assessment Exercises 1

When a message is encrypted by sender, then the receiver must _____ before it can be understood.

2.4 History of the Internet

Some of the historical facts of the Internet are:

2.4.1 Role of Academics and Government

- a. The Internet began in the 1960s as a means for academics and government researchers to share information.
- b. Computers in the 1960s were large and immobile, so it was very difficult to access data and information stored in computers in different locations. One had to either travel to the site of the computer or use postal systems to transport magnetic computer tapes from one place to another, with possible delays.
- c. Internet evolved as a solution to these problems of data sharing.

2.4.2 Cold War as Catalyst

- a. Another catalyst in the formation of the Internet was the Cold War between the Soviet Union (now Russia) and the US. During that time, the U.S.

Defence Department was considering how to ensure that there could still be human communication, even in the event of a nuclear attack.

- b. This led to the formation of the Advanced Research Projects Agency Network (ARPANET).
- c. It was this network that later evolved into the present day Internet.

2.4.3 Role of ARPANET

- a. Initially, ARPANET was a great success but membership was limited to only the academic and research organizations.
- b. Later, other networks were created to expand this original network.
- c. The official birthday of the Internet is considered to be January 1, 1983. The reason is that, prior to this day, various computer networks did not have a standard way to communicate with each other.

2.4.4 Role of TCP/IP Standard

- a. The establishment of the Transfer Control Protocol/Internet Protocol (TCP/IP) suite is considered a great milestone, since it made it possible for different kinds of computers on different networks to "talk" to each other.
- b. Thus, networks like the ARPANET and the US Defence Data Network officially changed to the TCP/IP standard on January 1, 1983.

Self-Assessment Exercises 2

The term TCP/IP stands for _____

2.5 Benefits of the Internet

Some of the benefits of the internet are:

2.5.1 Instant and E-mail Messaging

The existence of the Internet makes it possible for people to send instant messages and e-mails, do voice chat, video conferencing, et cetera. A number of companies, such as Yahoo and Google, among others, offer email services worldwide.

2.5.2 Geographic Mapping and Directions

Using Geographic Positioning System (GPS) technology, people are able to get directions to almost every place in different parts of the globe. This has given rise to the emergence of several transportation companies that make use of google maps, among other related technologies.

2.5.3 Online Shopping

The Internet has made online shopping to flourish more than ever before. It allows people to make purchases from the comfort of their homes. They can pay for flight tickets, book for accommodations, et cetera.

2.5.4 Bill Payments

Bill payment has been made quite easier. In fact, one can pursue academic admission in other countries and continents, and pay all the necessary fees all through the use of the Internet. This is quite amazing.

2.5.5 Online Banking

The Internet has made internet banking to flourish. People now check their balance, purchase phone recharge cards, and other things directly using their mobile phones with the use of the Internet.

2.5.6 Online Selling

One can successfully sell products or services online. The Internet helps service providers to reach out to their customers, and sell to them.

2.5.7 Work from Home

The Internet has also helped to make it possible for people to work from home. During the pandemic, it was a relief.

2.5.8 Entertainment

People now get entertainments through the internet. This is possible through U-Tube, online music, online games, et cetera.

2.5.9 Cloud computing

The Internet also enables subscribers to connect their computers and internet-enabled devices to cloud services such as cloud storage and other resources.

2.5.10 Career building

The Internet has helped in this regard. Many companies can recruit applicants online. Conferences and workshops now go online. Moreover, applicants can search for jobs online on different job portals and send their CVs speedily.

Self-Assessment Exercises 3

The technology used in geographical mapping and direction finding is called_____

2.6 The Intranets

As already studied, the Internet covers a global space. There are other networks of networks at smaller space coverage that mimic the internet. One of such is the Intranet as will be studied in this lecture note.

2.6.1 Important Facts about Intranet

Some of the important facts related to the intranet are:

- a. The intranet is a private network that belongs to an organization.

- b. In other words, the intranet is designed for the exclusive use of an organization and its associates, such as employees, customers, and other authorized people.
- c. In other words, the National Open University (NOUN) could build her own Intranet for internal use.
- d. The intranet offers a secure platform to transmit information and share data with authorized users.
- e. Confidential information, data, web forms, and applications can be made available to staff through the intranets.
- f. The intranet is therefore a private internet for an organization to use in serving the generality of the employees.
- g. Just like in the Internet, each computer in intranet is identified by its unique IP Address.
- h. The TCP/IP is used as communication protocol.
- i. The Intranet is protected from unauthorized access using firewalls and other security systems.
- j. The firewall is used by network administrator to monitor the incoming and outgoing data packets and ensure they do not contain unauthorized requests.
- k. It is important to mention that users on the intranet can also access the Internet if it has a link to it, but the internet users cannot have access to the intranet unless they have authorization.
- l. To access the intranet, a user would usually connect through the Local Area Network (LAN).

2.6.2 Benefits of the Intranet

There are many benefits of intranet. Some of them are:

- a. Intranet is easy to implement for an organization.
- b. Intranet can also be run in a safer environment than the Internet. This is because the organization is in a position to implement their security measures, usually free from access through the Internet.

- c. Intranet is of great benefit since it provides avenue for a company to effectively share its data and information.
- d. Because Intranet is controlled within the confines of an organization, it implies that delays in data sharing could be avoided.
- e. Through Intranet, messages can be broadcast to all the staff of an organization by the Managing Director, Human Resources (HR) Manager, et cetera, with ease.
- f. Through the intranet, the entire staff can access internal documents.
- g. Through intranet, an organization can manage the security of their resources.
- h. Through the intranet, an organization can control the type of information that goes out of the organization.
- i. The intranet offers a testing platform for new ideas within the organization, before they are uploaded on the company's internet webpage for the wider public.
- j. The intranet makes it possible for company information to be shared in real-time, and prevents unauthorized persons from accessing it.
- k. Mobile apps can also be installed as part of the intranet. This makes the employees to be connected.
- l. The intranet could be used to host a company social network.
- m. Intranets make the tracking of company projects very easy.
- n. Intranets could be used to monitor attendance to work and other activities.
- o. Intranets can be used by HR department to test staff and grade their performance.

2.6.3 Disadvantages of Intranet

Some of the disadvantages of intranet are as follows.

- a. Intranet could be costly to set up.
- b. Intranet setup and maintenance requires technical know-how.
- c. Without a functional firewall, the company intranet, with connection to the Internet, could be hacked through the Internet.

- d. The security of the intranet is very important, and could be an extra cost for the company.
- e. Just one careless staff within the organization could lead to compromise of the whole system.
- f. Just one criminal minded staff within the organization could lead to compromise of the whole system.
- g. There could be document duplication within the intranet, which could lead to confusion among employees
- h. There is a need to always monitor the activities of an intranet. This means the company will have to employ a database administrator.

2.6.4 Examples of Intranet

Some examples of common intranets are as follows:

2.6.4.1 Educational Intranet

This is generally found in a school, college, universities, and so on. For instance, a school intranet should be successfully used by teachers and tutors to communicate with one another and to get in touch with the students. Other possibilities are:

- Transmission of announcements on holidays.
- Transmission of Class Time Tables.
- Discussion class and messaging platforms.
- Updates on happenings within the campus.

2.6.4.2 Real Estate Intranet

The intranet of a typical real estate company makes it possible for its sales team to be able to access important brochures, templates, among other resources needed for successful sales of properties. The intranet also helps the employees to be up to date

24/7 on current events, meetings, training, conferences, news, sessions, et cetera. Moreover, such an intranet can also be used to share motivational thoughts to encourage the team.

2.6.4.3 Health Care Intranet

Health related intranets could be used by hospitals to share information and cautions related to pandemics, or causative factors for a particular disease. Such Intranet could be of help to medical students who may wish to login and learn things related to the treatment of particular ailments. Consultant doctors could also share reports, treatment procedures and bills through the intranets. Moreover, financial claims can be settled easily without moving from department to department, thus improving on speed and accountability.

2.6.4.4 Transportation Intranet

The Tourism and Hospitality Industry could effectively utilize the intranet in several areas. Some of which are:

- Booking for cars.
- Booking for aircraft
- Giving updates after a trip.

Self-Assessment Exercises 4

Which one is bigger in size; The Internet or Intranet?



2.6 Summary

The focus of this unit is on Internet Technology. The areas covered are Important Internet Terms which explored Internet Service Provider (ISP), IP Address, HTTP

and HTTPS, Encryption vs Authentication, World Wide Web vs Internet and Firewall. We also studied History of Internet which focused on Role of Academics and Government, Cold War as Catalyst, Role of ARPANET and Role of TCP/IP. Another topic studied is Benefits of the Internet which focused on Instant and E-mail Messaging, Geographic Mapping and Directions, Online Shopping, Bill Payments, Online Banking, Online Selling, Work from Home, Entertainment, Cloud computing and Career building. We also studied the Intranets, which focused on Important Facts about Intranet, Benefits of the Intranet, Disadvantages of Intranet and Examples of Intranet. The examples studied are Educational Intranet, Real Estate Intranet, Health Care Intranet and Transportation Intranet. A number of Self-Assessment exercises were done.

2.7 Glossary

ARPANET Advanced Research Projects Agency Network

ISP Internet Service Provider



2.8 References/Further Readings

NIL.



2.9 Possible Answers to SAEs

Answers to SAEs 1

Decrypt

Answers to SAEs 2

Transfer Control Protocol/Internet Protocol (TCP/IP)

Answers to SAEs 3

GPS Technology

Answers to SAEs 4

The Internet

UNIT 3: FUNDAMENTALS OF WEBSITES

Unit Structure

- 3.1 Introduction
- 3.2 Learning Outcomes
- 3.3 The URL
- 3.4 Anatomy of URL
- 3.5 Top Level Domain
- 3.6 Benefits of a website
 - 3.6.1 Cost-Effective Marketing
 - 3.6.2 Wider Reach
 - 3.6.3 User Friendly Medium
 - 3.6.4 Round the Clock Availability
 - 3.6.5 Self Service Possibility
 - 3.6.6 Increase in Productivity
 - 3.6.7 Location Independence

- 3.6.8 IT-Compliance
- 3.7 Classification in terms of webpage types
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 - 3.7.1.1 Benefits of Static Websites
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 - 3.7.2.1 Benefits of Dynamic Website
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 - 3.8.7 Government websites
- 3.9 Summary
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- 3.11 References/Further Readings
- 3.12 Possible Answers to Self-Assessment Exercises



3.1 Introduction

The very first website was developed by the web scientist named Tim Berners-Lee in August 1991. As at date, there are billions of websites on the Internet. A website can be defined as a collection of related web pages. This lecture note will focus on exploring websites. We shall begin with a study of related concepts, such as URL and its anatomy, and continue with more details, such as benefits of websites, classification of websites, and so on.



3.2 Learning Outcomes

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

- Define URL.
- Discuss the Anatomy of URL.

- Explain the Top-Level Domain
- Outline the Benefits of a website with specific focus on Cost Effective Marketing, Wider Reach, User Friendly Medium, Round the Clock Availability, Self Service Possibility, Increased Productivity, Location Independence and IT Compliance.
- Classify websites in terms of Static and Dynamic webpage types.
- Enumerate the benefits of each option.
- Explain the Classification of websites in terms of purpose and target audience.
- Discuss website seven options – Blog, Online Community, Social Media, E-commerce website, Informational website, Portal, and Government websites.
- Answer the Self-Assessment exercises



3.3 The URL

The acronym URL stands for Universal Resource Locator (also called Uniform Resource Locator). This is a form of address for locating a particular website stored in a web server on the Internet. The URL is commonly known as “Web Address”. Examples of the URLs of ten federal universities in Nigeria are shown in the following table:

S/N	URL	Comments
1.	https://nou.edu.ng	National Open University of Nigeria website.
2.	www.unizik.edu.ng	Nnamdi Azikiwe University, Awka
3.	www.fudutsinma.edu.ng	Federal University, Dutsinma, Katsina
4.	www.unilag.edu.ng	University of Lagos

5.	www.nda.edu.ng	The Nigerian Defence Academy Website
6.	www.uniport.edu.ng	University of Port Harcourt, Rivers State
7.	www.futa.edu.ng	Federal University of Technology, Minna
8.	www.uniabuja.edu.ng	University of Abuja, Gwagwalada
9.	www.unn.edu.ng	University of Nigeria, Nsukka
10.	www.unilorin.edu.ng	University of Ilorin, Kwara State.

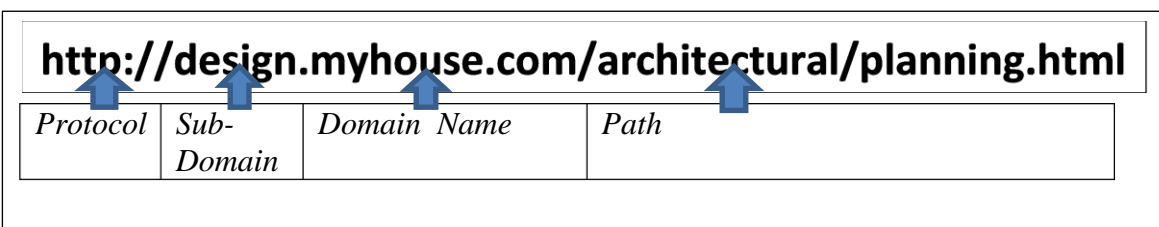
3.4 Anatomy of URL

The anatomy of URL involves breaking down a URL into the component parts. A typical URL can be broken into five major components. These are:

- a. Protocol
- b. Sub-Domain
- c. Domain Name
- d. Path

Note that this is not a static rule for every website. Some website addresses may have other components not mentioned here. However, a number of websites follow this.

EXAMPLES 1



As shown, the protocol is http:// which stands for “Hypertext Transfer Protocol”. This is a set of rules used by the web browser to communicate with the web server. Another example of protocol is https:// which is a secure version of http. The difference is that unlike “http”, the data on the page is encrypted in the case of “https”. The sub-domain is the division of the main page. It is important to state that not all website addresses have sub-domains. The domain name is a name that uniquely identifies the web site. It is also

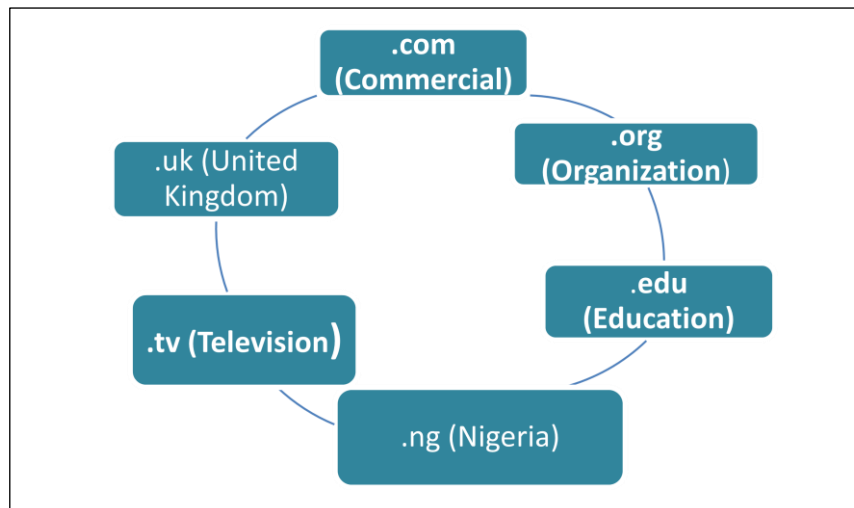
called the host name. The Path refers to the step or series of steps through which the actual web file is located.

Self-Assessment Exercises 1

Why is https preferred over http?

3.5 Top Level Domain

The tail end of the Domain Name, all that follows the final dot of a domain name, is usually called Top-Level Domain. For instance, in the URL <https://yahoo.com>, the top-level domain is “.com”. More examples are shown in the following figure.



Self-Assessment Exercises 2

In the website www.unilag.edu.ng, the term ‘.edu’ stands for _____, while ‘.ng’ stands for _____.

3.6 Benefits of a website

A website is an inevitable way of showcasing the information concerning one's business in today's world of Information Technology. It is obvious that the Tourism and Hospitality Industry of today cannot thrive without websites. We shall therefore explore some of the benefits of websites here.

3.6.1 Cost-Effective Marketing

The marketing of products and services through the use of websites has been discovered to be cheaper than through print advertising, televisions and radios. It is also very easy to make modifications to the contents displayed on the websites through editing. This is also very cheap, compared with other means of advertising.

3.6.2 Wider Reach

Using the website, you can reach larger population of people with information concerning your products of services. For instance, the Hospitality Industry utilizes the websites in order to reach out to people who may be in different countries of the world.

3.6.3 User Friendly Medium

Professional and good-looking websites could attract more customers. Such websites make customers to consider your business more credible than other businesses that lack websites.

3.6.4 Round the Clock Availability

When your business has a website, it has the potential to serve the customers 24 hours a day, 7 days a week. This is because both in the day or night, people in other climates and regions could still access your website, and could buy your products and services.

3.6.5 Self Service Possibility

It is important to state that when a company has a website, customers are able get the information on their own. This ensures that there is no form of service break down, and thus leads to growth of the company.

3.6.6 Increase in Productivity

The presence of websites could lead to increase in productivity, through contributing to increased activities.

3.6.7 Location Independence

The location of a business enterprise does not in any way affect the website, and vice versa. Thus, even when a business location changes, all that the management needs to do is to simply modify the website to reflect the current location. This makes things very easy.

3.6.8 IT-Compliance

The existence of a website for a business enterprise, especially in tourism and hospitality industry makes the business to be IT Compliant. In other words, the absence of such a website makes the company to look old fashioned and archaic to educated customers. This could be viewed as an anomaly, which could make people to desert the company.

Self-Assessment Exercises 3

Mention two benefits of website for an organization.

3.7 Classification in terms of webpage types

There are two classes of websites, in terms of the types of web pages. These are:

- a. Static Website

b. Dynamic Websites

3.7.1 Static Website

A static website is a type of website whose pages do not change. Some other facts related to static website is as follows.

- a. The webpages that make up a static website remain the same, until they are manually changed.
- b. Static websites are easy to create, maintain, and host.
- c. Complex web programming is not really needed in order to come up with a static website.
- d. Static websites can be created mainly by use of HTML (Hypertext Markup Language), which is a language that makes use of various tags in order to create websites.
- e. A static website can be compared to a brochure or template for a business that retains the same information year in, year out, until updated.
- f. All you need in order to view a static website is to have internet connection, and to open a browser on your computer or whichever device you are using to access the Internet.
- g. When viewing a static website, the content or webpage is taken directly from the file stored in the server somewhere in any part of the world.

3.7.1.1 Benefits of Static Websites

There are a number of benefits that could be derived from a Static Website. Some of these benefits are as follows:

- a. Creating a static website takes little time.

- b. The cost of building a static website is very minimal.
- c. The static webpages are delivered at a fast speed by the server where they are stored.
- d. The cost of hosting such websites is low.

3.7.2 Dynamic Website

A dynamic website is a direct opposite of a static website. This is a type of website whose pages change. Some other facts related to dynamic website is as follows.

- a. A dynamic website is a collection of web pages whose content changes dynamically.
- b. Unlike static website, the webpages that make up dynamic website are created using more complex technologies.
- c. For instance, you need to use a specialized programming technique called web programming in order to create it.
- d. The contents of dynamic websites can also be altered or updated using what is known as Content Management System (CMS).

3.7.2.1 Benefits of Dynamic Website

There are a number of benefits that could be derived from a Dynamic Website. Some of these benefits are as follows:

- a. Dynamic websites are more professional than static websites.
- b. Dynamic websites can be used for e-commerce, unlike static websites which are limited.

- c. Dynamic websites can be built using programming, unlike static websites that could be created using simple designs.

Self-Assessment Exercises 4

The opposite of static website is _____

3.8 Classification in terms of purpose and target audience

There are a number of classifications of websites in terms of their purpose and target audience. These are:

3.8.1 Blog

A blog is a simple website, which is most of the time owned by a single person, or a small group of persons. Other facts about a blog are:

- a. Blog posts are added regularly in reverse chronological order.
- b. This implies that the latest entries are on top of the main page, while the old ones are located towards the bottom.
- c. A blog is comparable to the release of a daily diary.
- d. The content in a blog could be presented in an informal or conversational style.
- e. A blog usually focuses on a particular subject matter.
- f. Examples are love blog, music blog, academic blog, et cetera.
- g. The content of a blog is usually known as a blog post.

- h. The information in a blog such as articles, photos, and videos are updated regularly on a daily basis to keep readers engaged.
- i. The rate of visit to blog is usually referred to as traffic. The more the traffic to a blog, the better.
- j. In blogs, readers have the opportunity to leave their comments about the posts.

3.8.2 Online Community

An online community is a website, which offers a platform for people to interact and share ideas with their neighbours. Other facts about online community websites are:

- a. This type of website brings people of similar interests and backgrounds together, and gives them a platform to interact.
- b. Their objective may be to promote a particular product or service.
- c. Other objectives may be to gather research-based feedback about their products, or to ask questions related to a survey.
- d. Another name for online communities is Online Forum.
- e. Most forum websites are designed to focus on technology, games, hobbies such as photography, cooking, et cetera.
- f. Three very popular internet forums are Reddit, Quora and Stack Overflow.
- g. Reddit is an old-fashioned discussion forum, where millions of people converge every day to discuss politics, technology, et cetera. The site is divided into sub-Reddit, with each user choosing which sub-Reddit they would like to subscribe to according to interest. Reddit is a very active community of

entrepreneurs who help each other find the best solutions to their personal questions.

- h. Quora is another online forum. It was founded in June 2009 by Adam D'Angelo and Charlie Cheever. Quora is a question and answer (Q & A) site where participants can ask their questions and get their answers. Quora allows members to create personalized homepages at will. The genius behind Quora is that users can vote on particular questions to determine which view is supported by a greater number of persons.
- i. Stack Overflow is a forum where students, researchers and professionals could post queries and answer questions, especially about computer science, particularly in the area of programming. In other words, Stack Overflow is a platform dedicated to showcasing knowledge. It is a free community where programmers converge to write quality answers, and by so doing, help themselves mutually.

3.8.3 Social Media

Social Media sites are more specialized than forums. Other facts about social media websites are as follows:

- a. These sites provide users a platform for social interactions.
- b. For this to be effective and realistic, a lot of features are provided, so that users can easily build their personal profiles in a very attractive manner.
- c. In such sites, users can also create friend, send friends request, accept friends request, block a friend, et cetera.
- d. In this type of site, people can create groups, join groups, et cetera.
- e. Examples of such sites are Facebook, Instagram, et cetera.

3.8.4 E-commerce website

The e-commerce websites are online shops where people can login to buy, and also to sell their products and services. Other facts about e-commerce websites are as follows:

- a. Buying of products on the e-commerce websites are made as convenient as possible.
- b. This is achieved through the use of online payment systems.
- c. People who wish to sell products online can create an E-commerce site instead of setting up traditional physical shops.
- d. Examples of e-commerce websites are Amazon, E-Bay, Konga, et cetera.

3.8.5 Informational website

These are websites created to provide free online information to users.

- a. Examples of such websites are tutorial sites, news sites, et cetera.
- b. Others are Newspapers online, Libraries online, Books online, et cetera.

3.8.6 Portal

A portal is a website that offers a broad range of services. Other facts about a portal are:

- a. A portal is usually owned and managed by an institution.
- b. Examples are employee portal, University Portal, Jamb Exam Portal, et cetera.
- c. Because of the importance of a portal and its contents, most portals are protected with passwords.

- d. There are also general portals such as Facebook portals, et cetera, which require password to access.
- e. Portals are in the category of dynamic websites.

3.8.7 Government websites

A government website is a type of websites created and owed by government. The major objective is to inform the public about government activities. It could be owned by different arms of a government such as a department, local government, state government, judiciary, et cetera.



3.9 Summary

This unit focused on the fundamentals of websites. The areas covered are meaning of URL, Anatomy of URL, Top Level Domain, Benefits of a website with specific focus on Cost Effective Marketing, Wider Reach, User Friendly Medium, Round the Clock Availability, Self Service Possibility, Increased Productivity, Location Independence and IT Compliance. Also studied are the Classification of websites in terms of Static and Dynamic webpage types, and the benefits of each option. The Classification of websites in terms of purpose and target audience, with focus on the seven options, which are Blog, Online Community, Social Media, E-commerce website, Informational website, Portal, and Government websites, was also presented. A number of Self-Assessment exercises were also answered.

3.10 Glossary

HTML Hypertext Markup Language



3.11 References/Further Readings

NIL



3.12 Possible Answers to SAEs

These are the answers to the SAEs within the content.

Answers to SAEs 1

This is because https is secured, while http is not.

Answers to SAEs 2

Education and Nigeria

Answers to SAEs 3

Round the Clock Availability and Increase in Productivity:

Answers to SAEs 4

Dynamic Website

UNIT 4: WEB BROWSERS AND SEARCH ENGINES

Unit Structure

- 4.1 Introduction
- 4.2 Learning Outcomes
- 4.3 What is Internet Browser?
 - 4.3.1 Table of Common File Extensions
 - 4.3.2 The Browser as a Client Program
- 4.4 History of Internet Browsers
- 4.5 How Browser Works
- 4.6 List of Internet Browsers
 - 4.6.1 Microsoft Edge
 - 4.6.2 Opera
 - 4.6.3 Apple Safari

- 4.6.4 Google Chrome
- 4.6.5 Mozilla Firefox
- 4.6.6 Internet Explorer
- 4.7 Web Search Engines
 - 4.7.1 What is a Search Engine?
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 - 4.7.2.4 Ask.com
- 4.8 Summary
- 4.9 Glossary
- 4.10 Reference
- 4.11 Possible Answers to Self-Assessment Exercises



4.1 Introduction

In order to effectively use the Internet to solve our problems, it is necessary for one to have a good knowledge of browsers and search engines. The Internet Browsers and Search engines will be explored in this section of this lecture note.



4.2 Learning Outcomes

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

- Explain Internet Browser.
- Present a table of Common File Extensions.

- Discuss the Browser as a Client Program
- Discuss the History of Internet Browsers and how the browser works
- Enumerate the major internet browsers such as Microsoft Edge, Opera, Apple Safari, Google Chrome, Mozilla Firefox and Internet Explorer.
- Discuss Web Search Engines
- Discuss some popular search engines such as Google, Bing, Yahoo! and Ask.com



4.3 What is Internet Browser?

A browser is a software program used to retrieve information stored on the World Wide Web, and to display it for users' consumption. Such information retrieved and displayed by the browser could be in form of:

- a. Images or pictures.
- b. Web pages.
- c. Ordinary Text Files.
- d. PDF Files
- e. Other forms of files.

4.3.1 Table of Common File Extensions

Given a file name xyz.abc, xyz is the actual filename, while abc is the file extension. The extension of a file usually comes after the full-stop in the file name. You can use the extension of a file to identify the type of file it is. The following table lists examples of 41 common file extensions, for a file known as example.

S/N	Extension	Type of File	Example
1.	.DOCX	Microsoft Word File	example.docx
2.	.HTML	Hypertext Markup Language File	example.html

3	.PDF	Portable Document Format File	example.pdf
4	.TXT	Text File	example.txt
5	.PPTX	Microsoft PowerPoint File	example.pptx
6	.CSV	Comma Delimited File	example.csv
7	.JPEG	Joint Photographic Experts Group	example.jpeg
8	.PNG	Portable Network Graphics	example.png
9	.GIF	Graphics Interchange Format	example.gif
10	.TIFF	Tagged Image File	example.tiff
11	.PSD	Photoshop Document	example.psd
12	.AI	Adobe Illustrator	example.ai
13	.MP3	MP3 audio file	example.mp3
14	.WAV	WAV file	example.wav
15	.RAR	RAR file	example.rar
16	.ZIP	Zip compressed file	example.zip
17	.DBF	Database file	example.dbf
18	.LOG	Log file	example.log
19	.MDB	Microsoft Access file	example.mdb
20	.SQL	SQL database file	example.sql
21	.VCF	E-mail contact file.	example.vcf
22	.BAT	Batch file	example.bat
23	.BIN	Binary file	example.bin
24	.EXE	Executable file	example.exe
25	.BMP	Bitmap image	example.bmp

26	.CSS	Cascading Style Sheet file	example.css
27	.PART	Partially downloaded file	example.part
28	.PHP	PHP file	example.php
29	.PY	Python file	example.py
30	.CLASS	Java class file	example.class
31	.JAVA	Java Source code file	example.java
32	.RTF	Rich Text Format	example.rtf
33	.SWIFT	Swift source code file	example.swift
34	.BAK	Backup file	example.bak
35	.CFG	Configuration file	example.cfg
36	.DRV	Device driver file	example.driv
37	.SYS	Windows system file	example.sys
38	.TMP	Temporary file	example.tmp
39	.MP4	MPEG4 video file	example.mp4
40	.MPEG	MPEG video file	example.mpeg
41	.WMV	Windows Media Video file	example.wmv

4.3.2 The Browser as a Client Program

A browser is said to be a client program because it runs on a user computer or mobile device and contacts another computer known as webserver in order to access the information requested by the user. In response, the web server sends the response back to the browser that displays the results on internet supported devices. Thus, the browser sends requests to web servers, wherever on the Internet, by using a set of rules or protocols. The exact protocol used is called HTTP (hypertext transfer protocol).

Self-Assessment Exercises 1

PDF stands for _____ while CSV stands for _____

4.4 History of Internet Browsers

The following table summarizes the historical events leading to the development of internet browsers.

Year	Historical Events
1990	The first web browser was created by Tim Berners-Lee, who was the Director of W3C, which was later renamed Nexus.
1992	In 1992, the Lynx browser was invented. It was a text-based browser, which could display graphical contents.
1993	The first graphical user interface browser called NCSA Mosaic was introduced in 1993. It was one of the most popular browsers in the world.
1994	In 1994, there were some improvements in Mosaic, leading to Netscape Navigator.
1995	The first browser developed by Microsoft known as the Internet Explorer was introduced in the year 1995.
1996	In the year 1994, a research project began on Opera. This was successfully concluded, and Opera was finally introduced to the public in the year 1996.
2003	The Internet browser known as Apple's Safari was introduced in

	the year 2003. This browser was specifically released for Macintosh computers.
2004	In the year 2004, Firefox was introduced as Netscape Navigator by Mozilla.
2007	In the year 2007, a browser called Mobile Safari was released. It is an Apple mobile web browser.
2008	Google Chrome was released in 2008. This is a very popular browser that is still in wide use today.
2011	The mobile-based browser Opera Mini was launched in the year 2011.
2015	In the year 2015, the Microsoft Edge browser was launched by Microsoft.

Self-Assessment Exercises 2

4.5 Who created the first web browser? the
 We w the
 results requested by users as they browse the Internet. Here is the summary.

STEP 1: A User makes a request. For instance, a user may wish to browse on a website www.nou.edu.ng. So, the user types this in the browser interface (address box) and presses ENTER key.

STEP 2: This request is passed to the domain name server (DNS). The DNS system works like a phone book by managing the mapping between names and numbers, thus translating requests based on names into IP addresses. The browser finds the IP address for the domain using DNS.

STEP 3: The browser initiates a connection with the server having the IP address supplied by the domain name server.

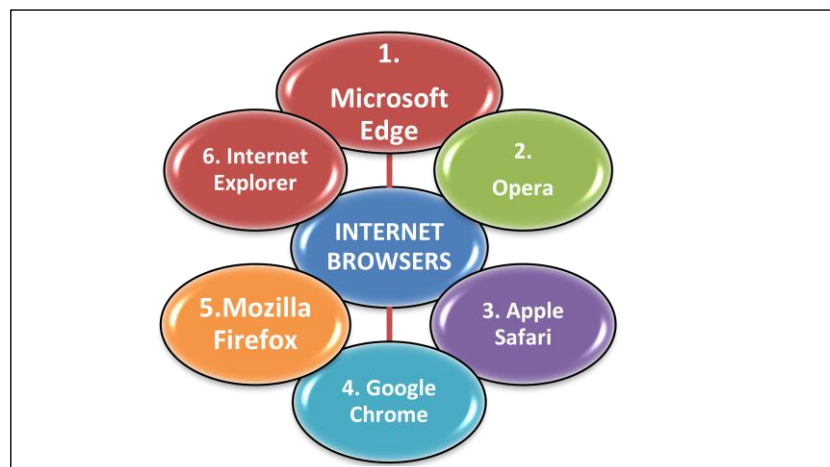
STEP 4: The browser sends an HTTP request to the webserver.

STEP 5: The server handles the request, as defined by the browser, and sends out an HTTP response.

STEP 6: Finally, the browser gathers all the necessary information requested by the user, and displays on the screen of the device. This is displayed in form of web pages.

4.6 List of Internet Browsers

It is important to do a brief study of some of the popular web browsers as shown in the following diagram.



4.6.1 Microsoft Edge

The Microsoft Edge is a web browser that comes pre-installed with Windows 10 as well as Windows Server 2016. Other important facts about Microsoft Edge are:

- a. Microsoft Edge was launched as a replacement for Internet Explorer Web browser.
- b. The code name for this browser was Spartan.
- c. A number of wonderful features were introduced with Edge, some of which are refined search, presentations for e-books, et cetera.
- d. The original code name Spartan was changed by Microsoft, to the current name Microsoft Edge in April 2015.
- e. Though Internet Explorer is also included in Windows 10 with Edge, Edge is the default browser.
- f. The Microsoft Edge technology enhances appreciable browsing speed.
- g. One disadvantage of Edge is that though it ensures fast or speedy browsing, it however requires at least 1 gigabyte of main memory.
- h. Microsoft Edge is good in the sense that it also provides better security compared to Internet Explorer.
- i. Moreover, Edge can also be combined with Cortana, Microsoft's virtual personal assistant.

Self-Assessment Exercises 3

Microsoft Edge can be combined with Microsoft's virtual personal assistant known as _____.

4.6.2 Opera

Some of the important facts about Opera browser are:

- a. Opera Internet browser was first conceived by Telenor Company in 1994.
- b. This was bought over by the Opera Software in 1995.
- c. Opera was initially conceived for desktop systems.
- d. Today, it is now more popular for mobile phones.
- e. An opera mini was released for smartphones in 2005.
- f. Opera mini can now be downloaded from the Apple play stores.

4.6.3 Apple Safari

Some of the important facts about Apple Safari browser are:

- a. Apple Safari internet browser is readily available for both the Macintosh, and Windows operating systems.
- b. It works with the iPhone, iPad, and iPod Touch.
- c. Apple Safari was launched by Apple, Inc. on 30 June 2003.
- d. Apple Safari is said to be the fourth most popular explorer after Microsoft Internet Explorer, Mozilla Firefox, and Google Chrome.
- e. This browser has a special technology known as WebKit engine, which is used for displaying graphics, page layout, et cetera.

4.6.4 Google Chrome

Some of the important facts about Google Chrome browser are:

- a. Google Chrome is an open-source browser.
- b. An Open source system is one that people can use free of charge.

- c. Google Chrome appears to be one of the most popular internet browsers used in accessing the web.
- d. Chrome was developed by Google in December 2008.
- e. Chrome browser can be used on several Operating Systems such as Windows, Linux, Mac OS X, Android, including iOS operating systems.
- f. It uses a special technique called sandboxing-based approach to provide web security.
- g. Sandboxing is a cybersecurity practice of running codes and analysing its results in a controlled environment. The major aim is to stop untrusted code from successfully activating what is not expected of it.
- h. Furthermore, Chrome also supports web standards like HTML5 and CSS (cascading style sheet).
- i. Since year 2010, the Chrome Web Store was introduced into Google Chrome. This is to enable users to buy and install web-based apps with ease.

4.6.5 Mozilla Firefox

Some of the important facts about Mozilla Firefox are:

- a. Just like Google Chrome, Mozilla Firefox is also an open-source web browser.
- b. Firefox is characterized with fast download speeds.
- c. Mozilla Firefox uses a technology called Gecko layout engine to translate web pages.

- d. The Gecko engine has the ability to execute current and predicted web standards.
- e. Mozilla Firefox provides user protection against spyware and malicious websites.
- f. The Firefox version 2.0 was launched in the year 2006.
- g. The new versions of Firefox have the ability to search multiple search engines simultaneously.

4.6.6 Internet Explorer

Some of the important facts about Internet Explorer are:

- a. Internet Explorer is a free web browser.
- b. It is commonly referred to with the acronym IE (Internet Explorer) or MSIE (Microsoft Internet Explorer).
- c. IE was introduced by Microsoft in the year 1995.
- d. IE was introduced as a response to Netscape Navigator which was the first geographical browser.
- e. In other words, the Explorer was very popular, as its capability clearly surpassed that of the Netscape Navigator from its inception.
- f. The IE was able to handle network file sharing, several internet connections, and security settings, and so on.

4.7 Web Search Engines

It is important to begin by giving a definition of what a search engine means, and then listing some popular search engines.

4.7.1 What is Search Engine?

A search engine is a software program that searches specific documents or repositories and thereafter, returns a list of items that were found, or are very close what were specified in the original search request. On the other hands, a web search engine is a software system that carries out web search. This implies that it searches the web in a systematic way for particular information specified by the user. The original request typed by the user, containing the request made, is known as a search query. Other facts about a web search engine are:

- a. A web search engine usually collects and organizes content from all over the web in order to satisfy a query issued by a user.
- b. Usually, the user issues a query composed of keywords or phrases, and the search engine provides a list of results that best matches the user's query.
- c. The operation of the search engine can be broken down into three phases.
- d. First stage involves trying to discover the information that answers the question or query of the user.
- e. The secondly stage involves trying to organize so it can be presented to the user.
- f. The third stage is to ensure the response satisfies the user query.
- g. Three major advanced techniques are used to achieve these.
- h. They are known as crawling, indexing and ranking, all of which are advanced, and will not be discussed here.

4.7.2 Popular Web Search Engines

Some of the popular web search engines are as follows.

4.7.2.1 Google

Google is the largest search engine in the world today. On a daily basis, it is estimated to handle over 6 billion search requests. This is quite enormous! Google Search Engine was originally developed by Larry Page and Sergey Brin in 1997, and has today become so successful that it has become synonymous with search engine services.

4.7.2.2 Bing

Bing was launched in 2009, and was some time ago, rated as a rival to Google, but has been overtaken by Google. However, Bing is available in at least 40 different languages.

4.7.2.3 Yahoo!

Yahoo! Search is also a big player in the search engine technology.

4.7.2.4 Ask.com

This search engine was originally known as Ask Jeeves. Ask.com differs from Google and Bing, as it uses a question-and-answer format.

4.8 Summary

This unit focused on the study of Web Browsers and Search Engines. The areas covered are what an Internet Browser means, exploration of a table of Common File Extensions, appreciating the Browser as a Client Program. Others are History of Internet Browsers and how the browser works, study of the major internet browsers such as Microsoft Edge, Opera, Apple Safari, Google Chrome, Mozilla Firefox and Internet Explorer. Also studied in this unit are fundamentals of Web Search Engines. Examples of search engines covered are Google, Bing, Yahoo! and Ask.com

4.9 Glossary

CSS Cascading Style Sheets

4.10 Reference

NIL

3.11 Possible Answers to SAEs

Answers to SAEs 1

PDF stands for Portable Document Format File while CSV stands for Comma Delimited File

Answers to SAEs 2

The first web browser was created by Tim Berners-Lee

Answers to SAEs 3

Cortana

MODULE 4

MISCELLANEOUS HANDS-ON TOPICS

Course Writing Template for Course Writers

UNIT 1: NUMBER BASE ARITHMETIC

Unit Structure

- 1.1 Introduction
- 1.2 Learning Outcomes
- 1.3 Types of Number Bases
- 1.4 Representation using Subscript
- 1.5 Binary Addition
- 1.6 Conversion from Base to Base
 - 1.6.1 Conversion from Base 10 to Base 2
 - 1.6.2 Conversion from Base 2 back to Base 10

- 1.6.3 Conversion from Base 10 to Base 8
- 1.6.4 Conversion from Base 8 back to Base 10
- 1.6.5 More Solutions
- 1.7 Summary
- 1.8 Glossary
- 1.9 References/Further Readings
- 1.10 Possible Answers to Self-Assessment Exercises



1.1 Introduction

As already mentioned in the earlier modules, computer does its arithmetic mainly in binary unit. Thus, the unit of memory sizes is in groups of bits. A bit is a binary integer, which could be a '0' or '1', representing absence or presence of an electronic property respectively. A group of 8 bits make up a byte, and so on. The machine language which is closest to the hardware is written in binary digits. Because of the importance of this topic, it is necessary to give a basic introduction of number base arithmetic.



1.2 Learning Outcomes

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

- Explain Types of Number Bases
- Explain Representation using Subscript.
- Perform Binary Addition
- Perform Conversion from Base to Base with specific focus on Conversion from Base 10 to Base 2, Conversion from Base 2 back to Base 10, Conversion from Base 10 to Base 8, Conversion from Base 8 back to Base 10.
- Solve a number of other issues related to number bases.



1.3 Types of Number Bases

There are many types of number bases. The special names given to different number bases, as well as the enumeration of specific numbers that make up such bases, are listed in the following table.

Name of Base	Base	Numbers Contained in the Base
Binary	2	0 , 1
Ternary	3	0,1, 2
Quaternary	4	0,1,2,3
Quinary	5	0, 1, 2, 3, 4
Senary	6	0, 1, 2, 3, 4, 5
Septenary	7	0, 1, 2, 3, 4, 5, 6
Octal	8	0, 1, 2, 3, 4, 5, 6, 7
Nonary	9	0, 1, 2, 3, 4, 5, 6, 7, 8

Decimal	10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Undecimal	11	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A
Duodecimal	12	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B
Hexadecimal	16	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

Before delving into a number of calculations as will be done in this chapter, the following facts should be noted:

- a. As shown in the table, the letters A, B, C, and so on, are used to represent numbers in bases higher than 10.
- b. Therefore, in Hexadecimal which is base 16, the number 10 is designated as A, 11 is designated as B, 12 is designated as C, 13 is designated as D, 14 is designated as E and 15 is designated as F respectively.
- c. The normal human mathematics is usually in Base 10 that is decimal.
- d. It is possible to convert from one base to another.
- e. The most common base for computer arithmetic is Binary (base 2), though other bases, such as Octal, Decimal and Hexadecimal, are also useful.
- f. Our focus in this lecture note will be limited to bases 2, 8, 10 and 16 only.

Self-Assessment Exercises 1

Base 16 is known as _____

1.4 Representation using Subscript

The standard way to represent numbers in their bases is to indicate the base as subscripts. This implies that given ABC in base Z, where ABC and Z are integers, this can be represented as ABC_Z . Here are other examples.

Example 1:

Given that 10110 is in base 2, it should be written as 10110_2 .

Example 2:

Given that 20673 is in base 8, it should be written as 20673_8 .

Example 3:

Given that 871162 is in base 10, it can be written as 871162_{10}

Example 4:

Given that 8A7B34C is in base 16, it should be written as $8A7B34C_{16}$

1.5 Binary Addition

In order to effectively perform addition in base two, the following rules are very important, and should be borne in mind.

Operand 1	Operator	Operand 2	Result
0	PLUS	0	0
0	PLUS	1	1
1	PLUS	0	1
1	PLUS	1	0 Carry 1

Example 5:

Add the two binary numbers 1011 and 1101.

Solution:

	1	0	1	1
	1	1	0	1
1	1	0	0	0

Therefore, the sum 1011_2 and 1101_2 is 11000_2

Example 6:

Add the two binary numbers 1110011_2 and 1000100_2

Solution:

1	1	1	0	0	1	1	
1	0	0	0	1	0	0	
<hr/>							
1	0	1	1	0	1	1	1

Therefore the sum of 1110011_2 and 1000100_2 is $1\ 0110111_2$

Self-Assessment Exercises 2

The sum of 100 and 11 and 1 in base 2 is _____

1.6 Conversion from Base to Base

The next task in this lecture note is to study conversion steps from one base to another.

The following conversion steps shall be covered:

- Conversion from Base 10 to Base 2
- Conversion from Base 2 to Base 10
- Conversion from Base 10 to Base 8
- Conversion from Base 8 to Base 10

1.6.1 Conversion from Base 10 to Base 2

The process of conversion from Base 10 to base 2 follows a well-defined algorithmic step.


Suppose we have a task to convert X in base 10 to Z in base 2. The algorithm is as follows:

- STEP 1: Place X and 2 side by side, in preparation for a continuous division by 2.
- STEP 2: Begin to divide X by 2, and at every step, write the numerical quotient first.
- STEP 3: This is followed by R then the remainder.
- STEP 4: Continue to do steps 2 and 3 until there is nothing to divide.
- STEP 5: Collate the binary digits by picking in a reversed order as they were generated.
- STEP 6: Final result Z is the binary number resulting from STEP 5.

Example 7: Convert $(45)_{10}$ into binary.

Solution:

2	45		
2	22	R	1
2	11	R	0
2	5	R	1
2	2	R	1
2	1	R	0
	0	R	1




The answer in binary is 101101_2

Example 8: Given that $372_{10} = X_2$, find X.

Solution:

2	372	R	
2	186	R	0
2	93	R	0
2	46	R	1
2	23	R	0
2	11	R	1
2	5	R	1
2	2	R	1
2	1	R	0
	0	R	1




The answer in binary $X=101110100_2$

Example 9: Convert 211_{10} to binary.

Solution

2	211		
2	105	R	1
2	52	R	1
2	26	R	0
2	13	R	0
2	6	R	1
2	3	R	0
2	1	R	1
2	0	R	1



Therefore $211_{10} = 11010011_2$

1.6.2 Conversion from Base 2 back to Base 10

The process of conversion from Base 2 back to Base 10 follows a well-defined algorithmic step. Suppose we have a task to convert Y from base 2 to base 10. The algorithm is as follows:

STEP 1: Create a table made up of two rows, and the same number of columns as the number of digits of the given binary number. For instance, if we are given a binary number 10111, then the table should have 5 columns, while if we are given binary number 1101010, then the table should have 7 columns.

STEP 2: Designate the first row for the binary number being converted, while the second row is what could be termed as the power row.

STEP 3: Write the given binary number on first row. Then on second row, insert 0, followed by 1, et cetera, from right hand side going left until all the cells are covered. For instance, if we are given the binary number 10111, then the table should be as follows.

1	0	1	1	1
4	3	2	1	0

STEP 4: For each of the columns, get the value of 2 raised to the power of the numbers in the second row. For example, we have 2^4 , 2^3 , 2^2 , and so on.

STEP 5: Multiply what you got in step 4 by the corresponding binary digit. Example for first column, we shall have 1×2^4 while in the next column we shall have 0×2^3 and so on.

STEP 6: Steps 4 and 5 are done for all the columns, and all the outcomes summed up.

STEP 7: The result is the number in base 10.

Example 10: Convert $(101110100)_2$ to X in Base 10.

Solution:

Binary	1	0	1	1	1	0	1	0	0
Power	8	7	6	5	4	3	2	1	0

$$\begin{aligned}
 X &= 1 \times 2^8 + 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\
 &= 1 \times 256 + 0 \times 128 + 1 \times 64 + 1 \times 32 + 1 \times 16 + 0 \times 8 + 1 \times 4 + 0 \times 2 + 0 \times 1 \\
 &= 256 + 64 + 32 + 16 + 4 \\
 &= (372)_{10}
 \end{aligned}$$

Example 11: Convert $(101101)_2$ to X in Base 10.

Solution:

Binary	1	0	1	1	0	1
Power	5	4	3	2	1	0

$$\begin{aligned} X &= 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\ &= 1 \times 32 + 0 \times 16 + 1 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1 \\ &= 32 + 0 + 8 + 4 + 0 + 1 \\ &= (45)_{10} \end{aligned}$$

Example 12: In tabular form, list the first ten digits in base 10 and their corresponding values in binary.

Solution:

The following table gives the solution to the above problem.

Number in Decimal	Binary Equivalent
0	0
1	1
2	10
3	11

Number in Decimal	Binary Equivalent
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010

1.6.3 Conversion from Base 10 to Base 8

The process of conversion from Base 10 to base 8 resembles the algorithmic step for converting from base 10 to base 2 studied earlier. The only difference is that rather than performing continuous division with 2, one uses 8 to perform the division. For the sake of clarity, the steps for converting from a number X in base 10 to base 8 will be listed as follows:

STEP 1: Place X and 8 side by side, in preparation for a continuous division by 8.

STEP 2: Begin to divide X by 8, and at every step, write the numerical quotient first.

STEP 3: This is followed by R then the remainder.

STEP 4: Continue to do steps 2 and 3 until there is nothing to divide.


STEP 5: Collate the base 8 digits by picking in a reversed order as they were generated.

STEP 6: Final result Z is the base 8 number resulting from STEP 5.

Example 13: Convert 1812_{10} into Octal (that is base 8).

Solution:

8	1812		
8	226	R	4
8	28	R	2
8	3	R	4
	0	R	3




The answer in Octal is $(3424)_8$

Example 14: Convert 5311_{10} into octal (that is base 8).

Solution:

8	5311		
8	663	R	7
8	82	R	7
8	10	R	2
8	1	R	2
	0	R	1



The answer in octal is $(12277)_8$

1.6.4 Conversion from Base 8 back to Base 10

The process of conversion from Base 8 back to Base 10 follows a step similar to the algorithmic step for converting from base 2 to base 10. The only major difference is that rather than powers of 2, we work with powers of 8. However, for the sake of clarity, the conversion steps will be outlined here.

Suppose we have a task to convert Y from base 8 to base 10. The algorithm is as follows:

STEP 1: Create a table made of two rows, and the same number of columns as the number of digits of the given Base 8 number. For instance, if we are given an octal

number 5142, then the table should have 4 columns, while if we are given an octal number 71346, then the table should have 5 columns.

STEP 2: Designate the first row for the octal number being converted, while the second row as the power row.

STEP 3: Write the octal number on first row. Then insert from 0, 1, 2, et cetera, on the second row, from right hand side going left until all the cells are covered. For instance, for the octal number 5142, the table should be as follows:

5	1	4	2
3	2	1	0

STEP 4: For each of the columns, get the value of 8 raised to the power of the numbers in the second row. For example, we have 8^3 , 8^2 , and so on.

STEP 5: Multiply what you got in step 4 by their corresponding base 8 digits. For example for first column, we shall have 5×8^3 while in the next column we shall have 1×8^2 and so on.

STEP 6: Steps 4 and 5 are done for all the columns, and all the outcomes summed up.

STEP 7: The result is the number in base 10.

Example 15: Convert $(5142)_8$ to X in Base 10.

Solution:

Octal	5	1	4	2
Power	3	2	1	0

$$X = 5 \times 8^3 + 1 \times 8^2 + 4 \times 8^1 + 2 \times 2^0$$

$$\begin{aligned}
&= 5 \times 512 + 1 \times 64 + 4 \times 8 + 2 \times 1 \\
&= 2560 + 64 + 32 + 2 \\
&= (2658)_{10}
\end{aligned}$$

Example 16: Convert $(26)_8$ to X in Base 10.

Solution:

Octal	2	6
Power	1	0

$$\begin{aligned}
X &= 2 \times 8^1 + 6 \times 8^0 \\
&= 2 \times 8 + 6 \times 1 \\
&= 16 + 6 \\
&= (22)_{10}
\end{aligned}$$

1.6.5 More Solutions

Example 17: In a tabular form, list the first 15 numbers in base 10 and their corresponding values in base 8.

Solution:

The following table gives the solution to the above problem.

Decimal Number	Octal Equivalent
0	0
1	1
2	2

Decimal Number	Octal Equivalent
3	3
4	4
5	5
6	6
7	7
8	10
9	11
10	12
11	13
12	14
13	15
14	16

Self-Assessment Exercises 3

If you convert 48 in base 10 to base 2, the result will be _____

1.7 Summary

The focus of this unit was on Number Base Arithmetic, which is very important in computer science. Areas covered are the Types of Number Bases, Representation of number bases using Subscripts, and Binary Addition. Other areas covered are Conversion from Base to Base, with specific focus on Conversion from Base 10 to Base 2, Conversion from Base 2 back to Base 10, Conversion from Base 10 to Base 8, and Conversion from Base 8 back to Base 10. A number of questions were solved, including Self-Assessment Exercises.

1.8 Glossary

Octal Refers to base 8.

1.9 Reference

NIL.

1.10 Possible Answers to SAEs

Answers to SAEs 1

Hexadecimal

Answers to SAEs 2

1000 in base 2

Answers to SAEs 3

110000 in base 2

UNIT 2: MICROSOFT WINDOWS OS

Unit Structure

- 2.1 Introduction
- 2.2 Learning Outcomes
- 2.3 History of Windows
- 2.4 Versions of Windows
 - 2.4.1 Windows 1 & 2
 - 2.4.2 Windows 3.x
 - 2.4.3 Windows 9x
 - 2.4.4 Windows NT
 - 2.4.5 Windows XP
 - 2.4.6 Windows Vista
 - 2.4.7 Windows 7

- 2.4.8 Windows 8 and 8.1
- 2.4.9 Windows 10
- 2.5 Summary
- 2.6 Glossary
- 2.7 References/Further Readings
- 2.8 Possible Answers to Self-Assessment Exercises



2.1 Introduction

Microsoft Windows, otherwise known simply as Windows is a graphical Operating System (OS) developed and marketed by an American multinational company Microsoft. Microsoft Windows is a proprietary operating system. It gives users the means to store files, run application software, watch videos, connect to the Internet., and so on. As already outlined in the definition section of this lecture note, an OS is a type of system software that provides an interface between computer user and the hardware. An operating system provides an avenue for performing basic tasks like:

- a. File management
- b. Process management
- c. Memory management
- d. Handling inputs and outputs

- e. Control of connected devices, such as printers, scanners, et cetera.

This study will focus on history of the Windows OS, and the different versions.



2.2 Learning Outcomes

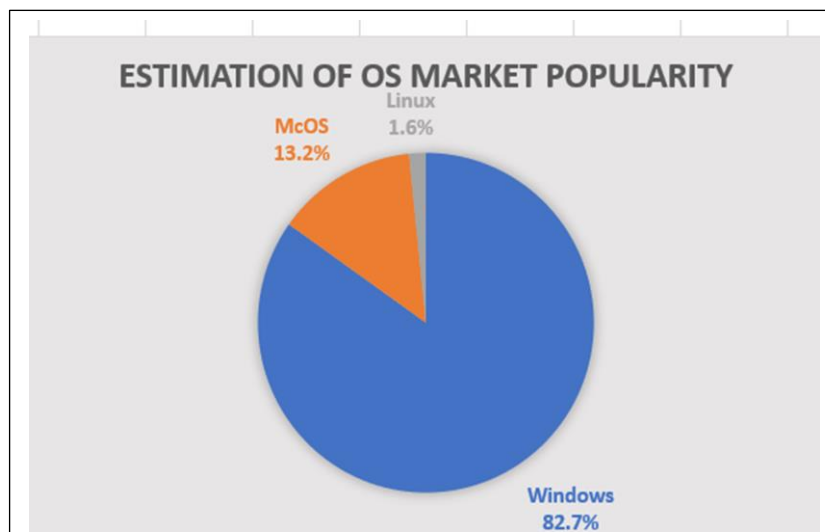
By the end of this unit, you will be able to:

- Discuss the History of Windows
- Briefly discuss Windows versions 1, 2, 3.x, 9x, NT, XP, Vista, 7, 8, 8.1 and Windows 10
- Answer self-assessment questions.



2.3 History of Windows

Microsoft first introduced Windows OS on November 20, 1985. The Windows OS has now become the most popular and dominant desktop OS. The following pie chart gives the current estimation of the market shares of Windows among two other competing Operating Systems.



As shown in the diagram, Windows accounts for about 82.7% of desktop OS markets while MacOS accounts for 13.2% and Linux accounts for just about 1.6%. It is therefore obvious that Windows is the most popular desktop, followed that Mac OS and then Linux. Windows was founded by Bill Gates. Again, the multinational company Microsoft was founded by Bill Gates and his childhood friend Paul Allen, on 4 April 1975 in Albuquerque, New Mexico.

Self-Assessment Exercises 1

Which OS currently has the largest market share?

2.4 Versions of Windows

2.4.1 Windows 1 & 2

The first version of Windows was Windows 1.0, which was just rudimentary at that early stage of development. This was followed by the second version known as Windows 2.0 introduced in December 1987. Windows 2.0 has some improved features in user interface and memory management.

2.4.2 Windows 3.x

The next major version of Windows was Windows 3.0, released in 1990. Thereafter, there were two upgrades which are Windows 3.1 released in 1992 and Windows 3.2 in 1994. Literature has it that the advent of Windows 3.x marked a major turning point in the commercial demands, as Microsoft sold about 2 million copies within the first six months of release.

2.4.3 Windows 9x

The two releases in this category are Windows 95 and Windows 98. Windows 95 was released on 24 August 1995. This version of Windows provided increased stability over previous ones, allowed for plug and play hardware, among other attributes. This was followed by Windows 98 in the year 1998.

2.4.4 Windows NT

The Windows NT was developed with the mindset of making the Operating System very secure. Another inbuilt strength is that it has multi-user capability. The different releases are Windows NT 3.1, NT 3.5, NT 3.5.1, NT 4.0 and Windows 2000.

2.4.5 Windows XP

The next major version of Windows is Windows XP, which was first released on 25 October 2001. One major breakthrough attribute of Windows XP is its networking features. Secondly, it was the first Windows version that was marketed in two main editions known as the Home Edition and the Professional Edition respectively. The target of the "Home" edition was the consumers whose interest is on personal computer use, while the focus of the "Professional" edition was towards business environments.

2.4.6 Windows Vista

Windows Vista was the direct successor to Windows XP. Windows Vista was released in two phases, first on November 2006 in what is known as volume licensing, restricted to manufacturers and business customers. The next phase of Vista release was in January 2007 for consumers. It had included a lot of new features such as new user interface, which entails an improved security.

2.4.7 Windows 7

Windows 7 and its Server edition known as Windows Server 2008 R2 were released as testing versions on July 2009. Thereafter, Windows 7 was released to the public about three months later. It is important to mention that a number of new features were

introduced into Windows 7, one of which is a home networking system known as Home Group. It is commonly agreed that Windows 7 is the most popular version of Windows to date.

Self-Assessment Exercises 2

Which Window is the direct successor to Windows XP?

2.4.8 Windows 8 and 8.1

The two releases in this category are Windows 8.0 and Windows 8.1 respectively. Windows 8 was released on October 26, 2012 as the successor to Windows 7. Windows 8.0 introduced a number of significant changes which supports touch-screen devices and laptops. The next version is Windows 8.1 which was released on 17 October 2013. It is important to mention that Windows 8 and Windows 8.1 removed the Start menu, an action that generated a lot of criticisms.

2.4.9 Windows 10

Windows 10 was released on 29 July 2015 as a successor to Windows 8.1.

Self-Assessment Exercises 3

Which version of Windows was released on 17 October 2013?



2.5 Summary

This unit focused on the study of Microsoft Windows OS. The areas covered are History of Windows and Versions of Windows. Specific versions covered are Windows 1, Windows 2, Windows 3.x, Windows 9x, and Windows NT. Others

covered are Windows XP, Windows Vista, Windows 7, Windows 8, Windows 8.1 and Windows 10. Self-Assessment Exercises were also answered.

2.6 Glossary

OS Operating Systems



2.7 References/Further Readings

NIL



2.8 Possible Answers to SAEs

Answers to SAEs 1

Windows

Answers to SAEs 2

Windows Vista

Answers to SAEs 3

Windows 8.1

UNIT 3: PROBLEM SOLVING IN OS

Unit Structure

- 3.1 Introduction
- 3.2 Learning Outcomes
- 3.3 Update Windows to Latest Version
- 3.4 Deletion of Temporary Files
- 3.5 Disabling Unwanted Start-up Program
- 3.6 Hard disk Defragmentation
- 3.7 How to Rename Your Computer
- 3.8 Summary
- 3.9 Glossary
- 3.10 References/Further Readings
- 4.11 Possible Answers to Self-Assessment Exercises



3.1 Introduction

A number of issues may happen while using the Operating Systems. When that happens, it is necessary to quickly proffer solutions. This section presents an outline of common problems and how they are practically resolved in Windows OS.



3.2 Learning Outcomes

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

- Update Windows to Latest Version
- Solve the problem of Deletion of Temporary Files
- Solve the problem of Unwanted Start-up Programs

- Solve the problem of Hard disk fragmentation
- Rename Your Computer
- Solve a number of other OS related problems
- Answer Self-Assessment questions

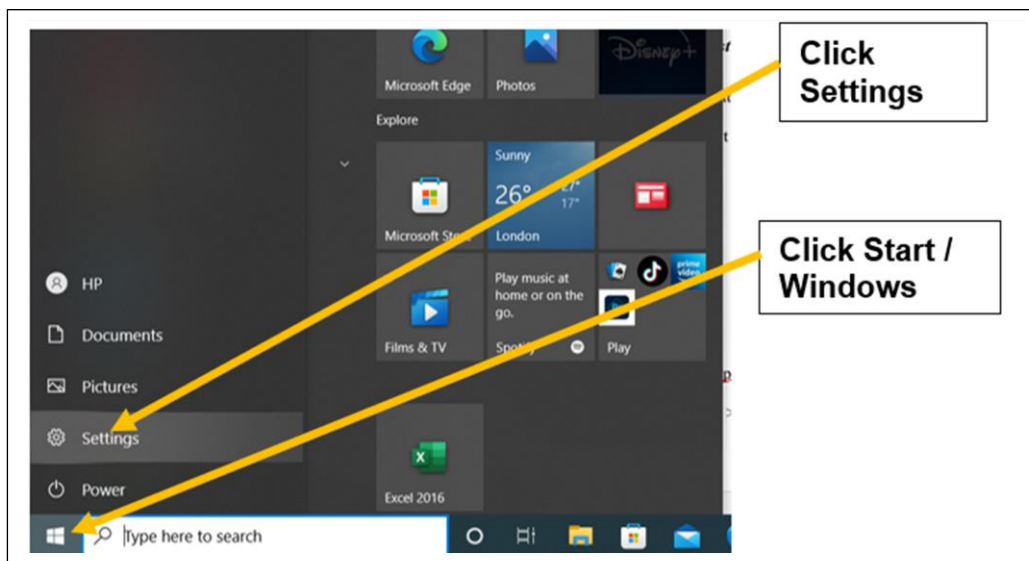


3.3 Update Windows to Latest Version

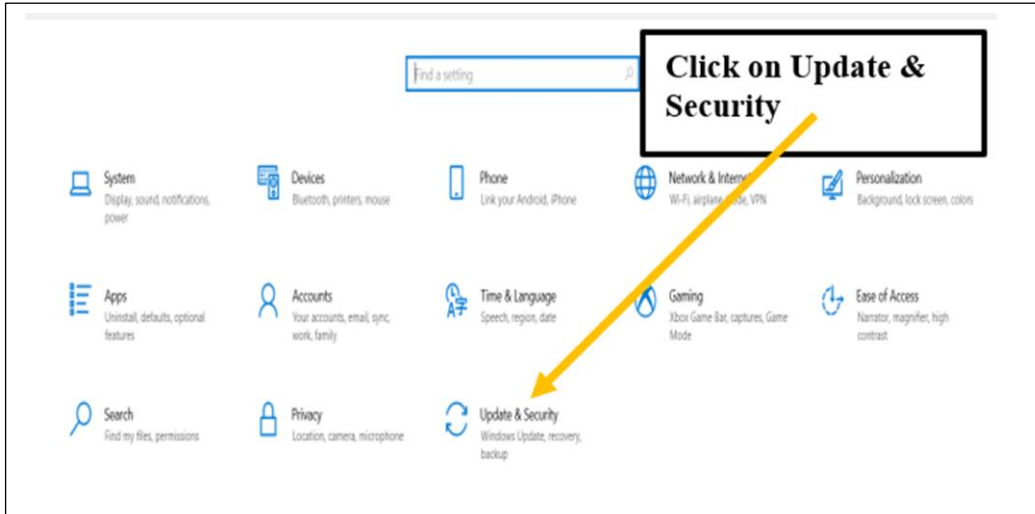
One of the ways to ensure that your computer works optimally is to ensure that the Windows OS is updated to its latest version. The steps for solving this problem, which may vary depending on the version of Windows in use, are outlined as follows:

STEP 1: Click on Start / Windows Key as shown in the following figure.

STEP 2: Click on Settings

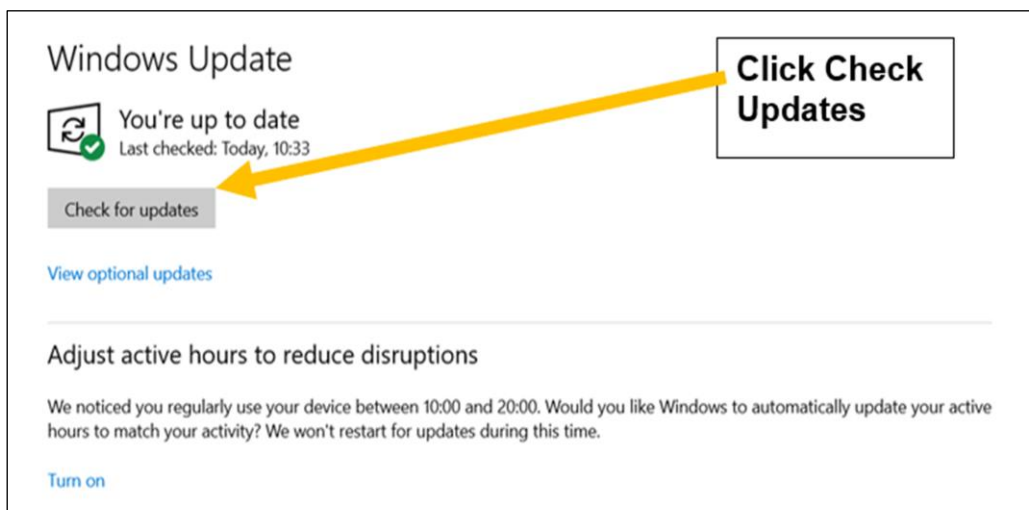


When you click Settings, a new screen appears as follows.



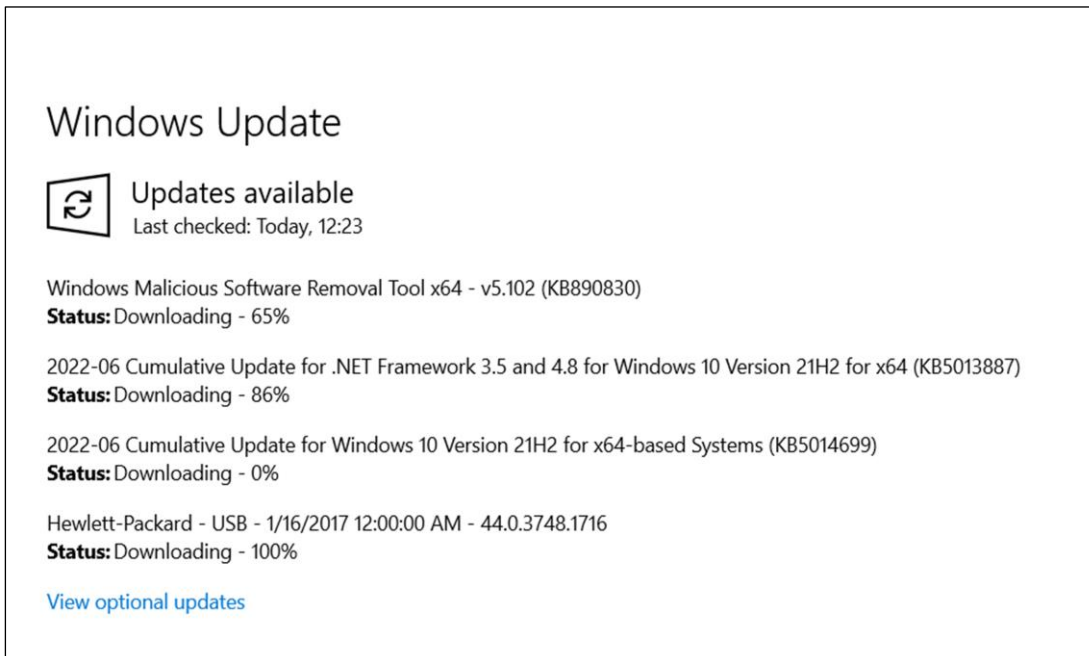
STEP 3: Next, Click on Update & Security

The result is that system displays the following screen.



STEP 4: Click on Check Updates.

Windows then searches to confirm if there are a number of pending updates. For instance, as at writing this manual, the following updates were reported pending on the writer's laptop as shown in the following figure.



In the figure, a total of four updates were pending. The update request triggers the process of update. Thus, first item is 65% download completed, second item is 86% download completed, third item is 0% download completed, and the fourth item is 100% download completed respectively. Immediately after each of the four items is 100% download completed, system proceeds to perform the installation. Then after Installation, system requests for system restart. It is important to note that windows update is important to improving the performance of the OS, as well as control of malicious software.

Self-Assessment Exercises 1

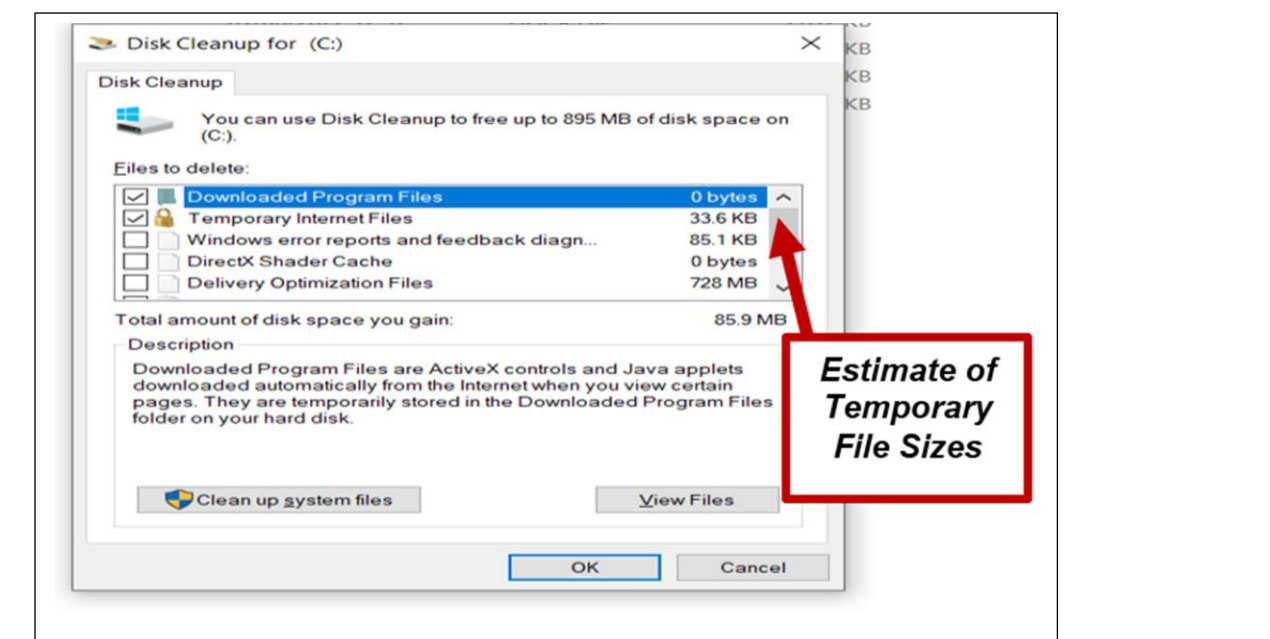
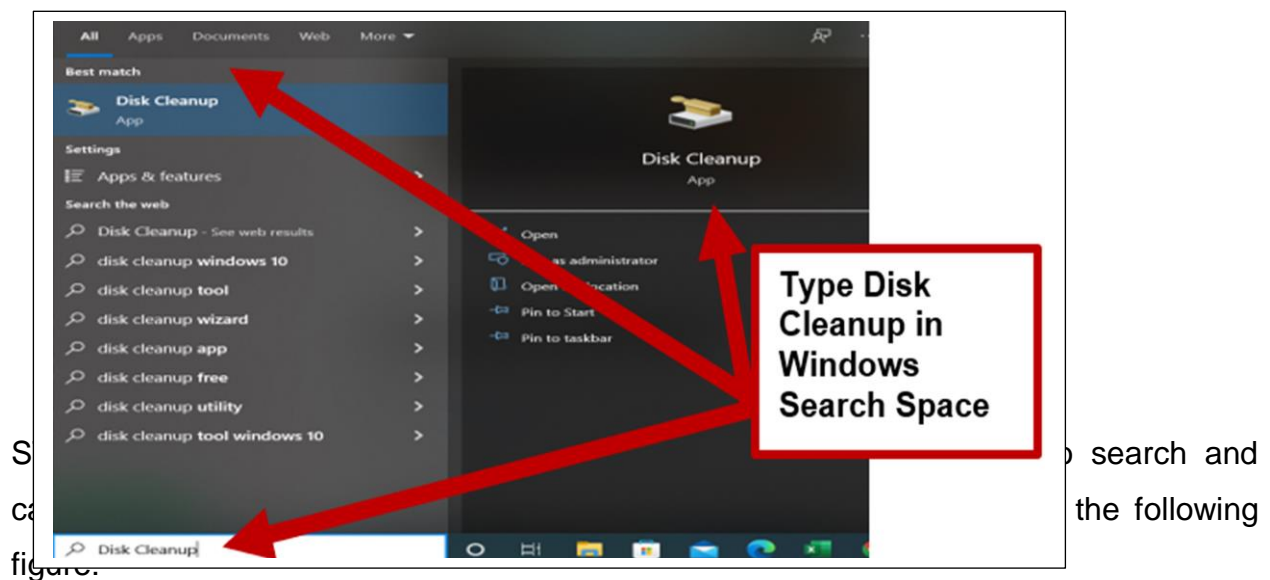
One of the ways to ensure that your computer works optimally is to ensure that the Windows OS is updated to the _____

3.4 Deletion of Temporary Files

It is a well-known truth that unwanted temporary files could clog the system and slow down its operations. One of the ways to ensure that your computer works optimally is to ensure that such temporary files are searched for, found and deleted from the Windows OS. The steps for solving this problem are outlined as follows:

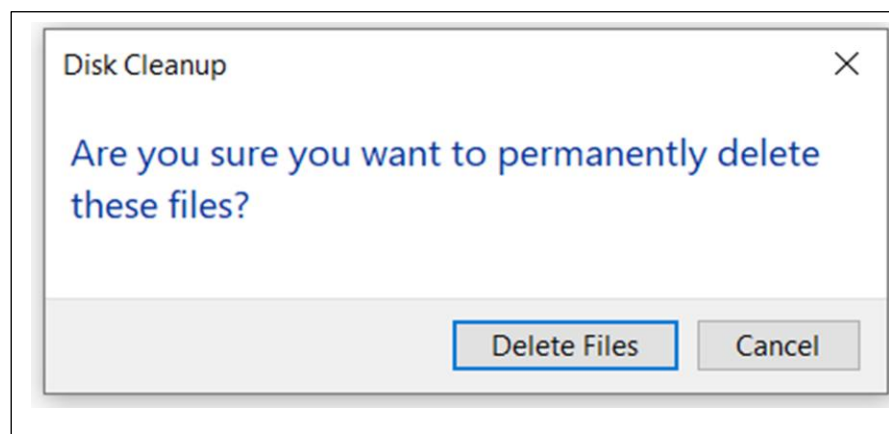
STEP 1: Type **Disk Cleanup** in the Windows Search Space as shown in the next diagram.

STEP 2: System will display the **Disk Cleanup App**, waiting for user to click on it.



STEP 4: The User should then select the temporary files to delete. This is done by clicking on the Check Boxes at the Right-Hand Side of the displayed figure.

STEP 5: When the user is done with selecting the options to clean up, he/she clicks OK. The system brings a confirmation screen asking “Are you sure you want to permanently delete these files”. This is to know if system should proceed with deletion.



STEP 6: To conclude the process, user should click on “Delete Files” to proceed with final permanent deletion or “Cancel” if the person changed his or her mind.

Self-Assessment Exercises 2

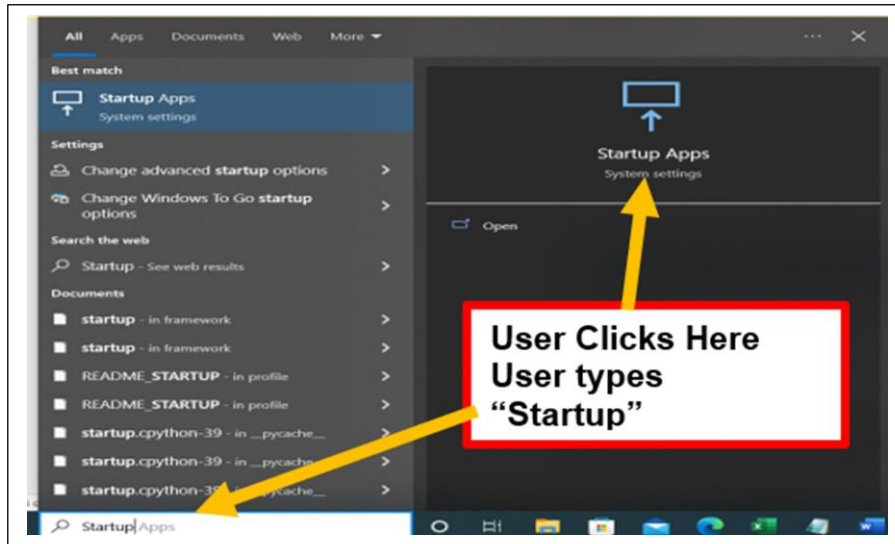
When a user attempts to permanently delete a file, what question will the system ask?

3.5 Disabling Unwanted Start-up Program

A program set to start on booting the computer is said to be set On at start-up. Unnecessary programs at start-up could slow down the system, and make it to crawl. One way to speed up your system is to review the programs set to run at start-up, and to disable all the irrelevant or unwanted ones. The steps for solving this problem are outlined here:

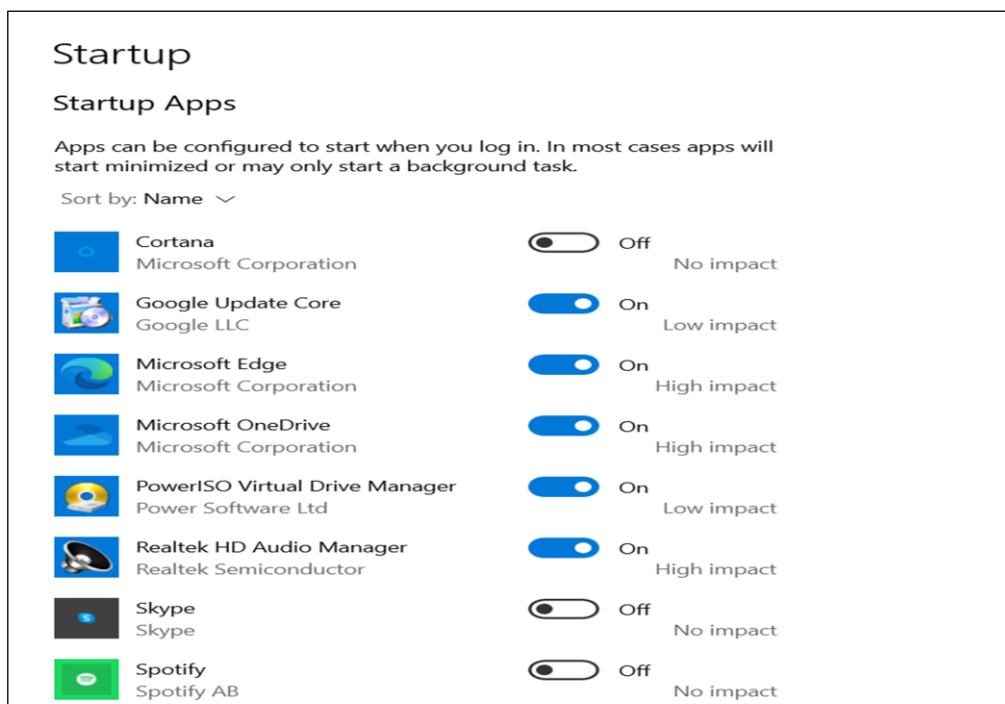
STEP 1: Type “Startup” in the Windows Search Space as shown in the next diagram.

When this is done, system will display the following Startup Apps screen, which awaits user’s mouse click.



STEP 2: Click Startup Apps.

When this happens, the system will display all the apps that have been setup to run at start-up as shown in the following figure:



As shown in the figure, a user is allowed to change the status of any apps to On or to Off, at start-up. For instance, in the figure, “Cortana”, “Skype” and “Spotify” are set to Off, while the rest are set to On status.

STEP 3: Perform a careful review of the applications listed, and note the ones that you feel like disabling from start-up.

STEP 4: Click the Off Option to disable any application from start-up.

3.6 Hard disk Defragmentation

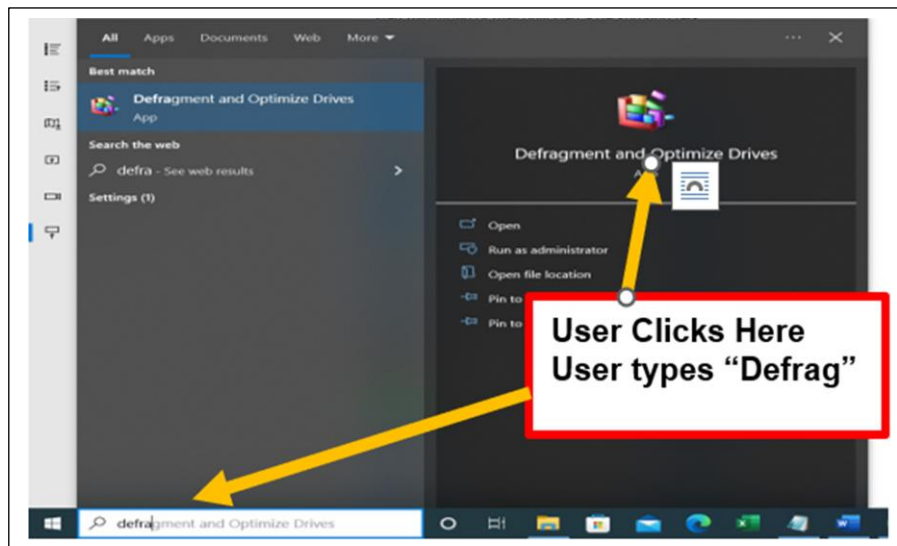
Fragmentation is a disk problem, where data in the disk seems to be in non-contiguous states. This is usually solved by a process known as **defragmentation**. Thus, defragmentation is defined as the process of re-arranging the non-contiguous bits of data into sequential and easily accessible blocks on the hard drive. The major benefit is to make the disk more optimized. This process filters out the unused free space in the hard disk, and also speeds up the system. Some of the causes of fragmented hard drive are:

- a. Saving of large files, such as videos, when adequate contiguous space could not be found.
- b. Deletion of files, which are not necessarily contiguous.

When disks are defragmented, there is visible upgrade to their performances. Note that in Windows 7.8 and 10 this process can be scheduled to run automatically. We will demonstrate the manual option here.

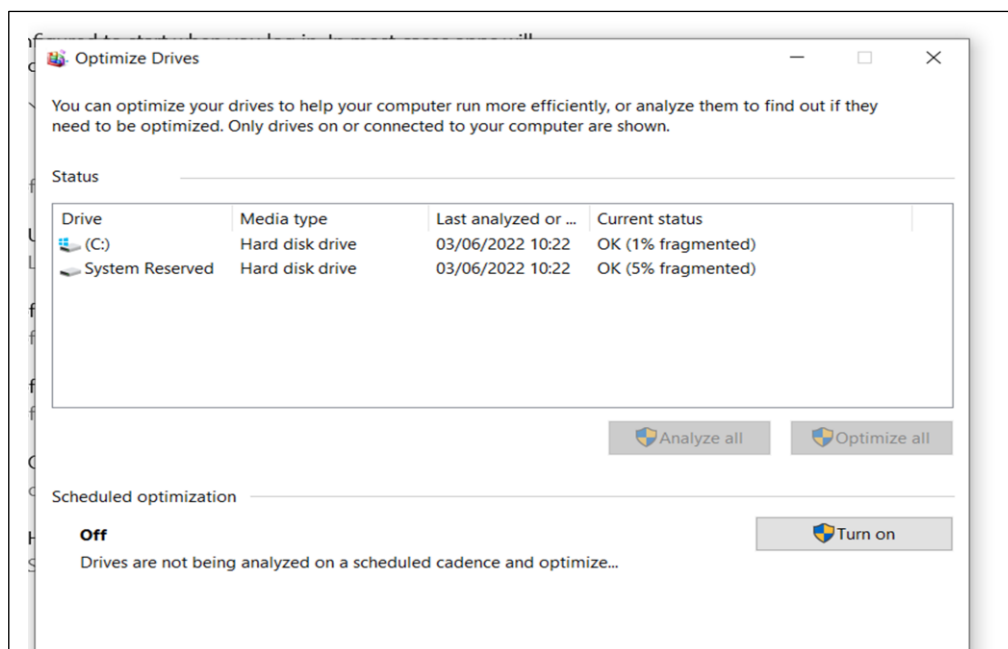
STEP 1: Type “Defrag” in the Windows Search Space as shown in the next diagram.

When this is done, system will display the following Defragment and Optimize Drive Apps screen, which awaits user’s mouse click.



STEP 2: Click Defragment and Optimize Drives Apps.

When this happens, the system will display all the existing disks in the system as shown in the following figure.



As shown in the figure:

- a. Two disk drives were displayed.
- b. These are **Drive C** and **System Reserved Drive**.
- c. The diagram also shows the percentage level of fragmentation.
- d. This percentage is a measure of how bad a disk already is.
- e. For instance, Disk Drive C is 1% fragmented, while the System Reserved Drive is 5% fragmented.
- f. User is allowed to select which of the disks for possible defragmentation.
- g. After selecting a disk, the three possible options that could be specified by user are Analyse, Optimize or Turn On.
- h. Analyse will do further analysis, and display outputs, while Optimize will perform some optimization steps. Turn on will turn system on for future defragmentation.
- i. When this is completed, user simply clicks Close to end.

Self-Assessment Exercises 3

A disk problem, where data on the disk seems to be non-contiguous is known as _____

3.7 How to Rename Your Computer:

Computers are given names, whether they are stand-alone or are on a network. When one purchases a new system, it is advisable to change its name to your own preferred name. Some important questions are as follows:

Question 1:

When a computer is first purchased, what name does it bear from the manufacturer?

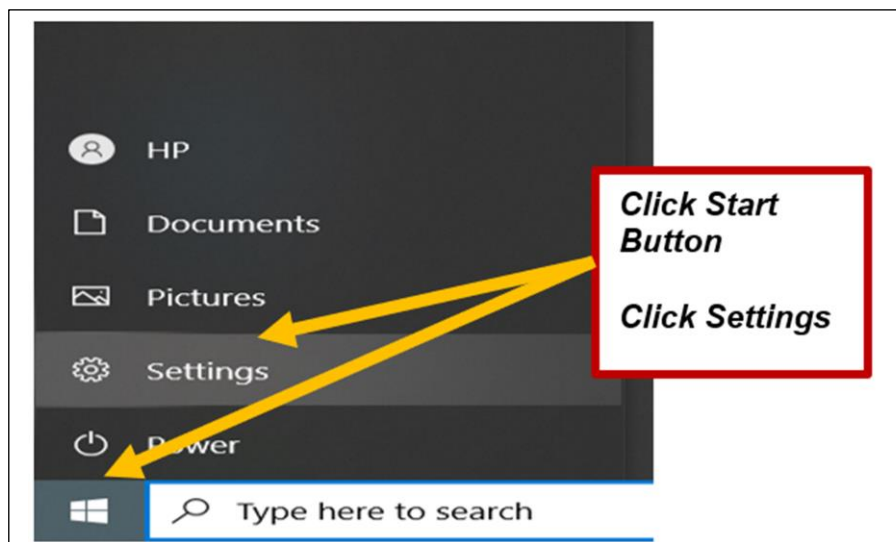
Answer: Generally, when you buy a new computer, the model's name of the computer is the name it bears.

Question 2:

Is it necessary to change the computer name when it is bought? If yes, why should that be?

Answer: The answer is YES. There are a number of reasons. One is for security reason. If you change the name, it bears that name until changed. It is easier to reclaim it when lost but found by somebody else. It is also easier to track it on networks, than if you left it with the generic model's name. We shall now demonstrate how to change the name of a computer.

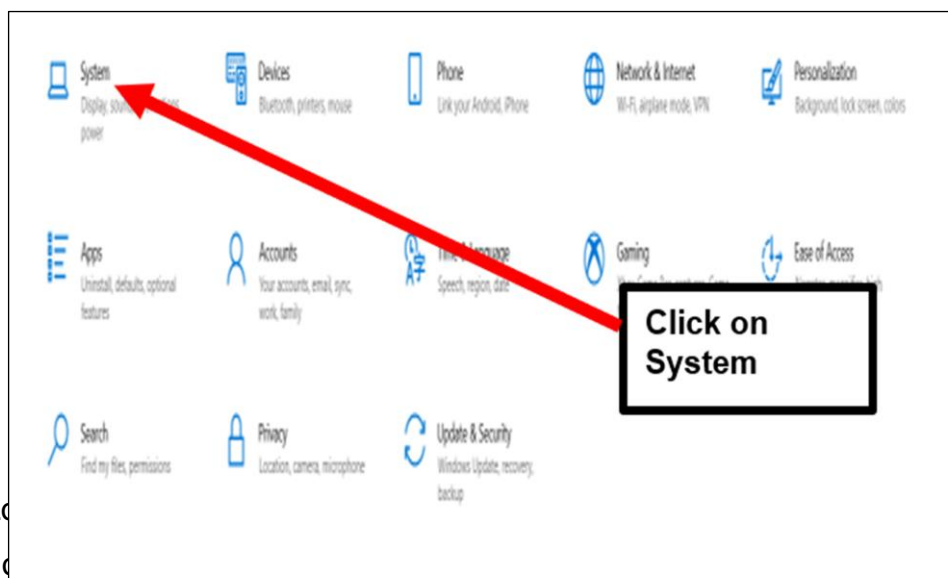
STEP 1: Click the Start Button, then the following screen appears.



STEP 2: User should then click on Settings.

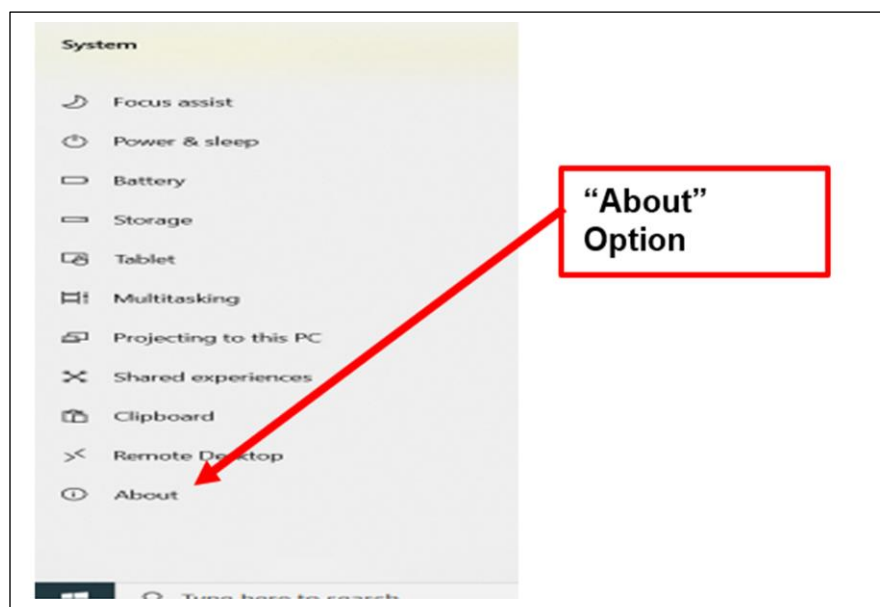
When this is done, this will open the general windows settings, listing different options that could be set, as shown in the following figure:

STEP 3: Locate the System option on the Top Left side of the screen. Then Click on System.

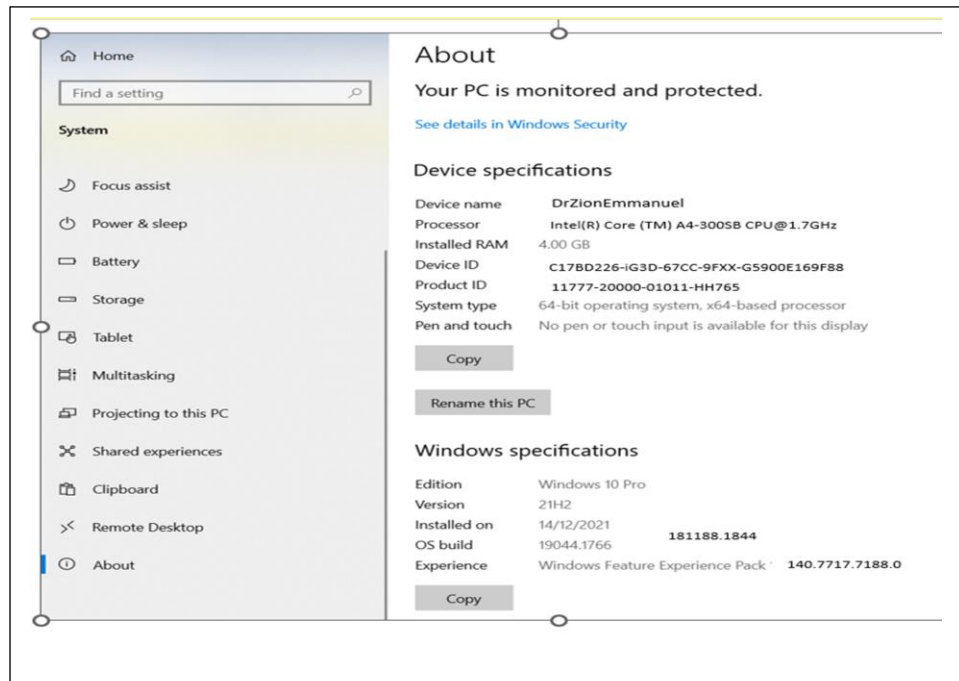


STEP 4: L
This is the c

“About”.



STEP 5: Click the About Option. The Computer Name and other system details for the computer in question will be shown.



As shown in the figure, the computer name is **DrZionEmmanuel**. This could be changed by simply clicking on the option “**Rename this PC**”, then modifying this name, and giving it a preferred name. It is necessary to state that in order to change a computer’s name, one must login with an admin (owner’s) password. Take a good look at the figure and you will see a number of other information about the computer. These are:

- a. Processor Details.
- b. RAM Information.
- c. Device ID.
- d. Product ID.
- e. System type.
- f. Windows Edition



3.8 Summary

This unit focused on solving of practical OS problems, with specific attention on Windows OS. The areas covered are Update of Windows to Latest Version, Solving the problem of Deletion of Temporary Files and Disabling Unwanted Start-up Program. Other things covered are solving the problem of Hard disk fragmentation, renaming Your Computer, plus a number of other related OS problems. The Self-Assessment Exercises were also solved.

3.9 Glossary

RAM Random Access Memory.



3.10 References/Further Readings

NIL.



3.11 Possible Answers to SAEs

Answers to SAEs 1

Latest Version

Answers to SAEs 2

The system brings a confirmation screen asking “Are you sure you want to permanently delete these files”.

Answers to SAEs 3

Fragmentation

UNIT 4: WEB FORMS DESIGN FOR IT-BASED RESEARCH

Unit Structure

- 4.1 Introduction
- 4.2 Learning Outcomes
- 4.3 What is Google Form?
- 4.4 The Starting Point
- 4.5 Starting a Customized Google Form
- 4.6 Creating Customized Form
- 4.7 Practical Examples
- 4.8 Other Tools in Question Screen
- 4.9 Form Testing Operation
- 4.10 Sending Forms to Participants
- 4.11 Summary
- 4.12 Glossary

4.13 References/Further Readings

4.14 Possible Answers to Self-Assessment Exercises



4.1 Introduction

In order to effectively manage the operations of Tourism and Hospitality Industry, there are moments when customers are required to fill forms. Such forms are used to capture necessary information regarding clients, their service needs, and so on. These activities require computerizations. One way to tackle this is to incorporate these forms into the major information system of the company. Another option, especially for small businesses, or start-ups is to use general forms to achieve this same aim. In this study, we shall be using Google Forms to demonstrate this.



4.2 Learning Outcomes

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

- Define Google Form and its necessity
- Initiate Google Form creation
- Initiate Customized Google Form creation
- Create Customized Google Form
- Demonstrate the process of Google Form creation
- Discuss Other Tools in Question Screen
- Discuss Google Form Testing Operation
- Explain Sending Google Forms to Participants
- Answer the Self-Assessment Exercises



4.3 What is Google Form?

Google Form is open source online software that allows users to create questionnaires, quizzes, and so on. Open source software is one that is free of cost. This is unlike proprietary software that would be purchased or paid for before use. Google Form is part of Google's web-based apps suite. Some other software incorporated in the Google's apps suite are:

- a. Google Docs
- b. Google Sheets
- c. Google Slides
- d. Google Contacts
- e. Google Calendar
- f. Google Sites and many others.

Note that Google Sheets, Docs and Slides are the equivalents of Microsoft Excel, Microsoft Word and Microsoft PowerPoint respectively.

Self-Assessment Exercises 1

Mention two examples of Google's web-based apps suite.

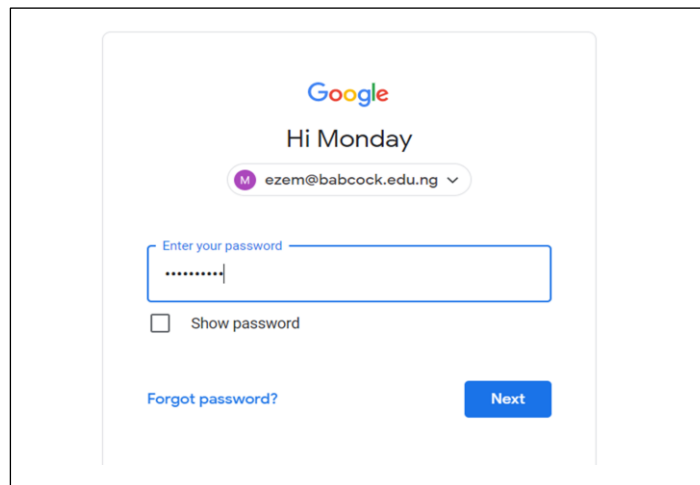
4.4 The Starting Point

The prerequisite for being able to use the Google Form is that someone must have a Google Account. In other words, the person should have signed into google account with an e-mail address xyz@gmail.com, where xyz is a string.

4.5 Starting a Customized Google Form

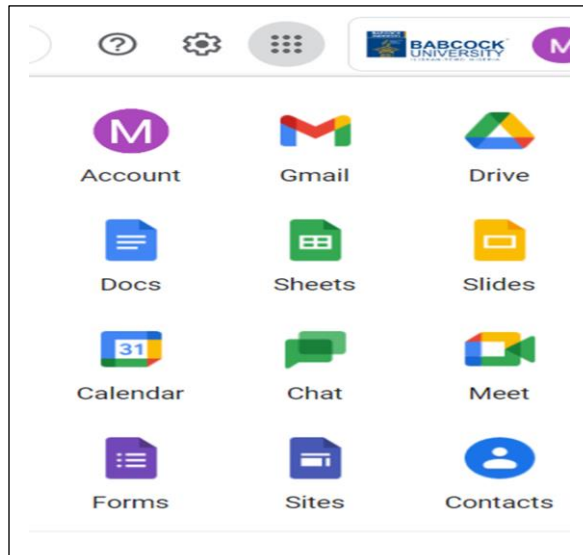
The process of creating a customized form involves a series of steps, which begins when a user first logs into the Google account, as will be itemized here.

- a. First login to Google as shown in the following figure:

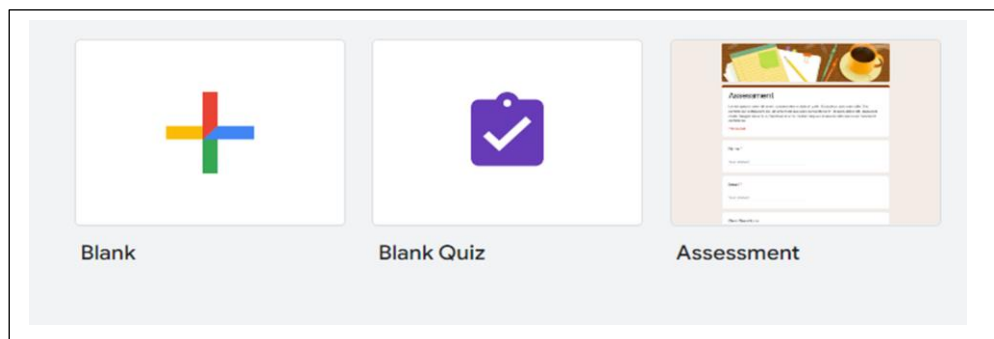


- b. Look out for the Google Apps Icon which consists of a 3 by 3 matrix of black dots, located at the Top Right Corner of the screen. Click on it.

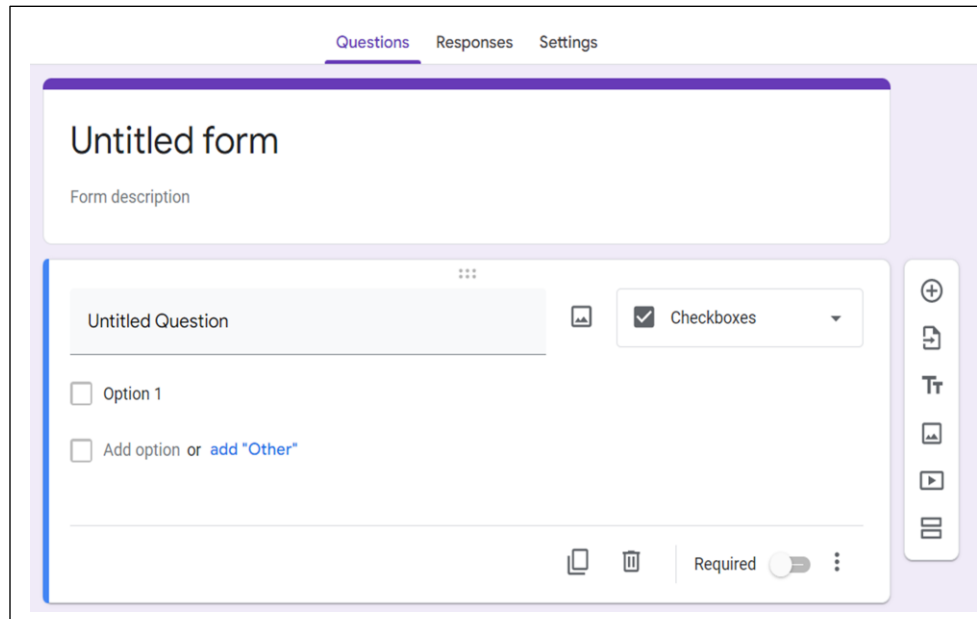
- c. On clicking on the Google Apps Icon, system will open a listing of so many applications that make up the Google apps. Examples are Accounts, Gmail, Drive, Docs, Sheets, Slides, Calendar, Chat, Meet, Forms, Sites, et cetera, as shown in the following diagram. The Forms Apps Icon is then selected.



- d. A row of templates will be displayed, beginning with “Blank” option. This is followed by special templates such as Blank Quiz, Assessment, and so on. To create a Form from scratch, user selects the Blank Template. Note that there is also a second row, which displays recent forms which may have been created or worked upon.



- e. Click on the Black Template. This opens up an Untitled Form. This is when Form Setup and Entry begins.



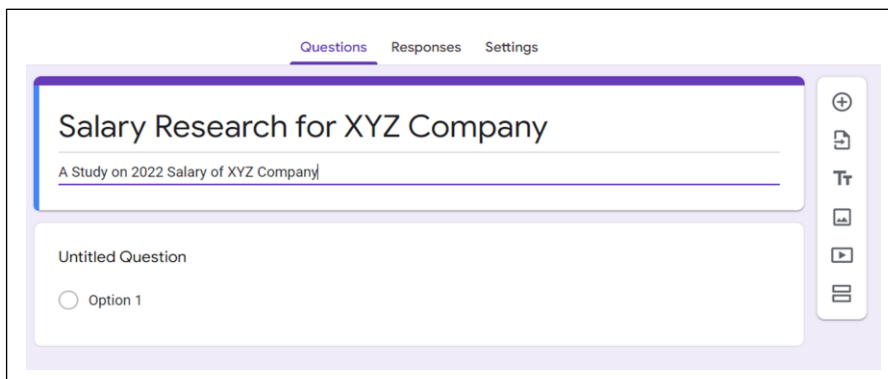
We shall now explain how to use the Untitled Form to create a customized form.

4.6 Creating Customized Form

- a. The Customized Form Template has three top options. These are Questions, Responses and Settings. The Question Option is used to create questions as shown above, while the Response Option is used to view incoming responses. The Settings Option is used for general settings of a given form creation operation.
- b. Some of the possibilities in Settings Option are:
- Automatic assignment of grade points to questions, by simply making it a quiz like document.
 - Collect / Don't collect email addresses
 - Send responders a copy of their response
 - Allow or disallow response editing

- Allow/ Disallow changes to responses after being submitted
 - Restrict / Don't restrict to users of a particular organization only, by requiring users to first sign in to Google.
 - Limit to 1 response or allow more than one response.
- c. As shown, the Question Option has a title section at the Top Left Corner. The general title before modification is “Untitled Form”, followed by a Form Description at the base. Both of these can be modified. For instance, the following modifications could be carried out in a typical sample project.
- Untitled Form → Salary Research for XYZ Company
 - Form Description → A Study on 2022 Salary of XYZ Company

The result of this modification is as follows:



The screenshot displays the Google Forms editor interface. At the top, there are three tabs: 'Questions', 'Responses', and 'Settings'. The main form area is highlighted with a blue border. The form title is 'Salary Research for XYZ Company' and the description is 'A Study on 2022 Salary of XYZ Company'. Below the description, there is an 'Untitled Question' section with a radio button and the text 'Option 1'. On the right side, there is a vertical toolbar with icons for adding, deleting, and duplicating questions, as well as a settings icon.

- d. There are six (6) Add/Import Tools, all located at the Far-Right Hand Side of the template. The serial number and functions/ descriptions of these six tools are outlined in the following table:

S/N	Description of Add/Import Tools
1	Add Question
2	Import Question
3	Add Title and Description
4	Add Image
5	Add Video
6	Add Section

- e. There are eleven (11) Question Type drop-down selectors, which can be used to indicate the type of question being setup. The serial number and descriptions of the options are outlined in the following table:

S/N	Description of Question Types
1	Short Answer
2	Paragraph
3	Multiple Choice
4	Check Boxes
5	Drop Down
6	File Upload
7	Linear scale
8	Multiple Choice grid
9	Check Box Grid
10	Date
11	Time

It is necessary to do a practical entry of questions.

Self-Assessment Exercises 2

The Customized Form Template has three top options namely_____.

4.7 Practical Examples

The following question will now be entered in the Sample Form being created.

Que 1: Name of Staff

Que 2: Sex of Staff

Que 3: What type of food you eat at launch.

The outcome is as follows:

The screenshot displays a survey form interface with the following elements:

- Navigation tabs: Questions, Responses, Settings.
- Form Title: Salary Research for XYZ Company
- Subtitle: A Study on 2022 Salary of XYZ Company
- Question 1: Que1: Name of Staff. Type: Short answer. Includes a text input field and a 'Required' toggle.
- Question 2: Que2: Sex of Staff. Type: Radio buttons. Options: Male, Female.
- Question 3: Que3: What types of Food do you eat at Launch?. Type: Checkboxes. Options: Garri and Egwusi, Tea and Bread, Ewedu and Potato.

4.8 Other Tools in Question Screen

It is necessary to mention the following important question tools:

- **Insert Image**
This is used to insert images or scanned documents as part of the contents.
- **Duplicate**
This is clicked to automatically duplicate the question being reviewed. With this tool, a user can easily copy a question from an earlier one, and modify it to get a new one, rather than re-typing everything afresh.
- **Delete**
This is used for outright deletion of any question / title earlier constructed.
- **Required**
This is used to tag a particular content as “required”, and thus cannot be avoided.

Self-Assessment Exercises 3

Which of the question tool automatically duplicates the question being reviewed when clicked?

4.9 Form Testing Operation

Immediately after creating a form, it is necessary to do a thorough review/ testing. This is achieved using the Review Tool as outlined as follows:

- a. The Review Tool is at the Top Right section of the larger screen.
- b. The Icon for Review Tool is indicated by an “Eye” Symbol

- c. When you click the review tool, system displays the form as is at the moment.
- d. User is then free to review to confirm that everything is in order before considering sending the form to respondents as shown in the following figure:

The screenshot shows a Google Form titled "Salary Research for XYZ Company" with the subtitle "A Study on 2022 Salary of XYZ Company". The form is displayed in a preview mode, showing the user's email address "ezem@babcock.edu.ng (not shared)" and a "Draft saved" indicator. The form contains three questions:

- Que1: Name of Staff. The answer entered is "Dr. Daniel Musanga".
- Que2: Sex of Staff. The "Male" radio button is selected.
- Que3: What types of Food do you eat at Launch?. The checkboxes for "Garri and Egwusi" and "Tea and Bread" are checked, while "Ewedu and Potato" is unchecked.

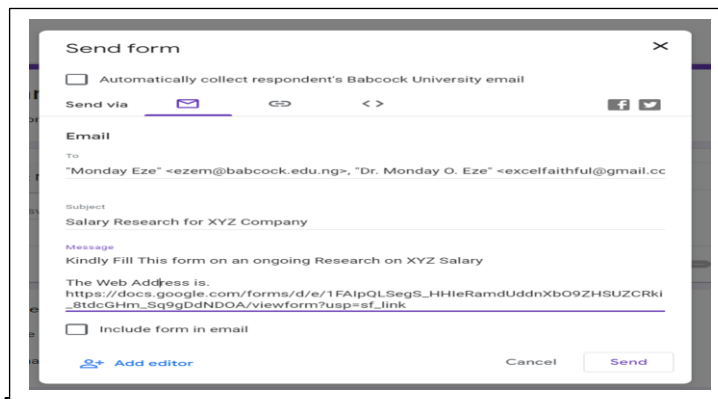
At the bottom of the form, there is a purple "Submit" button and a "Clear form" link.

- e. The form testing goes beyond simply looking at the preview form. Rather, system allows you to do an actual entry.
- f. The base of the Test Screen has a Submit Button, so that user can click to submit after the requisite data has already been entered.
- g. When you click Submit, system automatically submits form to the email address of the creator, with feedback as follows.

The screenshot shows the confirmation screen after the form has been submitted. The title "Salary Research for XYZ Company" is displayed at the top. Below the title, the message "Your response has been recorded." is shown. A blue link "Submit another response" is provided for the user to return to the form. At the bottom, there is a footer that reads "This form was created inside of Babcock University. Report Abuse" and the "Google Forms" logo.

4.10 Sending Forms to Participants

The final step in the creation of the web forms is to email the final template to the respondents, who will then click on the link, after which they would be required to login with their google account, and then proceed to complete the research form or survey. The screen for this step is shown as follows.



4.11 Summary

This unit focused on Web Forms Design for IT-Based Research. The areas covered are What Google Form Is, its necessity and the Starting Point in creating it. Other areas are starting a Customized Google Form, and Creating Customized Form. The unit also helps students to have a grip of Practical Examples. Other things covered are the Tools in Question Screen, Form Testing Operation, and Sending Forms to Participants. This unit also presented and answered some Self-Assessment questions.

4.12 Glossary

Eye Symbol This is symbol used for the Icon for Review Tool in Google Form.

4.13 Reference

NIL.



4.14 Possible Answers to SAEs

Answers to SAEs 1

Google Docs and Google Sheets

Answers to SAEs 2

Questions, Responses and Settings

Answers to SAEs 3

Duplicate

MODULE 5

COMPUTER APPLICATIONS

Course Writing Template for Course Writers

UNIT 1: MICROSOFT WORD

Unit Structure

- 1.1 Introduction
- 1.2 Learning Outcomes
- 1.3 Finding Your MS Word Version
- 1.4 Beginning with MS Word
- 1.5 The MS Word Environment
 - 1.5.1 The Ribbon
 - 1.5.2 The Quick Access Toolbar
 - 1.5.3 The Backstage View
- 1.6 MS Word Document View Switching

- 1.6.1 Read Mode
- 1.6.2 Print Layout
- 1.6.3 Web Layout
- 1.7 Pining MS Word Document
- 1.8 Inserting Unusual Symbols in MS Word Document
- 1.9 Text Formatting in MS Word Document
- 1.10 Text Alignment in MS Word
- 1.11 Summary
- 1.12 Glossary
- 1.13 References/Further Readings
- 1.14 Possible Answers to Self-Assessment Exercises



1.1 Introduction

Microsoft Word is word processing software that was developed by Microsoft. MS Word as its usually called is within the collection of a number of software commonly referred to as Microsoft Office Suite. It is a ready tool that enables users to create, edit and save professional documents. MS Word is user friendly, a quality that endears it to users worldwide. This lecture note gives an introduction to Microsoft Word, because it could be a very useful tool to users in Hospitality and Tourism Industry, among other users.



1.2 Learning Outcomes

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

- Find your MS Word Version
- Launch into the use of MS Word
- Explain MS Word Environment with specific focus on the Ribbon, the Quick Access Toolbar and the Backstage View.
- Explain MS Word Document View Switching with specific focus on Read Mode, Print Layout and Web Layout.
- Pin an MS Word Document.
- Insert Unusual Symbols in MS Word Document
- Explain Text Formatting in MS Word Document
- Explain Text Alignment in MS Word
- Answer the Self-Assessment Exercises.



1.3 Finding Your MS Word Version

We shall begin with a practical demonstration of how to find out the version of MS Word one is using. This is very important since there could be some variations, especially in the features of the old versions. In writing this lecture note, the writer used MS Word Version 16 Plus. Here is how to discover MS Word version:

STEP 1: Open MS Word document.

STEP 2: On the Top Left Corner, Click on File. The resulting screen is shown as follows:



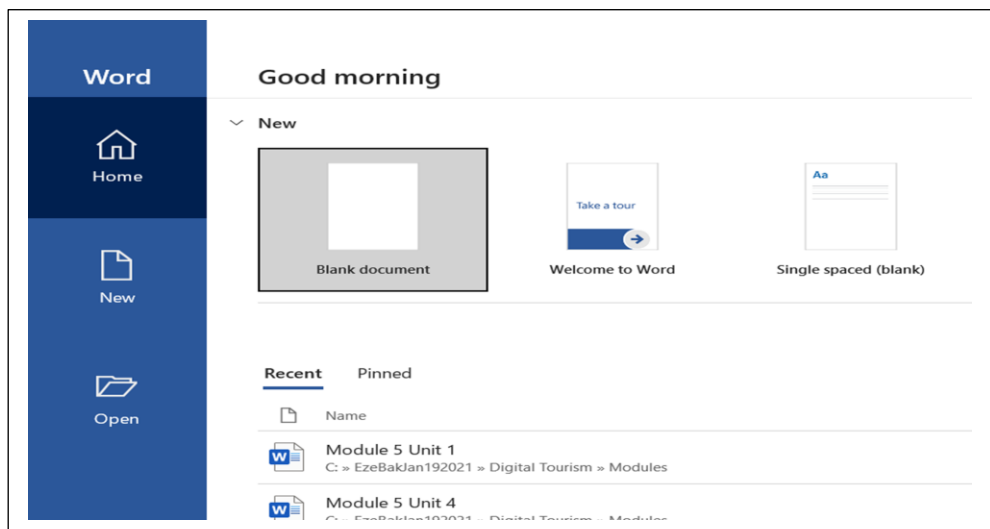
STEP 3: Click on Account option, then the version of the MS Word will be displayed as shown in the following figure:



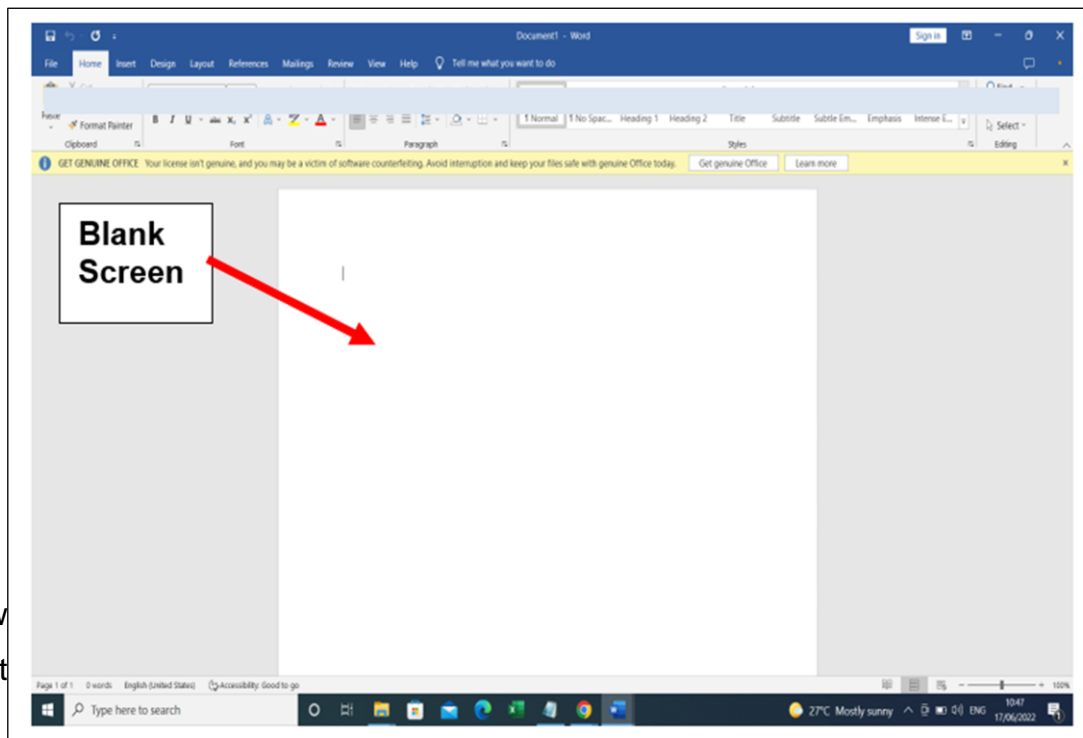
1.4 Beginning with MS Word

Having clarified how to find the MS Word version, we will now proceed with further study of the application. Note that Word 2016 has a lot in common with earlier versions like Word 2010 and 2013. Therefore, this lecture note will be relevant to users of those older versions. When a user opens MS Word for the first time, the following things are expected:

- a. The MS Word Start Screen will appear.
- b. Menu options will appear by the Left-Hand Side (LHS) panel, some of which are Open, New, Account, Feedback, et cetera.
- c. In most cases, system will display a greeting like “Good Morning”, “Good afternoon”, and so on, depending on the time of the day.
- d. A Blank Document will be displayed.
- e. A list of the most recently edited documents will also be listed.
- f. The initial screen looks like the following figure:



- g. To start work on a fresh MS Word file, the user should click Blank document, else to continue work on existing one, the person will click on any of the listed files, or possibly use Open option to locate the file. When one clicks on Blank document, the following will appear.



As shown
then on t

nd

Self-Assessment Exercises 1

What is the possible information at the greeting screen if you open your MS Word by 9am?

1.5 The MS Word Environment

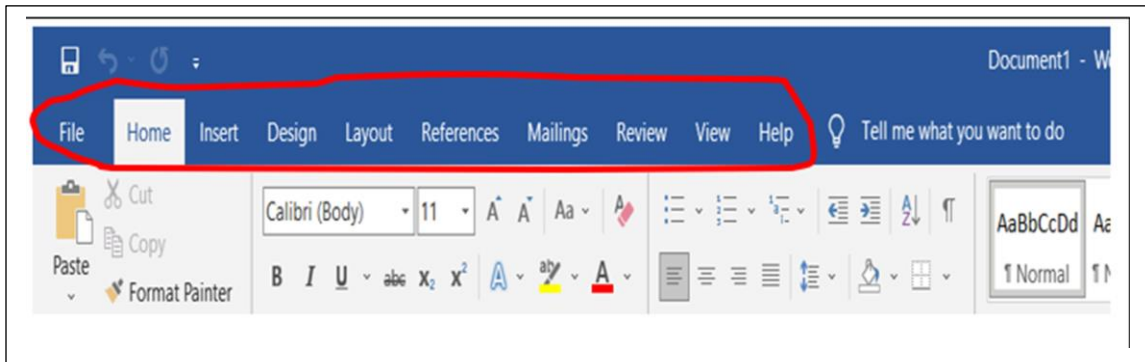
The MS Word Version 16 environment is characterized by three major features. These features which may be lacking in previous versions are:

- a. Ribbon
- b. Quick Access Toolbar
- c. Backstage view

These features will be discussed here.

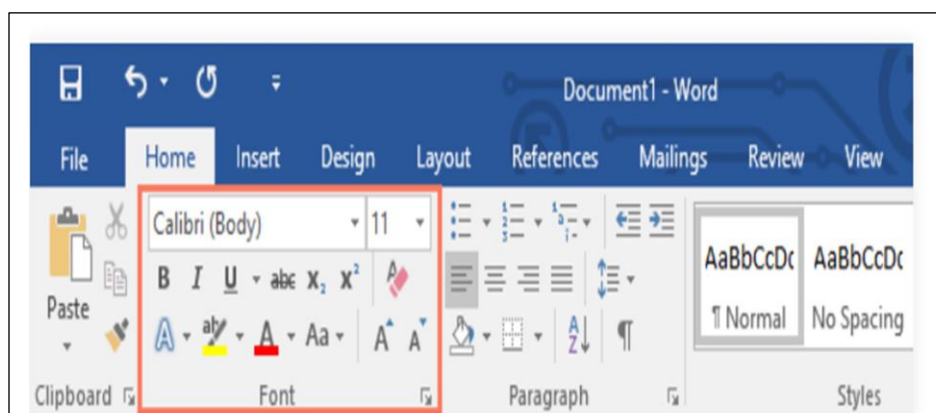
1.5.1 The Ribbon

MS Word uses a tabbed Ribbon system instead of traditional menus. The MS Word Ribbon is shown below.

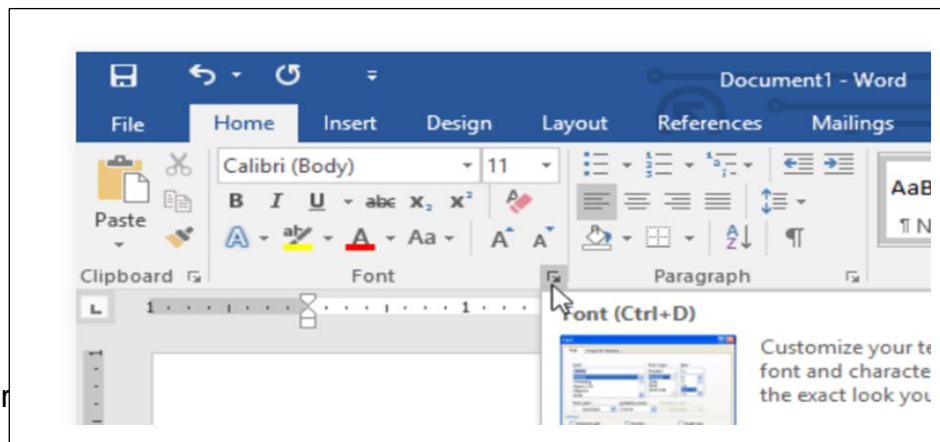


The following facts should be noted about ribbons:

- The MS Word Ribbon consists of multiple tabs, which are located near the top of the Word window. In the diagram shown, the ribbon has been encircled with RED mark.
- To understand why it is called ribbon, you will see that each tab contains several groups of related commands.
- For instance, the Font group on the Home tab contains commands for formatting text in the document. This is shown in the following figure:

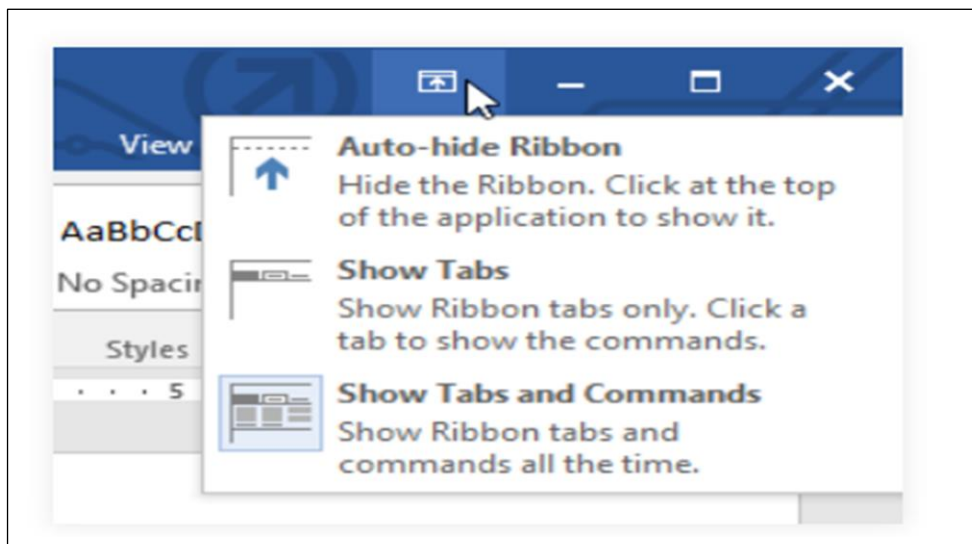


- d. Moreover, some groups also have a small arrow in the bottom-right corner through which one can click for more options, as shown in the following diagram.



- e. For the Ribbon, especially if it takes up a lot of screen space.

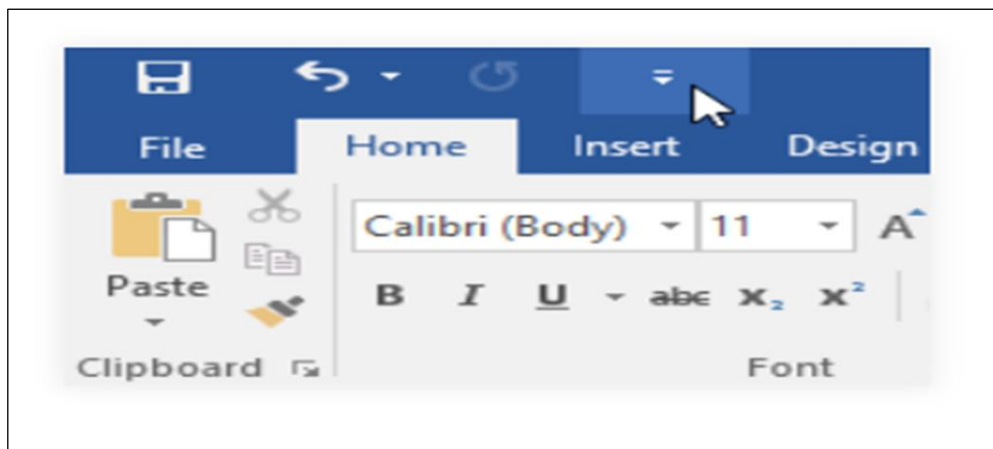
- f. To hide the Ribbon, click the Ribbon Display Options arrow in its upper-right corner, then select the desired option from the drop-down menu as shown in the following diagram:



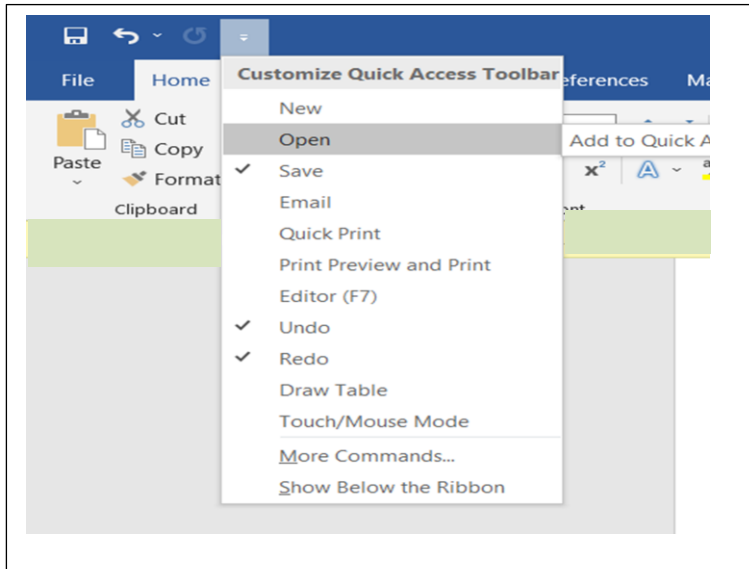
1.5.2 The Quick Access Toolbar

The Quick Access Toolbar is located just above the Ribbon. This feature allows the user to access common commands no matter which tab is selected. Usually, it shows the Save, Undo, and Redo commands, but a user can add other commands depending on one's needs. The steps for adding commands to Quick Access Toolbar are as follows:

- a. First Click the drop-down arrow located at the right of the Quick Access Toolbar.



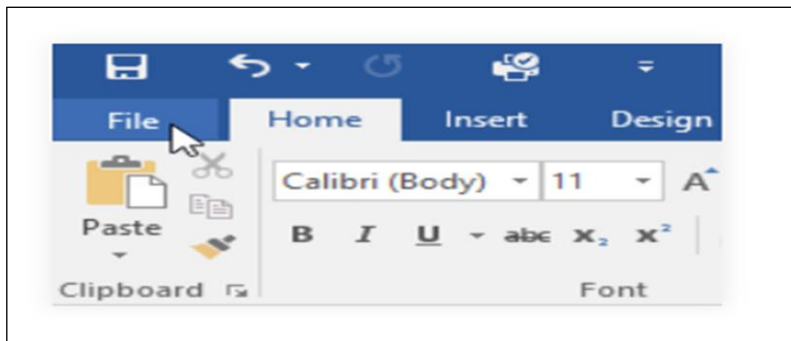
- b. Then, Select the exact command to be added from the menu as shown in the following diagram:



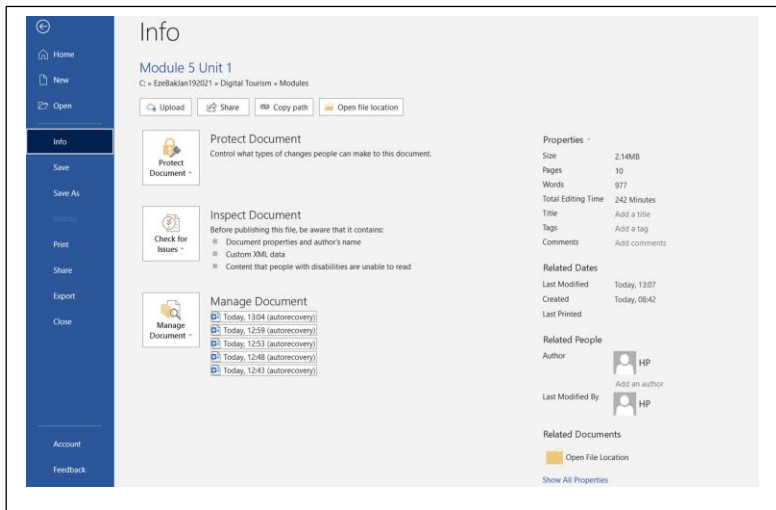
c. After selecting the Open Command, it will be added to the Quick Access Toolbar.

1.5.3 The Backstage View

In MS Word, Backstage view gives a user various option for saving, opening a file, printing, and sharing documents. To access the Backstage view, click the File tab on the Ribbon area as follows:



Then click Info. The result of this is shown in the following figure.



Self-Assessment Exercises 2

In the MS Word Environment, the Ribbon contains multiple _____

1.6 MS Word Document View Switching

MS Word document has a variety of viewing options that change how a document is displayed. The three major document view options are:

- Read Mode
- Print Layout
- Web Layout.

These views can be useful for various tasks, especially at the point of printing an MS Word document. Moreover, one can also use the zoom in and zoom out features to make document reading much easier. To switch between different document views, simply locate and select the document View tab to reveal the different options you may select or click a particular option's icon at the bottom-right corner of the Word window. Some of the attributes of the different views are as follows.

1.6.1 Read Mode

Read Mode view opens the document in a full screen. This view enhances reading large amounts of text.

1.6.2 Print Layout

This is accepted as the default document view in Word. Usually, it shows the way a document will appear when printed.

1.6.3 Web Layout

This view displays the document as a webpage. This option can be very helpful if one is using Word to publish contents online.

1.7 Pining an MS Word Document

When an MS Word document is used very frequently, one could use a technique called pinning to fasten its access. Thus, a user can pin it to Backstage view for quick access. The steps for performing document pinning are as follows:

STEP 1: Click File tab.

STEP 2: Click Recent option.

STEP 3: This will display a list of the most recently edited documents

STEP 4: Finally, user should hover the mouse over the document he / she wished to pin.

STEP 5: Click the Pushpin icon.

The result of this is that the pinned document will stay in Recent Documents list until it is unpinned. In order to unpin a document, click the Pushpin icon again.

1.8 Inserting Unusual Symbols in MS Word Document

Sometimes, it becomes necessary to use symbols which are not present on keyboards. Examples of such symbols are the copyright (©), trademark (™), beta (β) and pi (π) symbols, among others. The steps for inserting non-keyboard symbols are as follows:

STEP 1: Place the cursor at the point where insertion is to be done.

STEP 2: Click the Insert tab.

STEP 3: Locate and select the Symbol command, then choose the exact symbol from the drop-down menu.

STEP 4: Suppose the symbol is not yet found, user should select More Symbols for more options to select from.

STEP 5: Finally, the symbol will get inserted where indicated by the cursor in the document.

1.9 Text Formatting in MS Word Document

In word processing applications like MS Word, text formatting is very important. Why? Formatting is used to draw the attention of readers to specific parts of a document. Formatting therefore helps to lay emphasis on important information. In MS Word, formatting can focus on several options. Examples are:

- a. Adjusting font size
- b. Adjusting colours
- c. Adjusting the alignment of the text to change how it is displayed on the page, et cetera.

To change the font size:

STEP 1: User selects the texts to be modified.

STEP 2: On the Home tab, he / she clicks the Font size drop-down arrow.

STEP 3: Select a font size from the menu, and if the actual font size desired is not listed, type it and press the Enter key.

Also, to change the font colour, the following steps could be taken:

STEP 1: Select the text whose font is to be modified.

STEP 2: On the Home tab, click the Font Colour drop-down arrow.

STEP 3: This will make the Font Colour menu to appear.

STEP 4: Select the font colour to be assigned.

It is important to state that the choice of font colours is not limited to the ones available in the drop-down menu. Rather, one could also select More Colours at the bottom of the menu to access the Colours dialog box in order to choose more possible colours.

1.10 Text Alignment in MS Word

The default text alignment option in MS Word for a new document is Align Text Left. This could be changed at will by the user. The possible options are:

- a. Align Text Left, which aligns the selected text to the left margin.
- b. Centre Text, which aligns text an equal distance from the left and right margins.
- c. Align Text Right, which aligns all selected text to the right margin.
- d. Justify which lines up texts equally to the right and left margins.

It is important to state that many newspapers and magazines use Justify, because it makes the texts look organized.

Self-Assessment Exercises 3

List three document view options that change how a document is displayed.

1.11 Summary

This unit focused on Microsoft Word as a word processing application. Some of the areas covered are how to find the MS Word Version, and MS Word Environment with specific focus on the Ribbon, the Quick Access Toolbar and the Backstage View. Other areas covered are MS Word Document View Switching with specific focus on Read Mode, Print Layout and Web Layout, how to pin an MS Word Document, inserting Unusual Symbols in MS Word Document, Text Formatting in MS Word Document and Text Alignment in MS Word. The Self-Assessment Exercises were also answered.

1.12 Glossary

Text Justify This justification lines up texts equally to the right and left margins.

1.13 Reference

NIL.



3.14 Possible Answers to SAEs

Answers to SAEs 1

Good Morning

Answers to SAEs 2

Tabs

Answers to SAEs 3

The three major document view options are Read Mode, Print Layout and Web Layout.

UNIT 2: MICROSOFT POWERPOINT

Unit Structure

- 2.1 Introduction
- 2.2 Learning Outcomes
- 2.3 Introducing PowerPoint Version 2016
- 2.4 Creating Power Point Presentation
 - 2.4.1 Using a New Blank File
 - 2.4.2 Using a Template
 - 2.4.3 Using an Existing Presentation
- 2.5 Compatibility and File Conversion Issues:
 - 2.5.1 Important Points related to Compatibility
 - 2.5.2 Algorithm on Conversion to Higher Versions
- 2.6 Exporting PowerPoint Presentations
 - 2.6.1 Algorithm on Exporting to other files
 - 2.6.2 Alternative Option using Save as Dialog Box

- 2.7 Slide Operations:
 - 2.7.1 Slide Duplication Algorithm
 - 2.7.2 Slide Movement Algorithm
 - 2.7.3 Slide Deletion Algorithm
- 2.8 Playing Power Point Presentation
- 2.9 Applying a Theme to Power Point Presentation
- 2.10 Automated Advancing
- 2.11 Find and Replace Operations
- 2.12 Summary
- 2.13 Glossary
- 2.14 References/Further Readings
- 2.15 Possible Answers to Self-Assessment Exercises



2.1 Introduction

Microsoft PowerPoint is presentation software that was developed by Microsoft. MS PowerPoint is within the collection of a number of software commonly referred to as Microsoft Office Suite. It is a ready tool that enables users to create, edit and save professional presentation slides that could be used for Conferences, Workshops, in Classroom for lectures, and so on. PowerPoint is user friendly, a quality that endears it to users worldwide. No doubt, MS PowerPoint is useful in the Tourism and Hospitality and many other industries, thus the reason for incorporating this topic in this lecture note.



2.2 Learning Outcomes

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

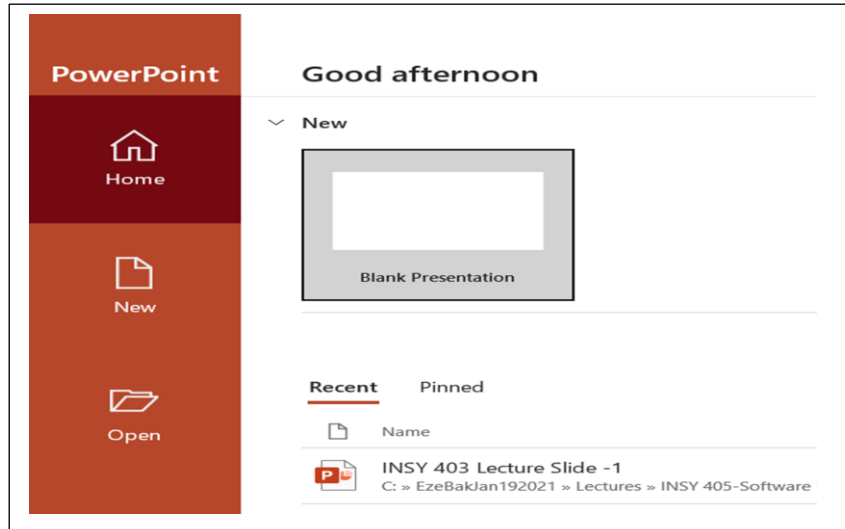
- Define PowerPoint Version 2016 and what it is used for.
- Create Power Point Presentation with focus on the three methods - using a New Blank File, using a Template and using an Existing Presentation.
- Explain MS PowerPoint Compatibility and File Conversion Issues
- Export PowerPoint Presentations with focus on Algorithm on Exporting to other files, as well as alternative option using Save As dialog box
- Explain Slide Operations with focus on three options, namely Slide Duplication Algorithm, Slide Movement Algorithm and Slide Deletion Algorithm.
- Explain how to play Power Point Presentation
- Discuss how to apply a Theme to Power Point Presentation
- Explain Automated Advancing.
- Use Find and Replace Operations.
- Solve the Self-Assessment Exercises.



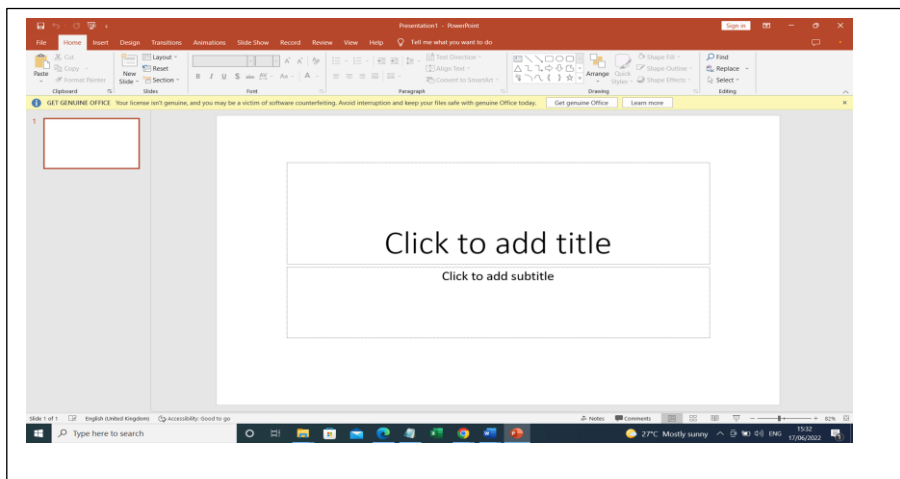
2.3 Introducing PowerPoint Version 2016

This lecture note will focus on MS PowerPoint Version 2016. MS PowerPoint 2016 has similarities with the earlier versions, such as PowerPoint 2013 and PowerPoint 2010. Anyone who is conversant with these previous versions will find PowerPoint 2016 very easy to use. We begin this unit by first studying and understanding MS PowerPoint 2016 interface. Some of the facts concerning the interface are:

- a. Immediately one opens the PowerPoint for the first time, the Start Screen will appear.
- b. Thereafter, one will be ready to create a new presentation by either choosing a template, or accessing a recently created presentation.
- c. An example Start Screen is as follows:



d. When a blank presentation is selected, the Power Point Presentation environment is opened as follows:



Just like in the MS Word Version 2016, the MS PowerPoint 2016 environment is also characterized by the following three features.

- a. Ribbon
- b. Quick Access Toolbar
- c. Backstage view

2.4 Creating Power Point Presentation

The term presentation is synonymous with PowerPoint files. A new project in Power Point can be created using any of the following three options:

- a. Using a blank file.
- b. Using a template file.
- c. Using an existing presentation.

2.4.1 Using a New Blank File

A new presentation is created from a blank one by taking two steps: STEP 1 is to select the File tab to go to Backstage view, and STEP 2 is to Select New on the left side of the window, then click Blank Presentation.

2.4.2 Using a Template

Alternatively, to create a new presentation from a template, a total of six steps will be taken as will be outlined here. First, we define a template as a predesigned presentation one can use to create a new one as briskly as possible. A power point template usually includes custom formatting and designs, a feature which can save one a lot of time and effort when tackling a new project. The six steps are as follows:

STEP 1: Click the File tab so as to access Backstage view, then select the New Option.

STEP 2: Click a suggested search to find templates or alternatively, use the search bar to find something more specific. For instance, you can search for the keyword school.

STEP 3: Usually, the types of templates that could be selected are: (a). Presentations, (b). Themes, (c). Education, (d). Charts, (e). Diagrams, (f). Business, and (g). Infographics.

Select a template to preview it.

STEP 4: A preview of the template will appear, including additional information on how the template could be used.

STEP5: Click Create to use the selected template.

STEP 6: Finally, a new presentation will appear with the selected template.

Please note that though many of the templates were created by Microsoft, quite a number of them were created by third-party providers and even individual users.

2.4.3 Using an Existing Presentation

To use an existing presentation to create a new one, a user is required to first open a presentation that was previously saved. The comprehensive steps to take are as follows:

STEP 1: Select the File tab to go to Backstage view.

STEP 2: Click the Open option

STEP 3: Click Browse. The alternative option is to search for the needed file in OneDrive, if previously saved there.

STEP 4: When the Open dialog box appears, one should locate and select the required presentation.

STEP 5: When the presentation file is found, click Open.

At this stage, you can now use the existing file, which can be modified accordingly. However, it is necessary to remember to save the file using another name to avoid losing or causing any form of conflict with the original presentation file.

Self-Assessment Exercises 1

List three options for creating a presentation.

2.5 Compatibility and File Conversion Issues

One may have presentations which were created in earlier versions of Microsoft PowerPoint, such as PowerPoint 2000, 2003, and so on, to be used in PowerPoint 2016. In cases like this, these older version files will appear in what is known as Compatibility Mode when opened. The Compatibility Mode disables certain features, so user will only access commands found in the program that was used to create the presentation. For example, if a PowerPoint 2003 file is opened, one can only use tabs and commands found in PowerPoint 2003. The implication is that this will disable some PowerPoint 2016 features.

2.5.1 Important Points related to Compatibility

There are a number of points to bear in mind as far as compatibility issue is concerned:

- a. It is very possible to totally or permanently exit compatibility mode.
- b. This can be achieved by converting the presentation to the current version, for example, Version 2016.
- c. However, if one is involved in a form of collaboration, where a number of users are jointly working on the presentation, it is more advisable to retain the presentation in compatibility mode, and thus, avoid changing the format from one everyone is used to.
- d. On the other hands, if one wishes to have access to all PowerPoint 2016 features, the best option is to convert the presentation to the 2016 file format.

- e. However, be informed that such a conversion may cause some changes to the original layout of the presentation.

2.5.2 Algorithm on Conversion to Higher Versions

The steps for conversion to a newer version are as summarized following:

STEP 1: First, Click the File tab to access Backstage view.

STEP 2: Locate and select the Convert command.

STEP 3: At this stage, the Save As dialog box appears.

STEP 4: Select the location where the presentation is to be saved.

STEP 5: Specify the file name, and then click Save.

The final result is that the presentation will get converted to the newer version file type.

Self-Assessment Exercises 2

In the conversion of file to Higher Versions, which View and Command are used?

2.6 Exporting PowerPoint Presentations

The default file type / extension for PowerPoint presentations is .pptx file type. It is however possible to export the file into a variety of other formats such as:

- a. PDF Format
- b. PowerPoint 97-2003 presentation.
- c. Video file
- d. Package for CD which involves saving the presentation in a folder along with the Microsoft PowerPoint Viewer, a special slide show player anyone can download

- e. Handouts which involve printing a handout version of the slides.
- f. Other file types, such as PNG, et cetera.

2.6.1 Algorithm for Exporting to other Files Types

The steps for exporting presentation to other file formats, such as PowerPoint 97-2003, et cetera, are as summarized following:

STEP 1: Click the File tab to access Backstage view.

STEP 2: Click Export, then choose the desired option.

STEP 3: Select Change File Type.

STEP 4: Select the desired file type, and click Save As.

STEP 5: When the Save As dialog box appears, Select the location where the exported presentation should be saved.

STEP 6: Finally, type the file name, then click Save.

2.6.2 Alternative Option using Save as Dialog Box

An alternative is to use the Save as type drop-down menu in the Save As dialog box in order to save presentations in a variety of file types.

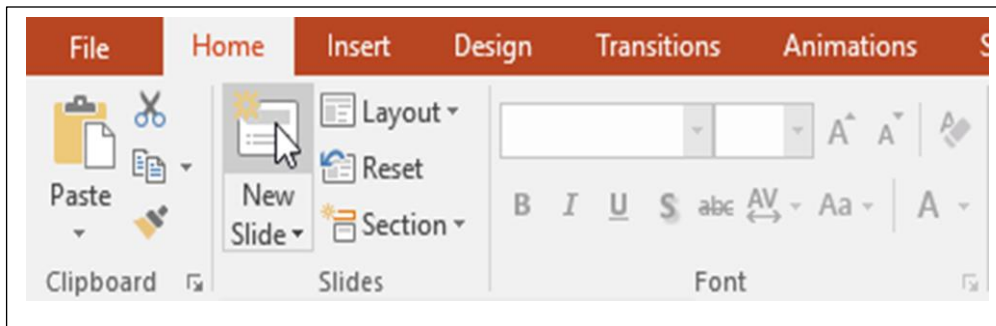
Self-Assessment Exercises 3

The default extension for a Power Point File is _____

2.7 Slide Operations

In order to gain expertise in the use of MS PowerPoint, it is necessary to master key slide operations. Thus, a fluent user would feel comfortable with tasks such as inserting a new slide, deleting slide, adding notes to slides, arranging existing slides, and so on. Some of these tasks are outlined as follows:

- a. One of the slide operations is to insert a new slide. A newly inserted slide usually has placeholders, which indicates where contents will be placed. Slides have different layouts for placeholders, depending on the type of information that one wishes to include. Thus, when one creates a new slide, it is necessary to choose a slide layout that fits the desired content.
- b. Note that Placeholders could contain different types of contents such as text, images, and videos, and so on. Moreover, a number of placeholders have thumbnail icons that one could click to add specific types of content, for example, Title, Content, et cetera.
- c. Every new presentation usually contains one slide with the Title Slide layout. One can insert as many slides as possible from a variety of layouts. This is achieved as follows: At the Home tab, click the New Slide dropdown arrow, and choose the desired slide layout from the menu that appears. As the new slide is added, user would click any placeholder and begin typing to add text. Alternatively, user can also click an icon to add other types of contents, such as pictures or charts.
- d. In order to change the layout of an existing slide, user would click the Layout command, and choose the desired layout or a chart.
- e. Also, to quickly add a slide that uses the same layout as last selected slide, user would click the top half of the New Slide command. This is shown in the following screen:



2.7.1 Slide Duplication Algorithm.

Slides can be duplicated by using the following steps:

STEP 1: Select the slide to be duplicated.

STEP 2: Right-click the mouse.

STEP 3: Choose Duplicate Slide from the menu that comes out.

2.7.2 Slide Movement Algorithm

Slides can be moved at will by following the following steps:

STEP 1: Click the desired slide.

STEP 2: Drag the slide in the Slide Navigation pane to the desired position.

Another way is to click View tab, click Slide Sorter presentation view option, and drag the slides to arrange them as one pleases.

2.7.3 Slide Deletion Algorithm

Slides can be deleted at will by following the following steps:

STEP 1: First, select the slide to be deleted.

STEP 2: Press the Delete key on your keyboard.

STEP 3: Alternatively, the Backspace key can also be used in lieu of Step 2 above.

2.8 Playing Power Point Presentation

Playing of the Power Point presentation is done to demonstrate its current status in terms of completion. Presentations are usually done intermittently so that the user can

make changes where necessary, until the final file is gotten. To play the presentation, one can take the following steps:

STEP 1: Go to the Quick Access Toolbar.

STEP 2: Click the 'Slide Show from Beginning' command.

STEP 3: The Power Point presentation will appear in its full-screen mode.

STEP 4: To advance to the next slide, simply click the mouse, or press the space bar on the keyboard, or use the arrow keys to move forward or backward through the presentation.

STEP 5: To exit the presentation mode, press the escape key.

Note that the alternative short cut for running a presentation is to simply press the F5 key.

2.9 Applying a Theme to MS PowerPoint Presentation

MS PowerPoint theme is referred to as a predefined combination of colours, fonts, and effects that can quickly change the look and feel of the entire presentation slides. In other words, the MS PowerPoint themes give users a quick and easy way to change the design of their presentations. Thus, themes control the primary colour palette, basic fonts and slide layout, among other key elements of a presentation. With such themes, one would not spend or waste much time formatting a presentation. Every theme uses its own set of slide layouts, and these layouts control the way Power Point contents are arranged, so as to achieve a very magnificent effect. Note that every PowerPoint theme has its own theme elements, three of which are:

- a. Theme Colours, which consists of 10 theme colours.

- b. Theme Fonts which consist of two theme fonts available at the top of the Font menu under Theme Fonts.
- c. Theme Effects, which affect the pre-set shape styles. These shape styles can be found on the Format tab whenever one selects a shape or SmartArt graphic.

It is important to state that for dynamism, when one switches to a different theme, all of these elements will update to reflect the new theme, leading to immediate change of the look of the power point presentation. The steps for applying themes are as follows:

STEP 1: Select the Design tab on the Ribbon.

STEP 2: User should then click the 'More' drop-down arrow to view all the available themes.

STEP 3: Select the desired theme. The implication is that the theme applied will affect the entire presentation.

2.10 Automated Advancing

During Slide Shows, the presentation advances to the next slide in response to mouse clicks or keyboard press events. However, this can be automated. The Automated Advancing Slides setting allows the presentation to advance automatically and display each slide for a specific amount of time. This feature is especially useful at trade show events where presentations may not necessarily require human intervention.

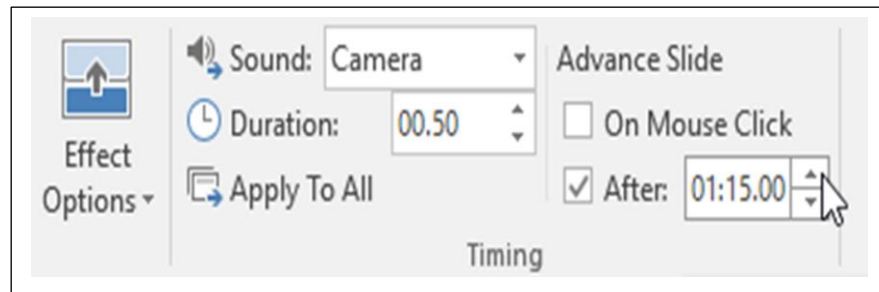
The steps for setting up automated advancing are as follows:

STEP 1: Select the slide to be modified.

STEP 2: On the Transitions tab, locate the Timing group.

STEP 3: Under Advance Slide, uncheck the box next to On Mouse Click.

STEP 4: In the After field, enter the amount of time you want to display the slide. Example: one can set the slide to advance automatically after 1 minute and 15 seconds, or 01:15:00 as shown in the following figure:



STEP 5: Select another slide and repeat the process until all slides have the desired timing.

Alternatively, one can simply click the **Apply to All** command to apply the same timing to all slides. Again, if a user wishes to advance to the next slide before an automatic transition, he / she can always click the mouse or press the spacebar to advance the slides as normal, despite the timing.

2.11 Find and Replace Operations

When one is working with large sized presentations, it can be difficult and time consuming to manually search, locate and replace specific words or phrases. This is achieved in PowerPoint using what could be termed as Automatic Find and Replace features of MS PowerPoint. For instance, the Find feature allows a user to quickly change words or phrases using the Replace feature.

The steps for achieving this are as follows:

STEP 1: From the Home tab, click the Find command.

STEP 2: When a dialog box appears, enter the text to be searched for, for instance, “Nigerian”, in the Find What field.

STEP 3: Click Find Next.

STEP 4: If the text is found, it will be selected.

Note that one can also access the Find command by pressing the key combination ‘Ctrl+F’. The steps for effecting automatic replacement of words or phrases are as follows:

STEP 1: Click Replace from the Home tab.

STEP 2: A dialog box appears; where user will type the text to be found/ replaced.

STEP 3: After typing the text you wish to find in Find what: field, you then type the text to be used to effect replacement in the Replace with: field.

STEP 4: Click Find Next.

STEP 5: If the text is found, user will review the text, and if he/she still wishes, will then select any of the replace options. Two possible options are to ‘Replace’, when the individual instance highlighted will be replaced with what is typed in the Replace With field, or to ‘Replace All’, which will lead to replacement of every instance of the word or phrase document-wide.



2.12 Summary

This unit focused on Microsoft PowerPoint as an application. Some of the areas covered are Understanding MS PowerPoint Version 2016 and what it is used for,

Creating MS PowerPoint Presentation with focus on the three methods - Using a New Blank File, Using a Template and Using an Existing Presentation. This unit also looked at Compatibility and File Conversion Issues, and Exporting MS PowerPoint Presentations with focus on Algorithm for Exporting to other files as well as Alternative Option using Save as Dialog Box. Other things covered are Slide Operations with focus on three options Slide Duplication Algorithm, Slide Movement Algorithm and Slide Deletion Algorithm. Others are Playing MS PowerPoint Presentations, Applying a Theme to MS PowerPoint Presentations, Automated Advancing, Find and Replace Operations, et cetera. There were also Self-Assessment Exercises and solutions.

2.13 Glossary

Ctrl+F Key combination for Find command.



2.14 References/Further Readings

NIL.



2.15 Possible Answers to SAEs

Answers to SAEs 1

They are using a blank file, using a template file and using an existing presentation.

Answers to SAEs 2

Backstage view and Convert command.

Answers to SAEs 3

The extension is *.pptx

UNIT 3: MICROSOFT EXCEL

Unit Structure

- 3.1 Introduction
- 3.2 Learning Outcomes
- 3.3 MS Excel Spreadsheet Interface
- 3.4 MS Excel Short Cut Keys
- 3.5 MS Excel Error Messages
 - 3.5.1 #DIV/0! Error
 - 3.5.2 #NUM! Error
 - 3.5.3 #N/A Error
 - 3.5.4 #NAME? Error
 - 3.5.5 #REF! Error
 - 3.5.6 #VALUE! Error
- 3.6 MS Excel Formulas
 - 3.6.2 SUM in Excel
 - 3.6.3 COUNT Excel Function
 - 3.6.4 COUNTBLANK Function in Excel
 - 3.6.5 AVERAGE Function in Excel

- 3.6.6 MIN Function in Excel
- 3.6.7 MAX Function in Excel
- 3.6.8 IF Function in Excel
- 3.7 Summary
- 3.8 Glossary
- 3.9 References/Further Readings
- 2.10 Possible Answers to Self-Assessment Exercises



3.1 Introduction

Microsoft Excel is an electronic spreadsheet application used for storing, organizing and analysing data and information. Excel has a wide range of usage not only in the Tourism and Hospitality Industry, but in academic research, and many other fields. A spreadsheet gives users the means to enter their data in a large-scale tabular format consisting of rows and columns. Some of the areas of usage of MS Excel are:

- a. Budgeting
- b. Economic Analysis
- c. Data entry in Tourism and Hospitality Industry
- d. Financial Management and Accounting
- e. Financial Analysis and Modelling
- f. Charting and Graphing
- g. Timetable Construction and Management
- h. Task Assignment and Monitoring
- i. Customer Relationship Management (CRM)



3.2 Learning Outcomes

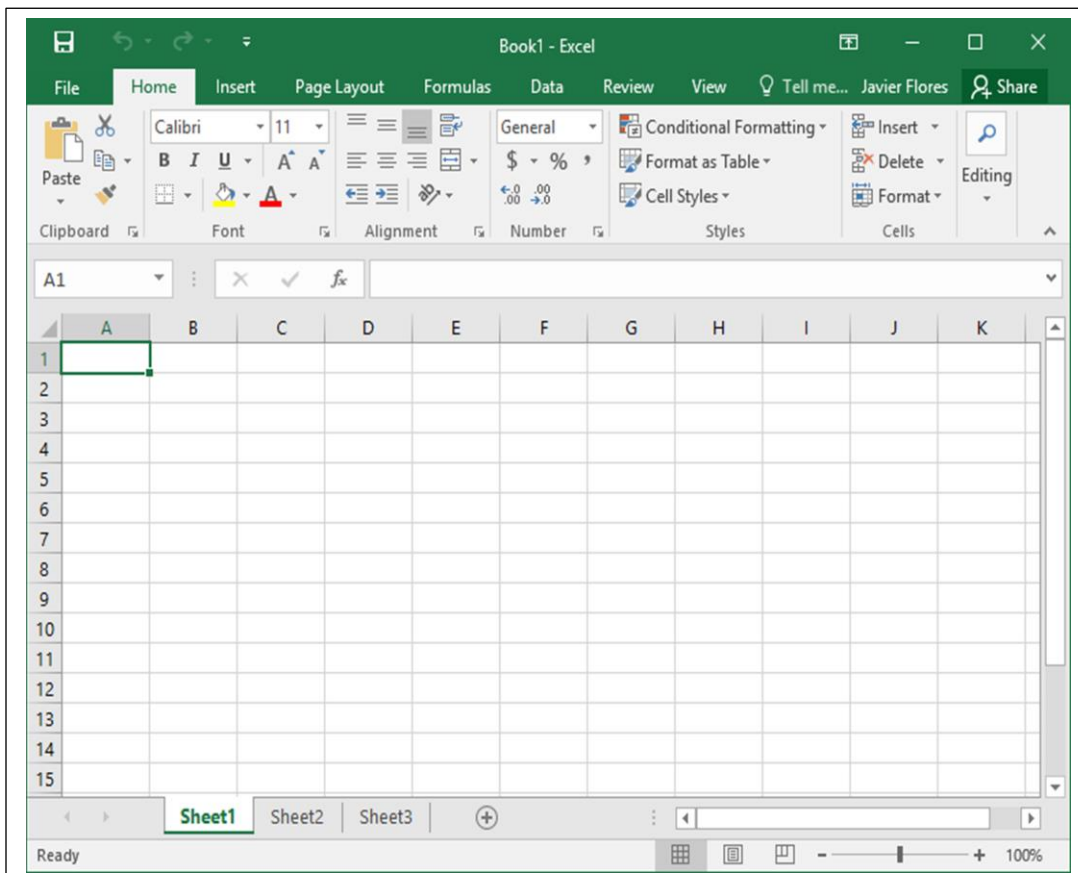
By the end of this unit, you will be able to:

- Discuss MS Excel Spreadsheet Interface.
- Explain MS Excel Short Cut Keys and MS Excel Error Messages.
- Explain the following six error messages - #DIV/0! Error, #NUM! Error, #N/A Error, #NAME? Error, #REF! Error and #VALUE! Error.
- Explain MS Excel Formulas.
- Use at least eight MS Excel functions, such as SUM, COUNT, COUNTBLANK Function, AVERAGE Function, MIN Function, MAX Function and IF Function in Excel
- Answer the given Self-Assessment Exercises.



3.3 MS Excel Spreadsheet Interface

In order to effectively study the MS Excel Application, it is necessary to begin with the general interface. The following diagram depicts a general MS Excel Interface:



The following fundamental information should be noted:

- a. An Excel file is usually referred to as a workbook.
- b. A workbook is made up of at least one sheet. For instance, the above workbook has a total of three sheets – Sheet1, Sheet2 and Sheet 3 respectively.
- c. There are a number of ways to start working with a workbook in Excel.
- d. One option is to create a new workbook with a blank workbook or a predesigned template, and another option is to simply open an existing workbook.
- e. Like a number of other MS Office applications, Excel 2016 uses a tabbed Ribbon system rather than traditional menus.
- f. The MS Excel Ribbon contains multiple tabs, each having several groups of commands, which are used to perform the most common tasks.
- g. MS Excel has been designed to automatically save workbooks to a temporary folder as the user is working on them. The implication is that if one forgets to save his/her changes or in the event of system crashing, the file could be recovered through what is known as Auto Recovery.
- h. MS Excel has a number of short cut keys, as will be outlined in the next section of this unit.

Self-Assessment Exercises 1

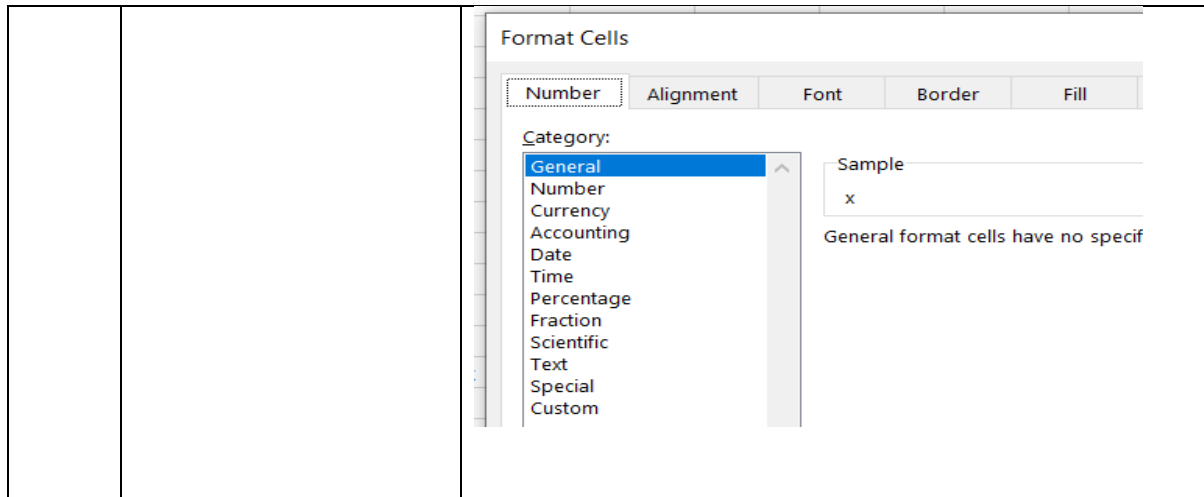
An Excel file is usually referred to as a _____

3.4 MS Excel Short Cut Keys

Some of the MS Excel 2016 short cut keys are as shown in the following table:

S/N	Short Cut Keys	Description
1.	CTRL + X	This is used to cut highlighted text.
2.	CTRL + C	This is used to copy highlighted text.
3.	CTRL + V	It is used to paste what has been copied.
4.	SHFT + F11	This key combination is used to insert the next worksheet. For instance, if there are two worksheets Sheet1 and Sheet2, then on pressing the key combination, the next one, Sheet 3, will be immediately added.
5.	ALT + I then R	This key sequence inserts a blank row. Note that this means pressing ALT and I at the same time, then press R after releasing the I key. The result is that a blank row will be inserted at the earlier cursor location.
6.	ALT + I then C	This key sequence inserts a blank column. Note that this means pressing ALT and I at the same time, then press C after releasing the I key. The result is that a blank column will be inserted at the earlier cursor location.
7.	CTRL + P	Print the file.
8.	CTRL + HOME	This key combination takes the cursor to cell A1.
9.	HOME	Pressing the HOME key takes the cursor to the beginning of the row.
10.	SHFT + Spacebar	This key combination is used to select the entire row, from left to right.

11.	CTRL + Spacebar	This key combination is used to select the entire column, from top to bottom.
12.	CTRL + 'pg up' CTRL + 'pg dn'	This key combination is used to navigate from one sheet to another adjacent one. Note that CTRL + 'pg up' navigates the sheets from Right to Left, while CTRL + 'pg dn' navigates the different sheets from Left to Right.
13.	CTRL + N	This opens a new workbook.
14.	CTRL+ O	This opens an existing workbook.
15.	CTRL + S	This saves the current workbook.
16.	CTRL + F4	This closes the file. If one wishes to close all open file, the key combination to be used is ALT + F4
17	CTRL + SHIFT then Arrow	This key combination is used to highlight a contiguous range in the direction of the arrow.
18.	CTRL + F	Find and Replace
19	CTRL + D	Fill down from cell above
20.	CTRL + R	Fill right from cell left
21	ESC	Cancel a cell entry and get out of cell
22	CTRL + ;	This key combination is used to automatically enter today's date.
23	CTRL +SHIFT+ ;	This key combination is used to automatically enter the current time.
24	ALT =	This key combination is used for automatic summation. When pressed, system will display = SUM() waiting for user to specify the range to be summed.
25	CTRL + 1	This key combination automatically calls up the cell menu. A cell menu looks like the following diagram, which could be used to modify cell properties



Self-Assessment Exercises 2

The key combination used to select the entire row, from left to right is

_____.

3.5 MS Excel Error Messages

It is necessary to outline some of the error messages and their causes in MS Excel. Here is a study of the common errors and messages.

3.5.1 #DIV/0! Error:

This error message occurs when one attempts to divide by zero. A sample screen of the occurrence of this occurrence is shown as follows:

ColA	ColB	ColC
100	150	50
20	10	0
5	15	#DIV/0!

As shown in the diagram, an attempt to divide 50 by 0 will trigger this error message. This problem can be solved using the following program code: `IF (J25=0, "", J24/J25)`, which should be placed at the right cell as follows:

ColA	ColB	ColC
100	150	50
20	10	0
<code>=IF(J25=0,"",J24/J25)</code>		

Note that the meaning of the code is that IF the denominator (in this case is J25) is zero, then the blank value "" should be used as quotient, else, the quotient is calculated as J24/J25. With such tactics, the problem that arises from outright division by zero is avoided. When the program code is run, and spread through the entire row, the result is as follows:

ColA	ColB	ColC
100	150	50
20	10	0
5	15	

3.5.2 #NUM! Error:

This error message occurs when a function call could not use a type of number given to it. For instance, it is a well-known truth that whenever someone attempts to calculate the square root of a negative number, it could lead to an error message. In higher Mathematics, this result is known as Complex Numbers. Let's demonstrate the occurrence of #NUM! Error:

NUM	25	49	64	-90
SQ	5	7	8	#NUM!

As shown in the table, the square roots of 25, 49 and 64 were successfully calculated in Excel as SQRT(25), SQRT(49) and SQRT(64) giving 5, 7 and 8 respectively. However, an attempt to use SQRT to get SQRT (-90) failed, giving an error message #NUM! Error.

3.5.3 #N/A Error

This error stands for “no value available” or “not available.” The error message indicates that the formula cannot find the value which ought to be returned.

3.5.4 #NAME? Error

This error message is triggered when a user misspells a function name. for example, the following figure shows an attempt to use a function SUM to sum up the columns ColA and ColB to make up ColC. Unfortunately, the user typed the name of function as SUMA instead of SUM. This led to the error message:

ColA	ColB	ColC
10		=SUMA(I31,J31)
15	4	
20	5	

ColA	ColB	ColC
10	3	#NAME?
15	4	
20	5	

3.5.5 #REF! Error

This error stands for reference error, and usually occurs when a user mistakenly deletes any cell which has already been referenced in a formula.

3.5.6 #VALUE! Error

This error happens when one uses wrong data type for a function or formula. For example, in the following figure, an attempt was made to add two items AAA and BBB which are not numeric.

	AAA	BBB	#VALUE!

Self-Assessment Exercises 3

When a user attempts to divide by zero, the error message that will occur is _____

3.6 MS Excel Formulas

We shall at this moment study some of the basic MS Excel formulas.

3.6.2 SUM in Excel

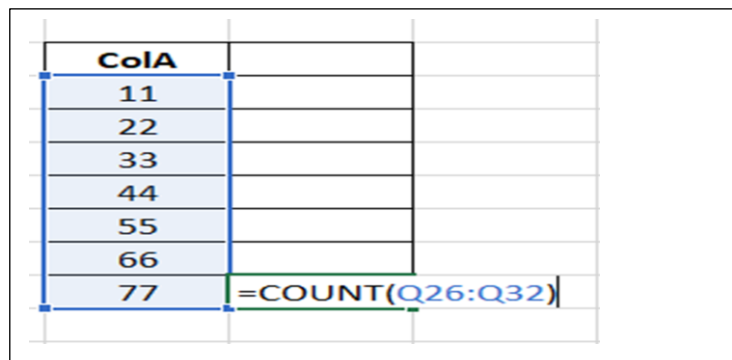
The SUM is used to get the sum of the values in two or more cells or range of cells. For instance, the following figure shows how SUM could be used to sum up the number of Boys and Girls into a new column.

246

Group	Boys	Girls	Total	
1	10		=SUM(I31,J31)	

3.6.3 COUNT Excel Function

The COUNT function is used to tell the number of numeric values in one or more cells or range of cells. Given the following spreadsheet, where Q26=11, Q27=22, Q28=33, ..., Q32=77.

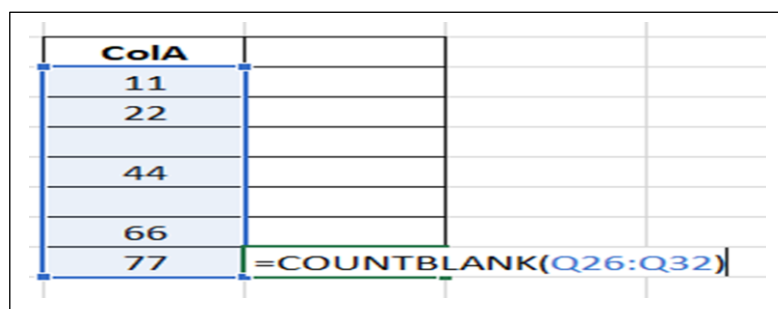


ColA	
11	
22	
33	
44	
55	
66	
77	=COUNT(Q26:Q32)

The function call COUNT(Q26: Q32) will count the total number of items from Q26 to Q32, giving the result as 7.

3.6.4 COUNTBLANK Function in Excel

The COUNTBLANK function counts the number of blank values in the specified range. For example the following function call COUNTBLANK(Q26: Q32) will count the total number blanks in the range Q26 to Q32, giving the result as 2.

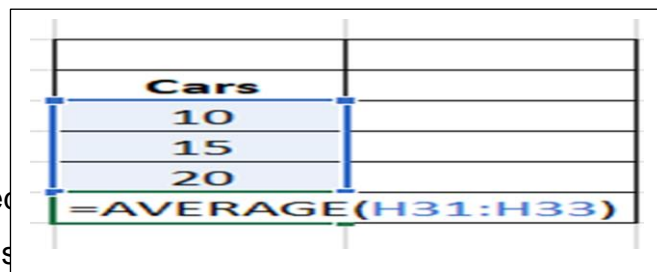


ColA	
11	
22	
44	
66	
77	=COUNTBLANK(Q26:Q32)

The final result is 2.

3.6.5 AVERAGE Function in Excel

This function is used to generate the average of the contents of one or more cells or range of cells. For example, the following shows a calculation of the average of the number of cars in three different garages.



Cars
10
15
20
=AVERAGE(H31:H33)

3.6.6 MIN Function

This function is used to find the minimum value of one or more cells or range of cells.

ents of one or more cells or range of cells.

and A4=9. Then the formula MIN(A1:A4) will give a result as 8, which is the smallest value in the specified range.

3.6.7 MAX Function in Excel

This function is used to generate the maximum value of the contents of one or more cells or range of cells. For example, suppose A1=8, A2=70, A3=94, and A4=9. Then the formula MAX(A1:A4) will give a result as 94, which is the largest value in the specified range.

3.6.8 IF Function in Excel

The IF function is used to perform logical tests in excel. The IF function usually has three arguments as follows:

- The first argument is the test to be carried out.

- The second argument is what should be the final result if the test becomes true.
- The third argument is what should be the final result if the test becomes false.

For example, suppose the MD instituted a bonus policy for the marketers of XYZ Company. The rule is that the company pays bonus sum of N2000 if a marketer wins over 50 customers, otherwise the marketer is paid only N500. This can be solved using the rule IF(A2>50, 2000, 500), and the final output is shown in the following table:

Customers Won	Bonus Paid
100	2000
7	500
80	2000
76	2000
5	500

It is assumed that Customers Won is in Column A, and that 100, 7, and so on, are in rows 2, 3, 4, and so on respectively. The IF function is assumed to be typed into cell B2 as IF(A2>50, 2000, 500), B3 as IF(A3>50, 2000, 500), and so on.



3.7 Summary

This unit focused on Microsoft Excel as an application. Some of the areas covered are Understanding MS Excel Spreadsheet Interface, MS Excel Short Cut Keys and MS Excel Error Messages. A total of six error messages were studied. These were #DIV/0! Error, #NUM! Error, #N/A Error, #NAME? Error, #REF! Error and #VALUE! Error. This unit also showed how to use MS Excel Formulas. Eight of such formulas demonstrated were SUM, COUNT, COUNTBLANK, AVERAGE, MIN, MAX, and IF Function. The Self-Assessment Exercises were also answered.

3.8 Glossary

SQRT Square Root



3.9 References/Further Readings

NIL



3.10 Possible Answers to SAEs

Answers to SAEs 1

Workbook

Answers to SAEs 2

SHFT + Spacebar

Answers to SAEs 3

#DIV/0! Error:

UNIT 4: R APPLICATION AND PROGRAMMING

Unit Structure

- 4.1 Introduction
- 4.2 Learning Outcomes
- 4.3 Overview of R
- 4.4 R Installation
- 4.5 Accessing R Programming Environment
- 4.6 Practical Project on Pie Chart Generation
 - 4.6.1 Practical Project 1
 - 4.6.2 Explanation of Program Code
- 4.7 Practical Project on Bar Chart Generation
 - 4.7.1 Practical Project 2
 - 4.7.2 Brief Explanation of Program Code
- 4.8 Summary
- 4.9 Glossary
- 4.10 References/Further Readings
- 4.11 Possible Answers to Self-Assessment Exercises



4.1 Introduction

In this unit of the lecture note, R will be studied, and practically demonstrated as an application, and a programming language platform. For a proper understanding of R, the unit began with R installation. Effort was made to demonstrate real life programming using simple examples in the area of generating pie charts, bar charts, et cetera. Related Self-Assessment Exercises were also provided.



4.2 Learning Outcomes

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

- Discuss Overview of R and why it is necessary to learn R as an application.
- Install R.
- Access R Programming Environment.
- Explain how to write R code.

- Demonstrate in practical terms how to handle Pie Chart Generation as a simple practical project in R.
- Demonstrate in practical terms how to handle Bar Chart Generation as a simple practical project in R.
- Explain R Program Code.
- Answer the given Self-Assessment Exercises



4.3 Overview of R

R is a software environment which has the capability to be used for statistical analysis and graphical representation, as well as a programming language. The name R was given to this programming language, based on the first letter of the names of the two originators. R Programming language was created by Ross Ihaka and Robert Gentleman at the University of Auckland, New Zealand. Apart from statistical analysis, graphical representation and programming, R is also used for data modelling and reporting. It is important to state that R is one of the most important tools used by researchers, data analyst, statisticians, and marketers to perform data retrieval, cleaning, analysis, visualizing, and presentations. You may wonder why R is such a powerful system. Some of the known reasons are:

- a. R is a simple and effective well developed programming language.
- b. R also doubles as data analysis software.
- c. It is well-designed, easy, and allows the use of various Input Output facilities.

- d. R comes with a number of versatile tools for visualization.
- e. R is very efficient in mathematical calculations using specialized data structures such as arrays, lists and vectors, and so on.
- f. R has efficient data handling and storage facility.
- g. R is an open-source system, which implies that you can freely download and use it without having to pay for its usage.
- h. R is an interpreted programming language. This implies that it brings out results line by line as you issue the command, rather than compiled languages that require you to wait till all instructions are issued before the result of computation is finally released.

Self-Assessment Exercises 1

Name the two originators of R Programming language, and their University.

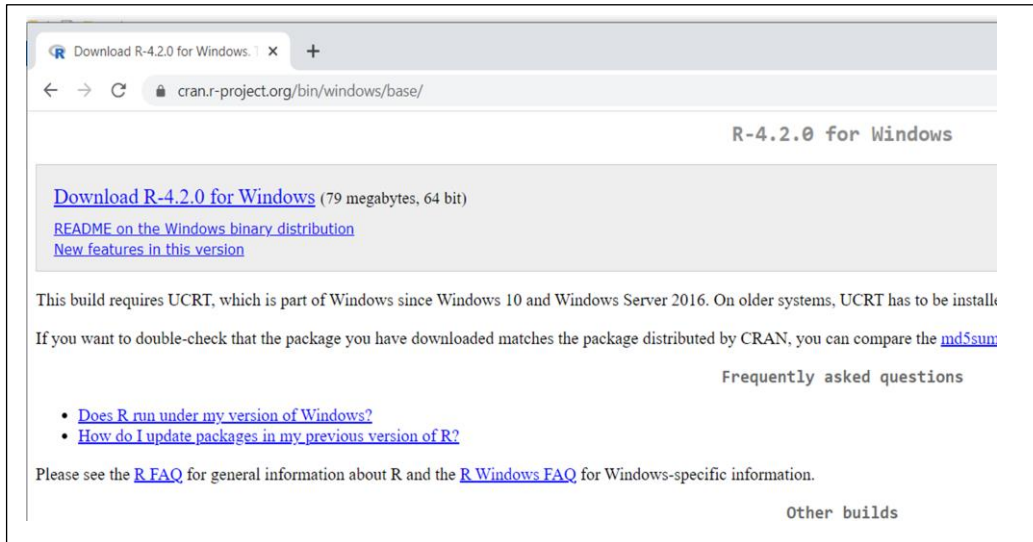
4.4 R Installation

The first task to be tackled in this course is to ensure that every student performs installation of R on his or her laptop. After completion of the installation process, the data analysis and programming environment of R would be fully ready for usage. Effort will be made to ensure that the process of installation is simplified as much as possible, and to achieve this, the necessary screens would be presented at key stages.

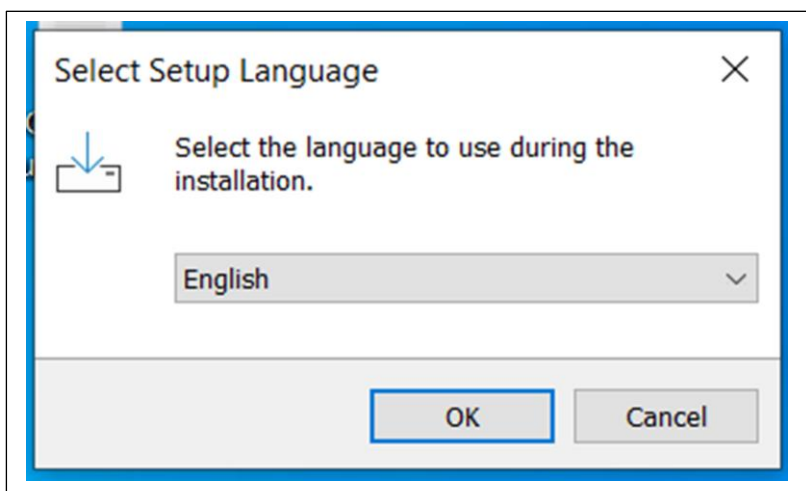
a. Download of Installation File

In this lecture, R version 4.2.0 for Windows will be used. To download the installation file, click on the website <https://cran.r-project.org/bin/windows/base/>.

The top left corner of the resulting screen is shown as follows:

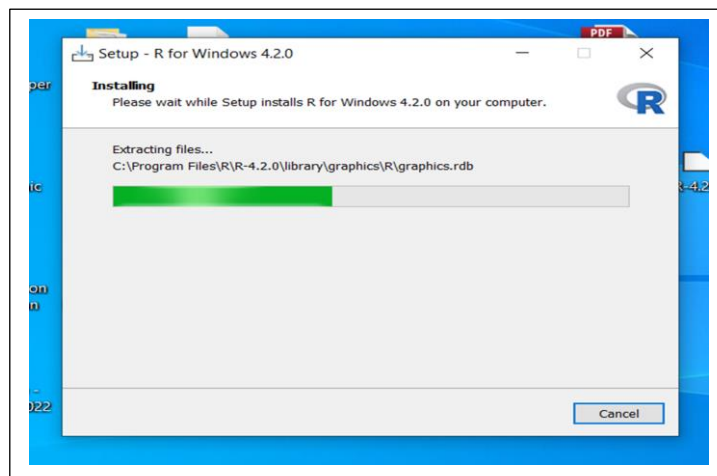


- b. On the Top Left corner of the screen, click the blue highlight **Download R-4.2.0 for Windows** (79 megabytes 64 bit). This will lead to the download of a file named R-4.2.0-win. This is the installation file.
- c. Locate the installation file in the Download Folder, and double click it to begin installation. The system displays an initial screen asking for permission to proceed with installation. Click YES to proceed, and system displays a new screen to confirm the language of operation, with **English** as a default.

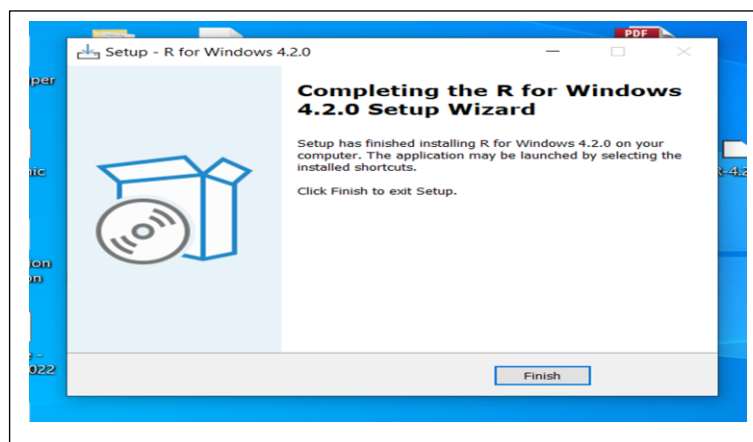


When user clicks OK after selecting Language option, system will bring a series of six consecutive screens. These are (1) **Information Screen** which displays important information for user, (2) **Destination Location Screen** which confirms location in the hard disk where installation should take place, (3) **Component Selection Screen** which confirms which components of R should be installed, and (4) **Start-up Option Screen** which confirms how R start-up should take place. The others are (5) **Menu Short Cut Screen** where user specifies where program shortcut should be placed, and (6) **Additional Task Screen** where user specifies other additional tasks. At each of these screens, user responds accordingly and proceeds by clicking NEXT.

- d. After clicking NEXT, system proceeds with the installation as shown in the following screen.



- e. Finally, the installation gets completed, and the following screen is displayed for user to Click Finish.



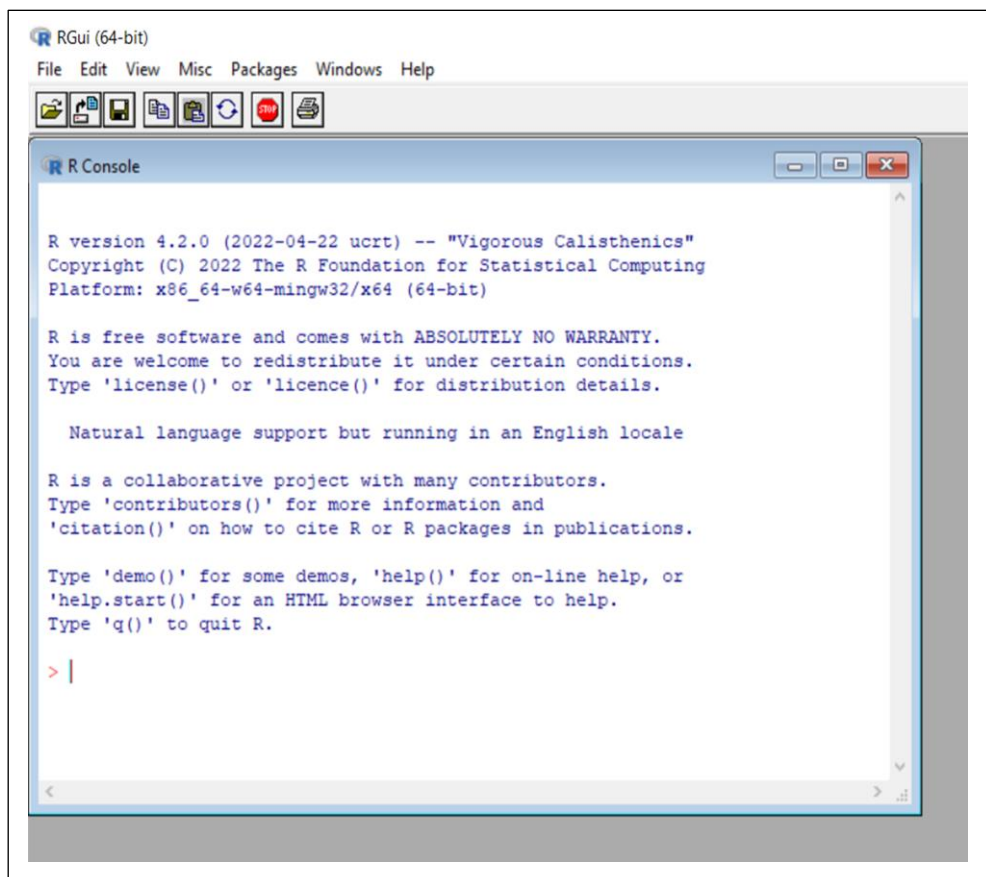
Click Finish to complete Installation. At this stage, students can now use R for their data analysis, visualization, programming, and so on.

Self-Assessment Exercises 2

During Installation of R, what is the role of Destination Location Screen?

4.5

Our next task is to access the programming screen, and demonstrate how to use R in practical terms. To access the programming screen, which is usually referred to as IDE (Integrated Development Environment), student should locate and double click the short cut R-4.2.0 located on the desktop. This will open the following screen:



```
RGui (64-bit)
File Edit View Misc Packages Windows Help

R Console

R version 4.2.0 (2022-04-22 ucrt) -- "Vigorous Calisthenics"
Copyright (C) 2022 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> |
```

Congratulations! You are now ready to begin practical use of the R for programming, data analysis and visualization. We shall demonstrate this using some real-life practical assignments.

4.6 Practical Project on Pie Chart Generation

R Programming language has several libraries that programmers can use to create charts and graphs. A pie-chart represents values as slices of a circle. In R, one can create such charts and add colours to the different sectors. The size of each slice of a chart is dependent on the size of the data it represents. In R the pie chart is created using the `pie()` function. The basic syntax of the command for creating a pie-chart using the R is as follows:

```
pie(x, labels)
```

where `x` is a vector containing the numeric values used in the pie chart, and `labels` is used to give description to the slices in question.

Please note that there are other parameters apart from `x` and `labels` mentioned above. For instance, there are parameters for specifying the colour of slides, the radius of pie chart, and so on, but for simplicity, we shall limit our focus to just two parameters.

4.6.1 Practical Project 1

A HMT 206 research requires students to visit five towns in Kaduna, and count the total number of standard hotels in each of the cities. They should then use the resulting data to plot a pie chart. Assume the cities covered and resulting counts are Kachia (117), Kafanchan (65), Kagoro (40), Zaria (80) and Zonkwa (61). Use R programming to plot the pie chart for the hotel data.

Solution:

The solution to the problem is as follows.

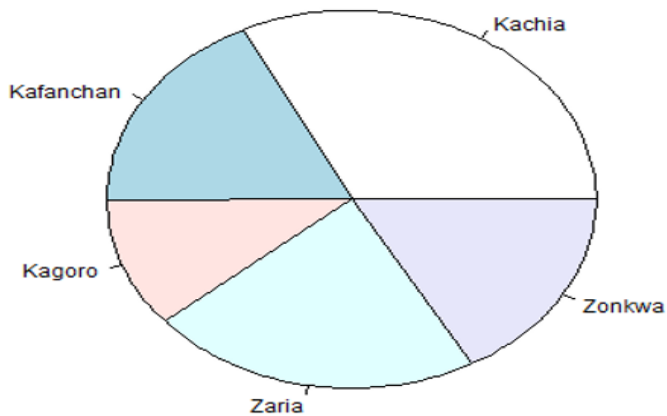
1. # HMT 206 ASSIGNMENT ON HOTEL COUNTS AND PIECHART
2. # First Create Data for the Graph
3. x <- c(117, 65, 40, 80, 61)
4. cities <- c("Kachia", "Kafanchan", "Kagoro", "Zaria", "Zonkwa")
5. # Giving Name to Chart output file
6. png(file = "KadunaHotels.jpg")
7. # Actual Plotting of the Pie Chart.
8. pie(x,cities)
9. # Saving the file.
- 10.dev.off()

As shown in the code above, there are a total of ten lines of codes. Students are encouraged to type in the ten lines of codes in the R programming environment studied earlier. Note that while keying in the codes, you should not type the serial numbers, as these were included simply for use in explaining the codes.

```
RGui (64-bit)
File Edit View Misc Packages Windows Help
R Console
> # HTM 206 ASSIGNMENT ON HOTEL COUNTS AND PIECHART
> # First Create Data for the Graph
> x <- c(117, 65, 40, 80, 61)
> cities <- c("Kachia", "Kafanchan", "Kagoro", "Zaria", "Zonkwa")
> # Giving Name to Chart output file
> png(file = "KadunaHotels.jpg")
> # Actual Plotting of the Pie Chart.
> pie(x,cities)
> # Saving the file.
> dev.off()
null device
      1
>
>
>
>
>
>
>
>
>
>
> |
```

Result of Program Execution

After executing the program, the chart will be generated. Further explanation will now be given concerning the program code, and the resulting output shown below:



4.6.2 Explanation of Program Code

1. Code Line 1: # HMT 206 ASSIGNMENT ON HOTEL COUNTS AND PIECHART

This is a comment statement. Any program code that begins with # character is a comment in R, and in a number of other programming languages. A comment is a statement that is not executed by Computer, but simply helps the programmer to recall or understand what is happening at that stage.

2. Code Line 2: # First Create Data for the Graph

This is also a comment statement, just like line 1 mentioned above.

3. `x <- c(117, 65, 40, 80, 61)`

Line 3 introduces the values of the counts of the hotels. These are values 117, 65, ..., 61. These values are stored as a one row variable with name x.

4. `cities <- c("Kachia", "Kafanchan", "Kagoro", "Zaria", "Zonkwa")`

In a similar way, cities is a variable that keeps record of the names of the cities involved, and the reading of the hotel counts in x have correspondence with the cities. For instance, cities number 4 is Zaria, with corresponding hotel count as x number 4 which is 80.

5. # Giving Name to Chart output file

Line 5 is also a comment statement, just like lines 1 and 2 mentioned earlier.

```
6. png(file = "KadunaHotels.jpg")
```

Line 6 is a program statement that specifies that output of this project should be saved in an image file known as KadunaHotel.jpg

```
7. # Actual Plotting of the Pie Chart.
```

Line 7 is also a comment statement, just like lines 1 and 2 mentioned earlier.

```
8. pie(x,cities)
```

Line 8 is a program statement that generates the pie chart.

```
9. # Saving the file.
```

Line 9 is also a comment statement, just like lines 1 and 2 mentioned earlier.

```
10.dev.off()
```

Finally, Line 10 closes the plotting device, and generates the output accordingly.

4.7 Practical Project on Bar Chart Generation

In statistics and data analysis, a bar chart represents data in rectangular bars with each length of the bar proportional to the value of the variable it represents. In R, the function `barplot()` is used to create bar charts. Note that such bars could be vertical or horizontal. R has the capability for generating both cases. Moreover, each of the bars can also be given different colours. The basic syntax to create a bar-chart in R is –

```
barplot(H,xlab,ylab,main, names.arg,col)
```

Where:

H is a vector or matrix containing numeric values used in bar chart.

xlab is the label for x axis.

ylab is the label for y axis.

main is the title of the bar chart.

names.arg is a vector of names appearing under each bar.

col is used to give colours to the bars in the graph.

4.7.1 Practical Project 2

Suppose the estimated annual rainfall for six cities in Nigeria is shown in the following table:

City	Rainfall
Lagos	300mm
Kano	80mm
Enugu	250mm
Abuja	100mm
Calabar	260mm
Sokoto	50mm

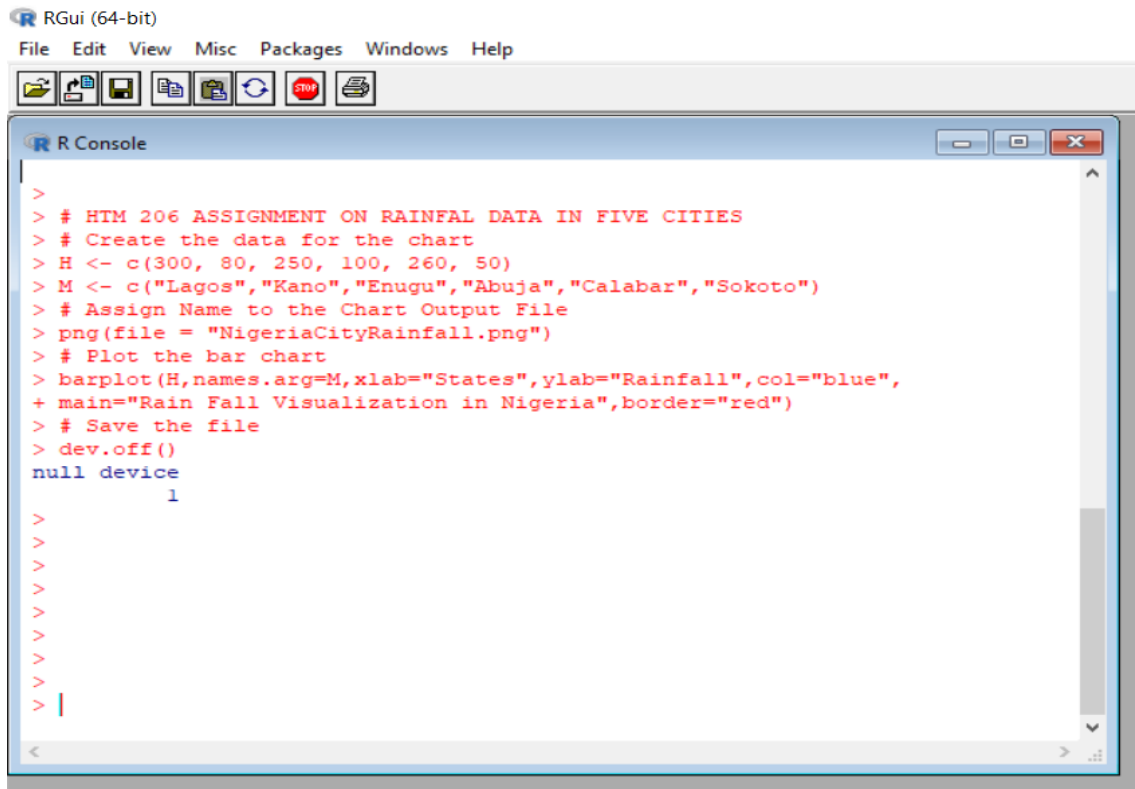
You are required to plot a bar chart using the above stated data.

Solution:

The program code solution to the problem is as follows.

1. # HMT 206 ASSIGNMENT ON RAINFAL DATA IN FIVE CITIES
2. # Create the data for the chart
3. H <- c(300, 80, 250, 100, 260, 50)
4. M <- c("Lagos","Kano","Enugu","Abuja","Calabar","Sokoto")
5. # Assign Name to the Chart
6. png(file = "NigeriaCityRainfall.png")
7. # Plot the bar chart
8. barplot(H,names.arg=M,xlab="States",ylab="Rainfall",col="blue",
9. main="Rain Fall Visualization in Nigeria",border="red")
- 10.# Save the file
- 11.dev.off()

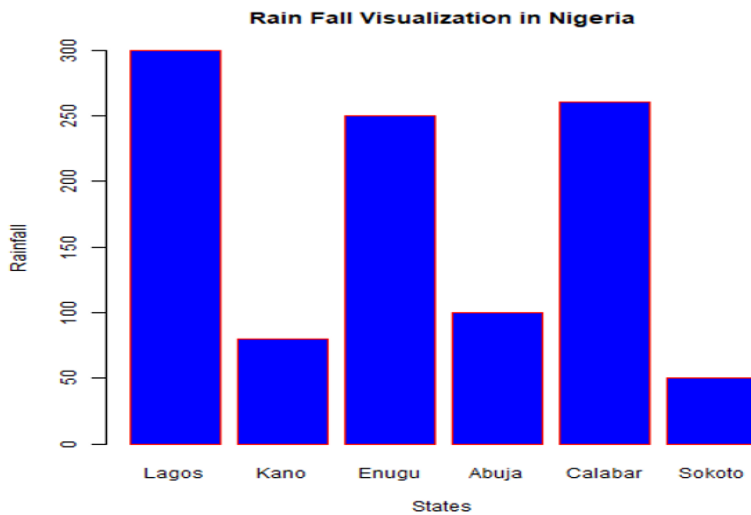
As shown above, there are a total of eleven lines of codes. Students are encouraged to type in the lines of codes in the R programming environment studied earlier. Again, note that while keying in the codes, you should not type the serial numbers, as these were included simply for use in explaining the codes:



```
>
> # HTM 206 ASSIGNMENT ON RAINFAL DATA IN FIVE CITIES
> # Create the data for the chart
> H <- c(300, 80, 250, 100, 260, 50)
> M <- c("Lagos", "Kano", "Enugu", "Abuja", "Calabar", "Sokoto")
> # Assign Name to the Chart Output File
> png(file = "NigeriaCityRainfall.png")
> # Plot the bar chart
> barplot(H, names.arg=M, xlab="States", ylab="Rainfall", col="blue",
+ main="Rain Fall Visualization in Nigeria", border="red")
> # Save the file
> dev.off()
null device
  1
>
>
>
>
>
>
>
>
>
>
> |
```

Result of Program Execution

After executing the program, the following bar chart results.



4.7.2 Brief Explanation of Program Code

Line 1 and 2 of the code are comment statements, just to remind the user or programmer what the problem is trying to solve. Line 3 and 4 are used to supply the data for the rainfall and states respectively. Line 5 is another comment statement. Line 6 states the name of the output PNG file, while Line 7 is also a comment statement. Line 8 is a command that generates the bar chart. Note that Line 9 is a continuation of Line 8. Finally, Line 10 is a comment statement while Line 11 closes the plotting device, and uploads the output accordingly.

Self-Assessment Exercises 3

Create a comment statement in R that says, “Nigeria is a Giant Country while Africa is a Giant Continent”

4.8 Summary

This unit focused on R as both an application and a programming tool. Some of the areas covered are Overview of R and why it is necessary to learn R. Also covered is R Installation, and how to access R Programming Environment. Another is demonstrating, in practical terms, how to generate Pie Chart, with understanding on how to write the

code and explain the Program Code. A second practical project learnt is Bar Chart Generation. The code was written and explained accordingly. The given Self-Assessment Exercises were also answered.

4.9 Glossary

Comment Statement A statement that is not executed as part of a program, but is there to serve as a guide or signpost to programmers.

4.10 Reference

NIL.



4.11 Possible Answers to SAEs

Answers to SAEs 1

R was created by Ross Ihaka and Robert Gentleman at the University of Auckland, New Zealand

Answers to SAEs 2

The Destination Location Screen confirms location in the hard disk where R installation should take place.

Answers to SAEs 3

Nigeria is a Giant Country while Africa is a Giant Continent

