



STUDY PACK

ON

DIGITAL & MANAGEMENT INFORMATION SYSTEM

FOUNDATION

DIGITAL & MANAGEMENT INFORMATION SYSTEM

FOUNDATION

@CIPM 2023

FOURTH EDITION

**CHARTERED INSTITUTE OF PERSONNEL
MANAGEMENT OF NIGERIA**

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FOREWORD

This fourth edition of the CIPM study pack is one of the learning resources recommended to persons preparing for certification through professional examinations. It is uniquely prepared to meet the knowledge standards of HR certification bodies and/or degree awarding institutions. The study pack is highly recommended to researchers, people managers and organisations responsible for human capital development in its entirety.

Each chapter in the text has been logically arranged to sufficiently cover this subject's various sections as itemised in the CIPM examination syllabus. This is to enhance systematic learning and understanding of the users. The document, a product of in-depth study and research, is practical and original. We have ensured that topics and sub-topics are based on the syllabus and on contemporary HR best practices.

Although concerted effort has been made to ensure that the text is up to date in matters relating to theories and practices of contemporary HR issues, we advise and encourage students to complement the study text with other study materials recommended in the syllabus. This is to ensure total coverage of the elastic scope and dynamics of the HR profession.

Thank you and have a productive preparation as you navigate the process of becoming a seasoned Human Resources Management professional.

Olusegun Mojeed, FCIPM, fnli
President & Chairman of the Governing Council

ACKNOWLEDGEMENTS

On behalf of the President and Chairman of the Governing Council, Mr Olusegun Mojeed, FCIPM, and the entire membership of the Chartered Institute of Personnel Management of Nigeria (CIPM), we acknowledge the intellectual prowess of Dr Babajide Matthew Adeyemi in writing this well-researched text for Digital and Management Information System. The meticulous work of our reviewer, Mr. Oludare Adegbayi Pearse has not gone unnoticed and is hereby acknowledged for the thorough review of this publication.

We also commend and appreciate the efforts of members of the Education Committee of the Institute, under the chairmanship of Mr. Henry Onukwuba, MCIPM for their unflinching support.

Finally, my appreciation goes to my internal project team, led by the Director, Professional Standards and Development, Mr. Gbenga Samuel Odetunde ACIPM, the Team lead, Certification and Licensing, Mr. Samuel Eviewho, ACIPM and Team lead, Professional Examination, Mr. Yinka Oyedere, MCIPM for making this project a success.

Oluwatoyin Naiwo, FCIPM
Registrar/Chief Executive

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CHAPTER ONE

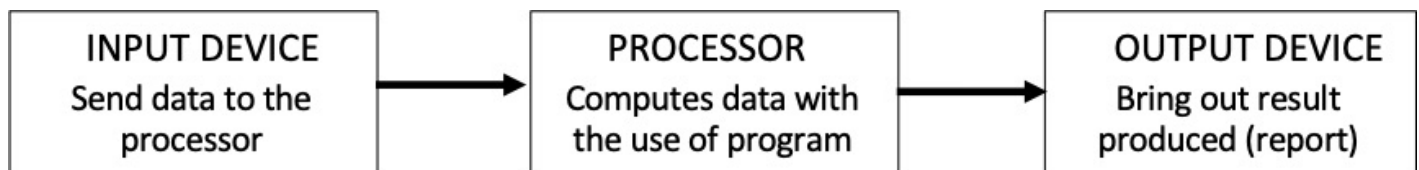
INTRODUCTION TO COMPUTER

1.0 The objectives of this chapter are stated below:

- (i) Enable students/candidates to have the general knowledge of computer and its applications.
- (ii) The students/candidates should be able to identify each component of computer system
- (iii) Enable students /candidates to distinguish among phases of computer system design.
- (iv) Students should be able to differentiate between hardware, software and firmwares.
- (v) Application of computer system to every other field of life including personnel, business, information security, data-security, data analysis, science, and engineering.

1.1 DEFINITION OF COMPUTER

A Computer is a set of electronic equipment that **accepts** data as input, process them with the aid of predefined instructions called **programs**, and **produces** useful output for management's (or any other people's) use. The collection of computer equipment is referred to as **Hardware** while the instructions for processing areas are called **software**.



1.1.1 TYPES OF COMPUTER

Computers are mainly classified according to size, purpose, and capability. There are three categories of computers namely; Microcomputer, Minicomputer and Mainframe computers.

MICROCOMPUTERS:

Otherwise known as Personal Computers, are usually placed on desks and can carry out day-to-day tasks for individuals or a group of people. They are referred to as stand-alone in that because they are usually used by one person at a time, although they can be networked, allowing them to share resources and information. They can also be connected to either a minicomputer or a mainframe computer. Some microcomputers today can perform the work of mini or mainframe computers. A microcomputer with internal capability like a mini or mainframe typically has three main units for operations, which are:



Fig 1.1: Standalone upright Micro Computer System

- a. the input unit (the keyboard),
- b. the processing unit (system unit, housing the CPU) and
- c. the output unit (monitor or display unit)

These three units are necessary for a microcomputer to function. All other units like printer, scanner etc. are optional.

MINICOMPUTERS:

- a. They are smaller in size and lower in capacity compared with the mainframe and therefore occupy less space. They do not require special environment like mainframe. They are cheaper than mainframe. A minicomputer has the ability to serve a single unit of an organisation or a small establishment.
- b. It can accommodate few terminals and some Personal Computers can be attached to it. Digital Equipment Corporation launched the first minicomputer, the PDP-8 in 1965. Examples of minicomputer by **IBM System/3 Model 10** and **IBM System/34**



Fig 1.2: IBM Mini computer

MAINFRAME COMPUTERS:

Mainframe computers are large systems with the ability to serve large organisations. With modern technology, this kind of system can be accessed through terminals. Several terminals and personal computers can be connected to a mainframe. In terms of price, they are higher than other types. They also have larger memory capacities. A mainframe computer can accommodate other peripherals from different manufacturers. Compared with other computers, mainframe computers require special environment for operation.



Fig 1.3: IBM System 360/50 Mainframe Computer

They generate much heat, therefore, are normally provided with air conditioning system to make the room suitable for their operation. Several peripherals can be connected to a mainframe, often accommodating multiple types simultaneously. In other words, two printers or several terminals can be connected to the processor of a mainframe. Some producers of mainframe systems are IBM, NCR and ICL. Some of their products are: **IBM 360, IBM 370, ICL 1900 and ICL 2900.**

SUPERCOMPUTERS:

These are computers with extremely fast speed capable of performing hundreds of millions of instructions per second. They are purpose-built for multi-processing systems, utilizing multiple processors to solve problems. They are mainly used for weather forecasting, image processing and bio-medical applications. Examples are **IBM 3090 and ETA 20.**

CHARACTERISTICS OF COMPUTER:

Computers differ in operation compared to other manual and mechanical equipment. As human needs evolved, we developed more advanced means of meeting those needs when traditional methods fell short.

Computation tools have progressed from rudimentary tools like fingers and stones to intricate machines that perform calculations at speeds surpassing the capabilities of the human brain. Contemporary computers exhibit the following characteristics:

SPEED-FAST:

The speed of a computer is determined by the number of bytes the CPU can process within a second; it is measured in **Megahertz** (MHz) that is millions of cycles per second. This makes it possible for it to process at faster rate. To attain higher speed, one needs to acquire more processing chips. Computers with higher value work better and cost more.

VERSATILITY – (ABILITY TO PERFORM DIFFERENT TASKS):

One of the characteristics of computers is versatility. This means that computers can be used for different jobs unlike a camera that is only used for photography. As a result of this, computers fit into any organisation like schools, hospitals, banks, corporations, government offices and diverse places. They can be used for various applications such as scientific, business, engineering etc.

ACCURACY:

The output from a computer is always accurate and dependable when both the input data and the processing program are correct. It should be noted that a computer does not know everything, therefore, whatever data is supplied for any variable will be accepted and used, hence the word GIGO (Garbage In Garbage Out). If the correct amount on a cheque to be supplied to computer as input is 14 and the operator keys in 41, the computer cannot know this error. Computers do not think, rather users do, and hence IBM logo says: **THINK**.

STORAGE CAPABILITY:

Computers have very large memory of storage capability. Some computers can store billions of characters in a small magnetic material of the size of a mobile handset. New materials like CD and high capacity hard-disks make it possible for computers to keep large data now and as well possible to transfer large data with ease. Flash disks can as well be used to transfer data with ease.

EXCEPTION REPORT:

If a system is well analysed during its initial setup, it becomes possible for the system to grant users access only to the information they need. This saves the user's time from having to go through large file. This system is normally available in Data Base Management System. With this system, users can print only the necessary information for their assignments from the entire system, resulting in cost and time savings.

RELIABILITY:

Processing with a computer is far reliable compared to manual operations. Once the programs have been thoroughly tested, the results will be consistently accurate as long as the input data is correct.

FLEXIBILITY:

Unlike manual operation, a computer system can deal with more data without any danger to the system. If a system is purchased when only the input data is 20,000, it will easily deal with higher number of data in future with little additional time. In case of manual operations, serious adjustment will be needed before higher data can be processed.

For instance, if the data is doubled, an additional set of staff of the former time would be required to carry out the operation or else there will be serious delay in production.

1.2 WORD PROCESSING USING MS-WORD 2016

GENERAL OVERVIEW:

Word processing is an enhanced or computerised form of typing and editing of any kind of text, memos, letters, articles, reports and even books. These are achieved with the aid of some input devices and output devices, already discussed in the preceding chapters. The advent of word processing was due to the increasing need for document processing in the shortest possible time and in most cases presentation of such document with the necessary effects.

Ms Word 2016 is an integrated part of Office 2016 developed by Microsoft Corporation, which is the world's most popular word-processor. It is a tool based on the concept of word processor and an improvement over previous versions, such as Word 97, 2000, 2003 and 2010. There are several word processing packages from different software houses, trying to produce varying package to suit users need. Good examples are, WordPerfect, Loco script, WordStar, MultiMate, Report star, Lotus note, Perfect writer, professional write and Microsoft Word. The application of Microsoft word as a word processing package will be discussed in this chapter.

General Features of Word Processing Packages:

Irrespective of the Version of the Microsoft Word Processing package used, the mode of entering text is similar and the following are common:

Entering Text:

- i. **Status Line:** This reflects the current status of the system, indicating the line number and position of the cursors, special features are also indicated.
- ii. **WordWrap:** This is the automatic moving of words from one line to next. When words cross the margin that marks the maximum length of line, the system breaks the line and moves the words being entered to the next line. In this environment, return key need not be struck at every line, using the present margins, the software breaks at the correct place.

Editing Text:

- a. **Inserting Text:** Characters or words are inserted into existing text.
- b. **Replacing Text:** The entered characters are placed “on top of” existing characters, erasing previous characters.
- c. **Deleting Text:** This involves removing or erasing unwanted characters.
- d. **Correcting Text:** This involves combination of interesting, deleting and replacing text.
- e. **Character Adjustment:** Character can be underlined, boldfaced, and overprinted. Many systems can change the font and size of individual characters. Sections of text can be indented, margins can be adjusted.

Text Formatting:

1. **Page Layout:** The formatting portion of word processing programs manages elements such as controlling the number of lines per page, adjusting paragraph indentation, and implementing headers and footers within the document.

Advanced Features:

- i. **Search and Replace:** Information embedded within a document can be located by the software and adjusted as needed.
- ii. **Moving Block of Text:** Portion of text or blocks can be moved from one place to another within a document.

Additional Capabilities:

- a. **Mail Merge:** It enables the word processing software to combine a list of names, addresses with a form or letter.
- b. **Spelling Checkers:** This involves comparing a word with a built-in electronic dictionary; spelling of word in a document can be checked for correctness.
- c. **Thesaurus:** This involves the use of list of synonyms to the typed document which will appear so that word in document can be adjusted.
- d. **File Merging:** This feature makes it possible to combine, in a single document, information created by other application packages.

1.2.1 TYPES OF WORD PROCESSING PROGRAMS

1. **Text Editor/Text Formatter:** Text is entered without regard to how it will look on the printed page.
2. **Back-slash commands:** Command that are read by the formatter portion of the word processor and affect the final layout of the document.
3. **What You See Is What You Get (WYSIWYG):** This type of word processor seamlessly integrates both the editing and formatting features within the software. When a formatting command is given, it is executed immediately, and the text on the screen is promptly adjusted to reflect the applied formatting changes.

GETTING STARTED WITH MICROSOFT WORD 2016

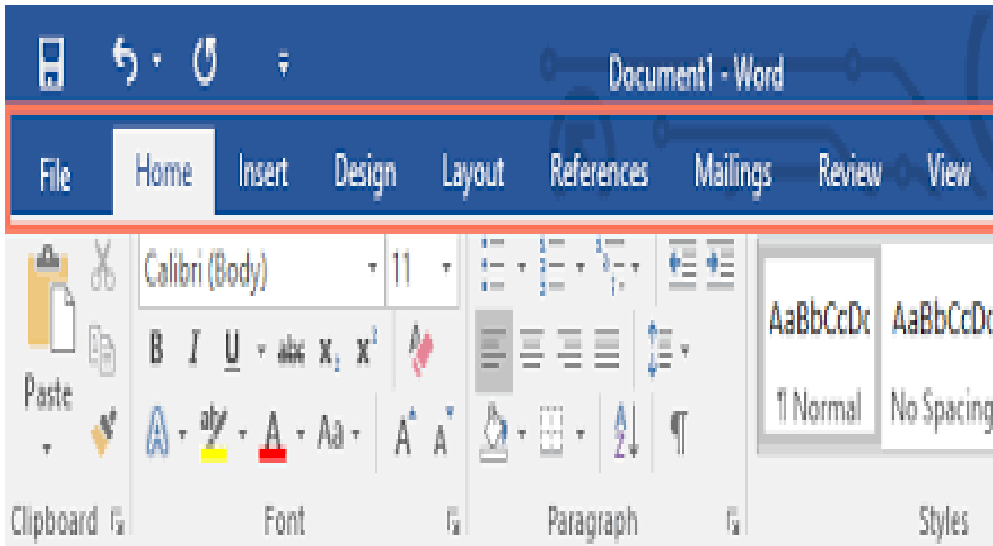


Fig.1.4: Word Icon and Desktop of Windows 11 with ms-word 2016

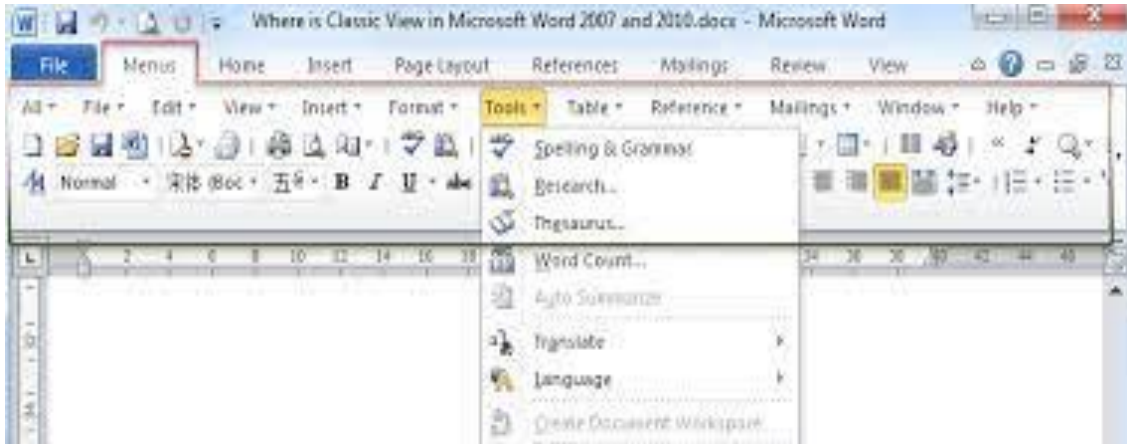
When the Computer system has completed the booting activity, it presents its desktop, with icons scattered on it. Search if the Word Processing Icon is on the desktop. If YES, then double click on it to see Fig 1.4. If NO, place your mouse on the START icon and perform the following actions to see Fig 1.4.



Fig 1.4:Start Menu sub-menus

Step 1: Double Click on the WORD icon, if tagged to the START MEMU

Step 2: If Step 1 is NO, then click on ALL PROGRAMS to fetch for the Word Icon through Microsoft Office. Then Double Click on it.



Step 3: The result of either Step 1 or Step 2 will yield Fig.1.5

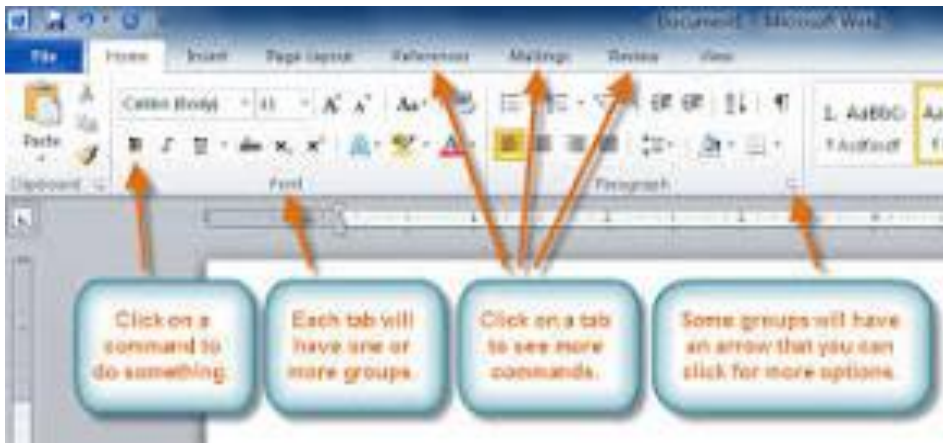


Fig. 1.5 Microsoft Word 2016 Environment/Screen

When Fig 1.5 is accomplished, all typing, drawing, and editing, e.t.c. can be done within the environment.

Identifying Essential Parts of the Windows Environment

For easy usage of the package, it is important to identify and know the functions of essential part of the environment.



Fig 1.6: Ms-Word Working Environment Icons

Note that the Tool Bar has SEVEN modules (Home, Insert, Page Layout, References, Mailings, Review and View) with each having its peculiar functions. However, if the activity being performed on the Word environment involves drawings, then additional module, called FORMAT comes up automatically. Format Module may come up as PICTURE Tool or DRAWING Tool or TEXTBOX Tool, depending on the type of image (Picture or Drawing or Textbox).

The functions are similar but specific to drawings or pictures or text boxes. PICTURE Tool has the following modules (Adjust; Shadow Effects; Border; Arrange and Size) while DRAWING Tool has the following modules (Insert Shapes; Style; Shadow Effects; 3-D Effects; Arrange and Size). It is pertinent to add that each of the modules has list of activities that could be performed on the image, be it picture or drawing. However, if the activity involves inserting or drawing tables, TABLE TOOLS (comprising of DESIGN and LAYOUT) will be added instead of FORMAT. See Fig1.6

Similarly, if the activity on the document involves inserting Header and Footer, HEADER & FOOTER TOOLS (Comprising of only DESIGN) will be invoked, as shown in Fig 1.6.



Fig 1.7: The use of Zoom tools for Maximal and Minimal variables

If you Click on the Zoom Level, Zoom Dialog Box will open as shown.

OPENING WORD DOCUMENT

To open an existing file, the following methods will suffice:

Fetching the existing File from Document

Step 1: Click on the START ICON for a pop-up dialogue box. See Fig 1.8

Step 2: On the Dialogue Box, Click on DOCUMENTS.

Step 3: Result of Step 2 will generate Fig 1.4, where the list of all files on the system, irrespective of the package used, will be seen.

Step 4: From the list, select appropriate file and click on it.

Step 5: Result of step 4 opens the desired file.

Step 1: Click on the START ICON for a pop-up dialogue box. See Fig1.8

Step 2: On the Dialogue Box, Click on RECENT ITEMS

Step 3: Result of Step 2 will generate Fig.1.9, where the list of all files that have just been recently worked upon will be seen

Step 4: From the list, select appropriate file and click on it.

Step 5: Result of step 4 opens the desired file

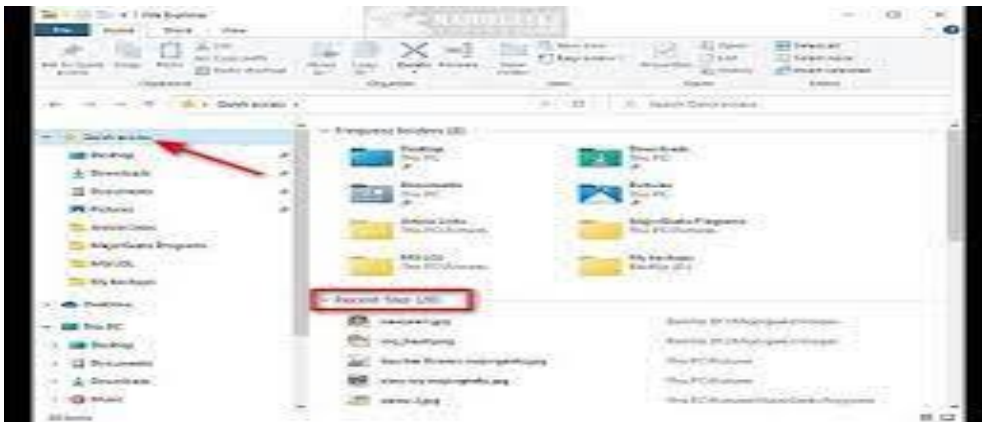


Fig.1.10: List of files on Recent Items

Fetching the existing File through OFFICE BOX

Step 1: Click on the Office Box for a Drop down Dialogue Box

Step 2: On the Drop down Dialogue Box, you can perform either action.

Step 3: Select the desired file from list of files on RECENT DOCUMENTS or

Step 4: Select and Click on the “OPEN” button to arrive at Fig1.10.

Step 5: Select and Click on the desired file OR Click the OPEN button at bottom of the dialogue box Fig.

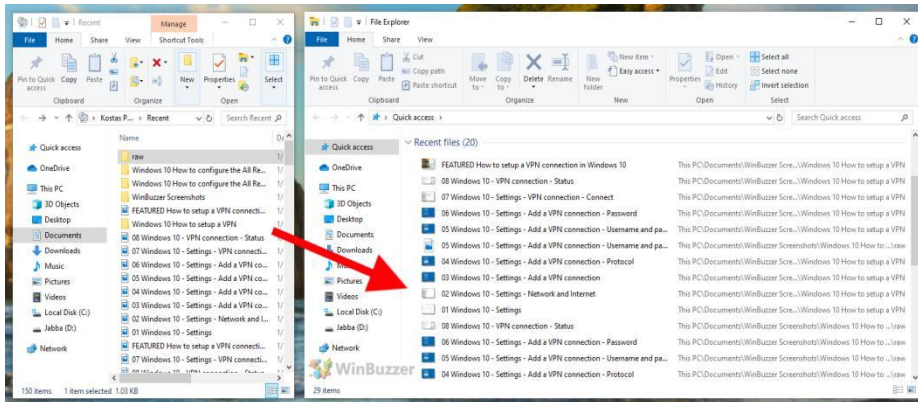


Fig.1.11: 'Open' Dialogue Box(fetching existing file from flash drive)

Fetching the existing File from FLASH DRIVE

When a flash drive is inserted into a computer system, it operates on “Auto Play” mode, irrespective of the version of Microsoft office used. The implication is that the entire files on such flash can be viewed and the desired one opened by Double Click only as soon as the flash is inserted. For example, when the flash labeled ADELANWAPHD was inserted through the USB port, Fig.1.11 was displayed, automatically. From the dialogue box, we can select any file of our choice on the Flash Drive.

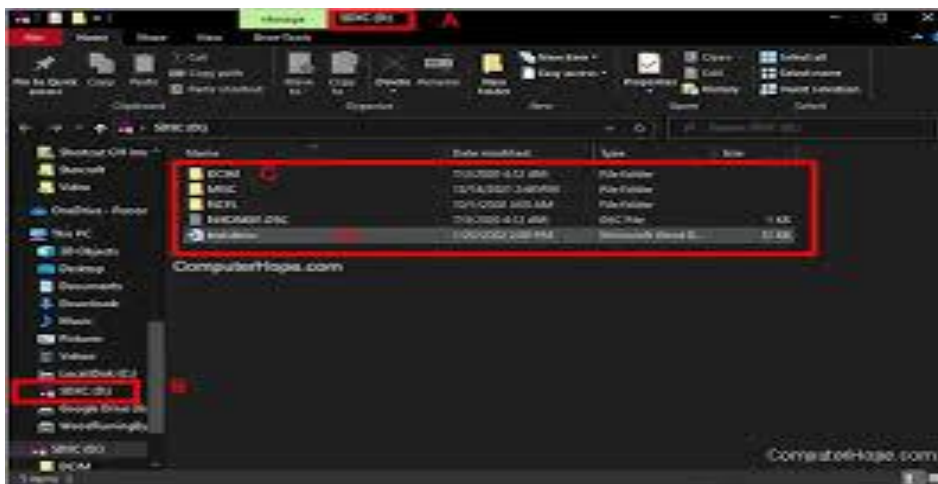


Fig 1:12: Dialogue Box displaying the contents of Flash Drive.

However, if the flash does not run an “Auto Play” then the following steps can be employed to fetch and open the desired file:

Step 1: Click on START for a pop up Dialogue Box

Step 2: On the Dialogue Box, Select and Click

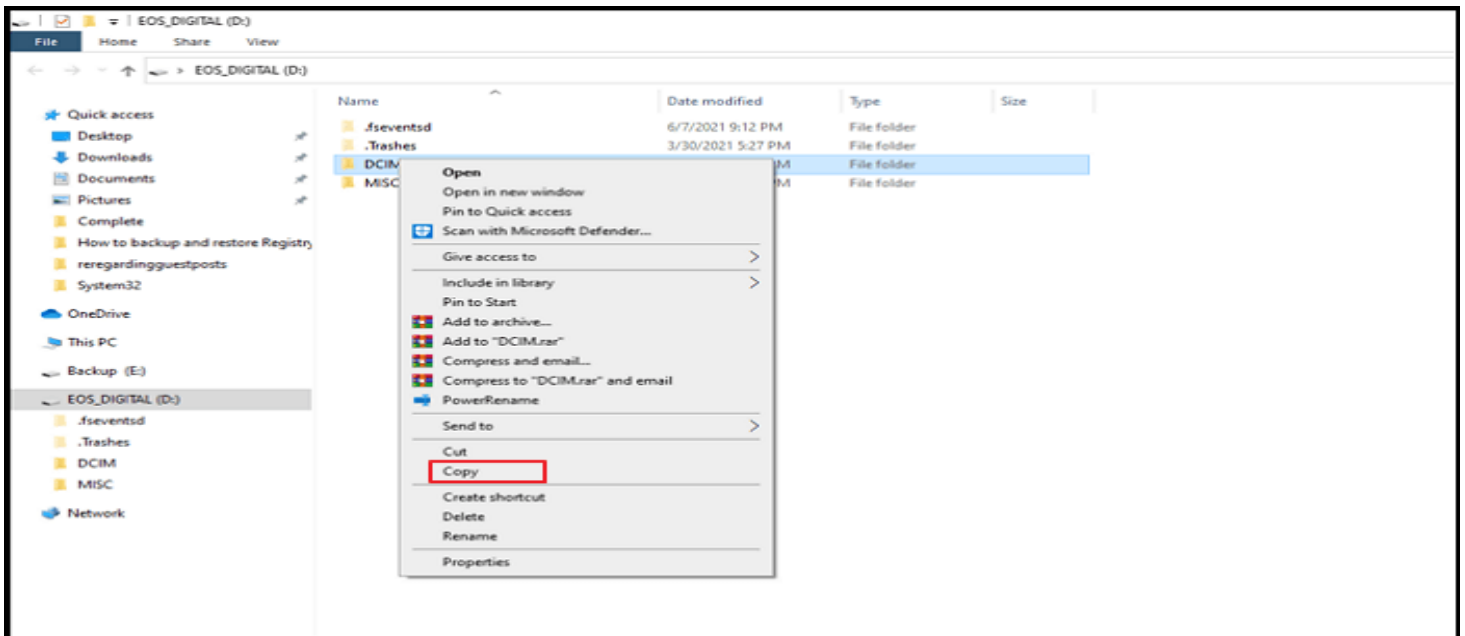


Fig 1.13: The system displaying the source of file EOS_DIGITAL(D)

Step 3: The result of step 2 will generate Fig. 1.12

Step 4: On Fig. 1.12 click on the Flash Drive named EOS_DIGITAL

Step 5: Step 4 will also generate Fig. 1.13 and any desired file on the flash can be selected and double click on.



Fig 1.13.: Window displaying all the Disk drives and other Hardware

SAVING WORD DOCUMENT:

Saving files or Documents is an essential task in Word Processing activity, since only saved files can be re-opened, edited, updated and resaved, for future use. In addition, our file cannot be named for easy referencing until the processed is initiated. Therefore, it is important to name our files, few minutes into commencement of typing to avoid loss in case of power outage. To save a file after typing on the workspace area, the following steps can be carried out.

Step 1: Select and Click on the OFFICE BOX

Step 2: Select and Click the SAVE AS option as shown in Fig 1.8

Step 3: Select the compatibility option, so that your file can open on other versions elsewhere

Step 4: Select the favorite Links, e.g. Document, Flash Drive, Desktop etc.

Step 5: Type your file name in the filename textbox after erasing the contents in the box.

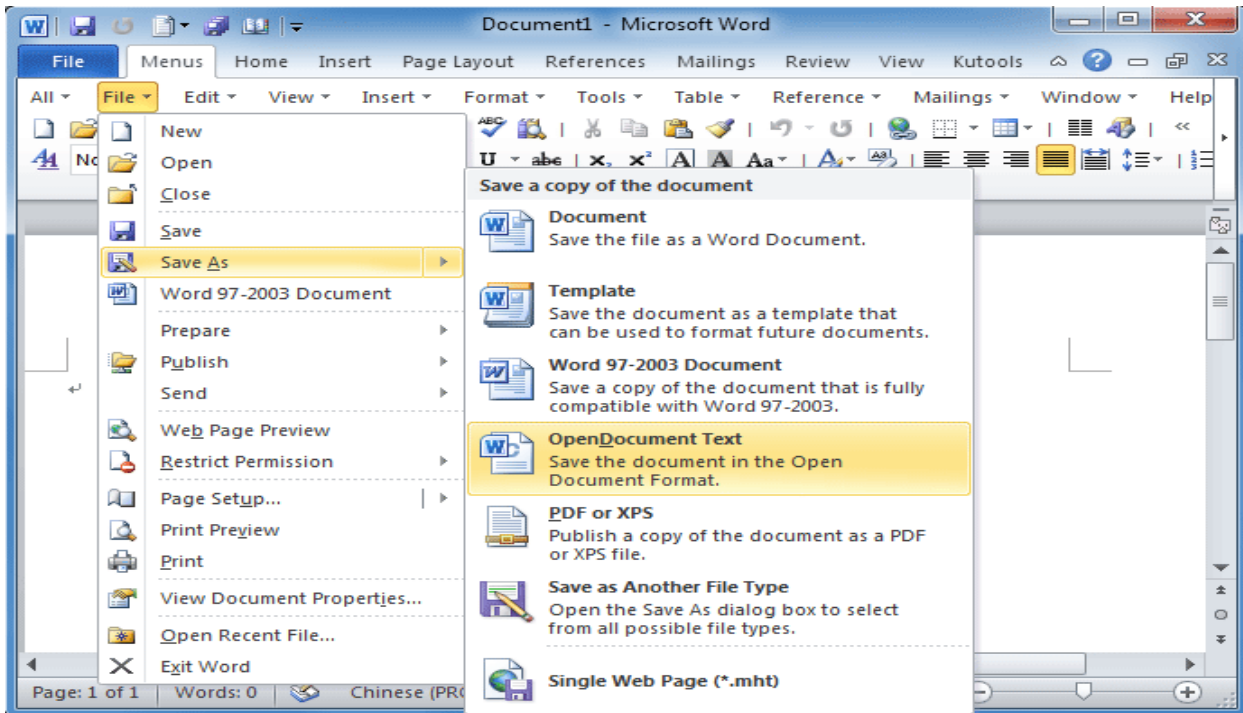


Fig 1.14 Using OFFICE BOX to Save a file

Step 6: Click the SAVE button at the bottom of the Dialogue box.

Word automatically gives an “Extension. Doc” to the file. Thus, the file is saved with your <filename> .doc. For example, the file MYBOOK1 has been successfully saved in DOCUMENT and carries MYBOOK1. Doc. This new name replaces the default name on the Title Bar, immediately.



Fig.1:15: Window showing how a file is saved

DOCUMENT MODIFYING:

(a) By selecting the HOME button on the Main Menu, the following sub-sectional activities can be accomplished in arriving at a desired document.

Modifying using CLIPBOARD TASK PANE

One may require repeated typing to use the same piece of information at more than one place, instead of typing it again you can use the feature of cut, copy and paste provided by MICROSOFT Word. The CUT is a way of temporarily or deleting a part or whole of a text. The COPY allows for text duplication within or outside a given document while the PASTE allow for a copied or deleted text to be displayed at a give part of a document. This is accomplished using CLIPBOARD TASK PANE.

Modifying using FONT DIALOGUE BOX

Similarly, text can be displayed in different format to highlight a particular point, using the FONT DIALOGUE BOX. With this, Font type can be changed; Font size, increased or decreased; text Bold, Italicized and/or underlined. In addition, the following action can be performed:

Strikethrough (ii) Subscript (iii) Superscript (iv) Change Case (v) Font Colour and (v) Clear-Formatting.

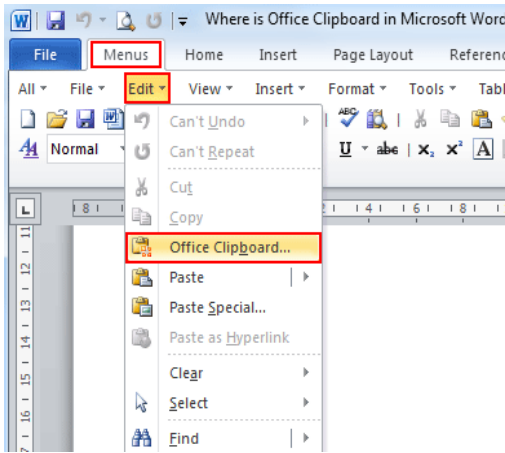


Fig.1:16(a)

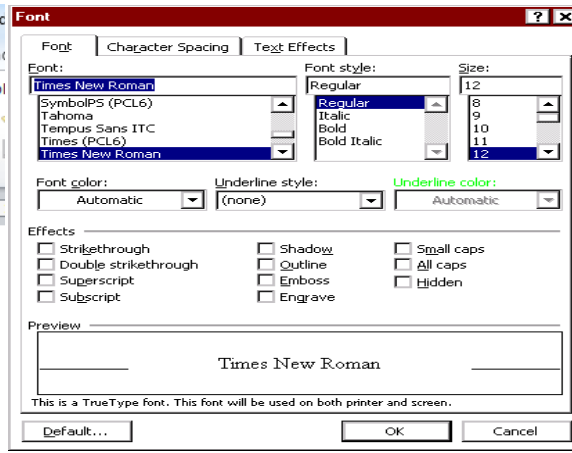


Fig.1.16 (b)

Modifying using Clipboard Task Pane

Modifying using Paragraph Dialogue Box

The PARAGRAPH DIALOGUE BOX allows us to increase or decrease Indent; introduce paragraphs marks; insert bullets and number; Align Text Left or Right; Center; Start a Multilevel List; Sort; Shading; customized the borders of select Text or Cell and modify line spacing

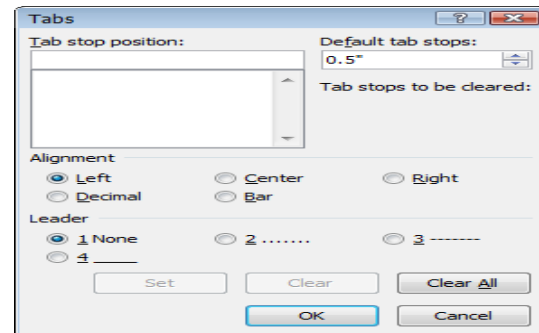


Fig 1.17: modifying Using paragraph indent default

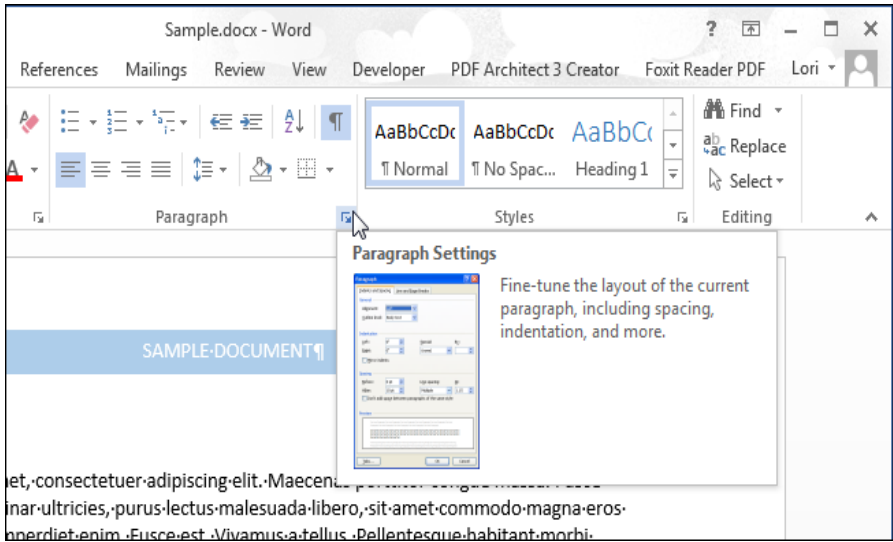


Fig1.18: Modifying Using Paragraph Dialogue Box

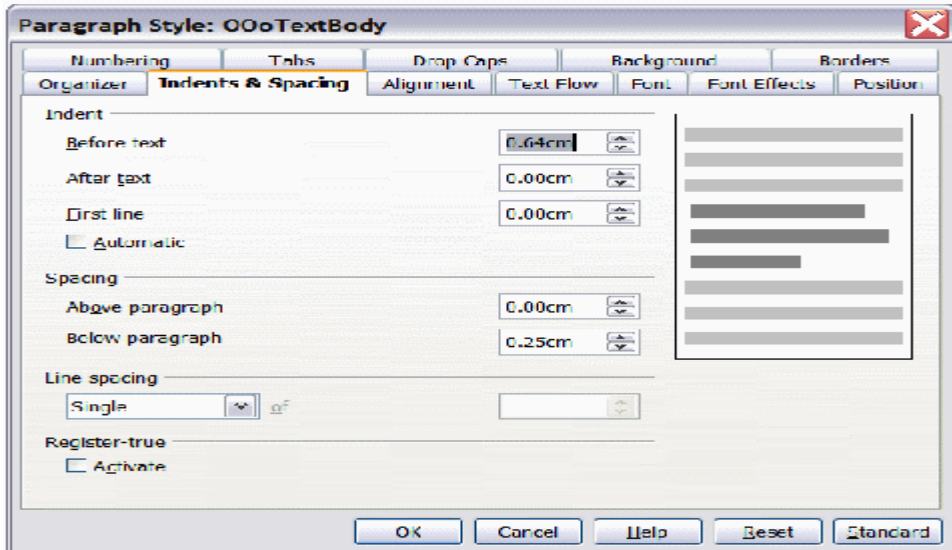


Figure Number range Figure: Example of Paragraph Style dialog box

Fig 1.19: Paragraph style dialog box

Modifying using PAGES DIALOGUE BOX

The Pages Module has the following activities: (i) Cover Page (ii) Blank Page and (iii) Page Break. As the name implies, Microsoft has templates of possible cover design from which you can select and modify for desired document. Also, you can insert a new blank page anywhere on your document by placing the cursor at the appropriate position or point and clicking on “Blank Page” option. In order to create a Page Break, place your cursor at the specific point on your document where you want the page to break from, and then click on ‘Page Break’ option. The page breaks immediately at that point.

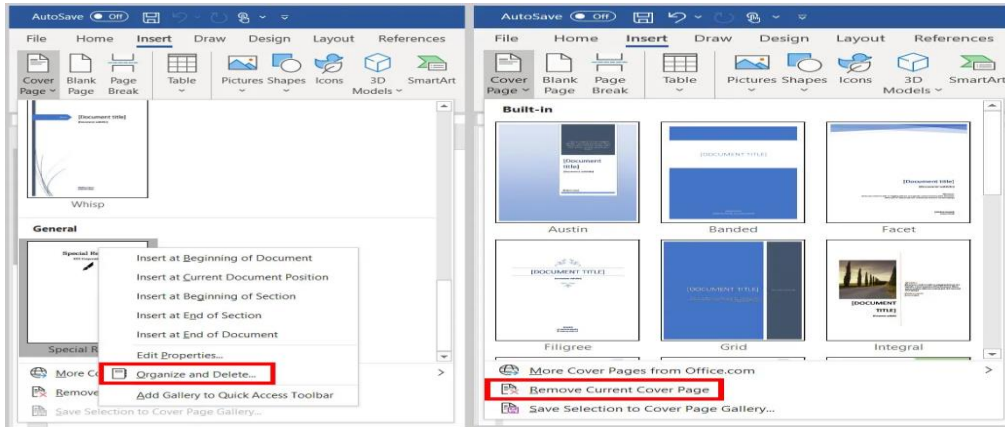


Fig 1.20 windows cover page templates

Creating Tables

You may wish to make use of table for entering data; the TABLE Module will assist you in inserting or drawing a table into the document and allows you to convert existing text into a table.

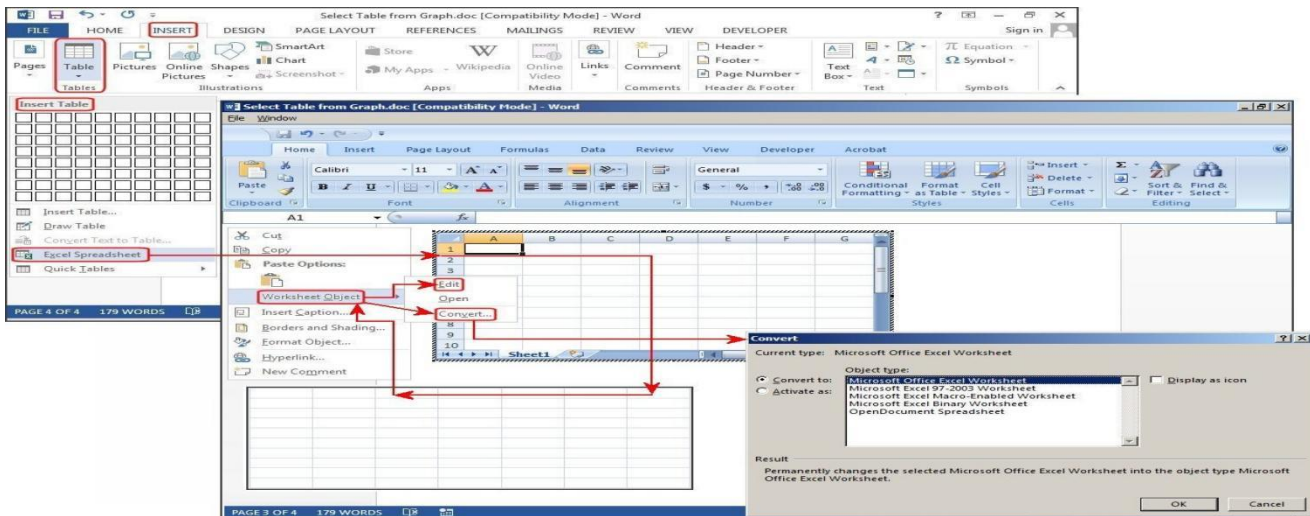


Fig1.21: creating table window

By clicking on the TABLE and selecting a 6x8 table, windows automatically generates a table of six (6) columns by eight (8) rows into the document. However, the number of columns and rows can be changed to reflect the desire of the user. This can be done by selecting “Insert Table” on the drop down dialogue box. Once the table is inserted into your document, the Table Tools (Comprising of DESIGN and LAYOUT) comes up automatically to assist you perform essential tasks on your table.

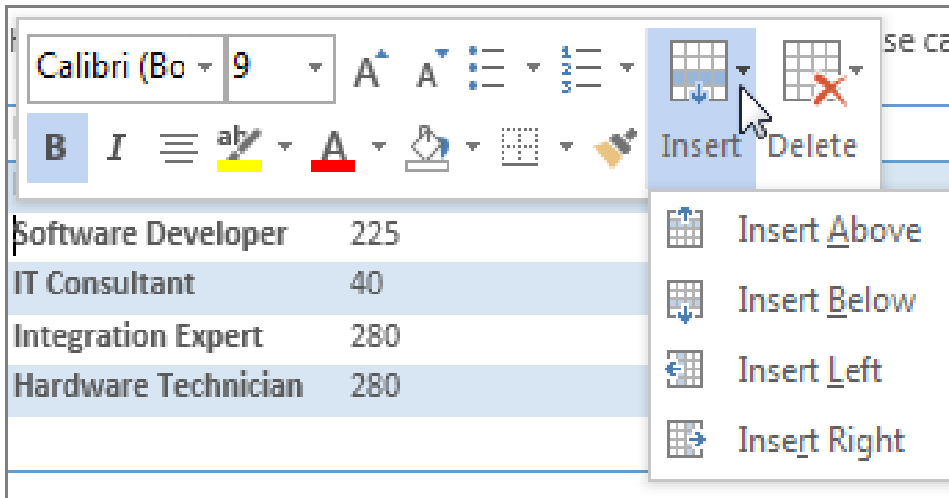


Fig: 1.22: creating additional rows and column

With respect to increasing change in data, the numbers of rows and columns is bound to change. Additional rows (up or down) and columns (right or left) can be inserted into an existing table clicking on the LAYOUT menu and launch the ‘Insert Cells’ dialogue box. Using this box, we can also invoke the reversal of these activities by deleting rows, columns cell or the entire table.

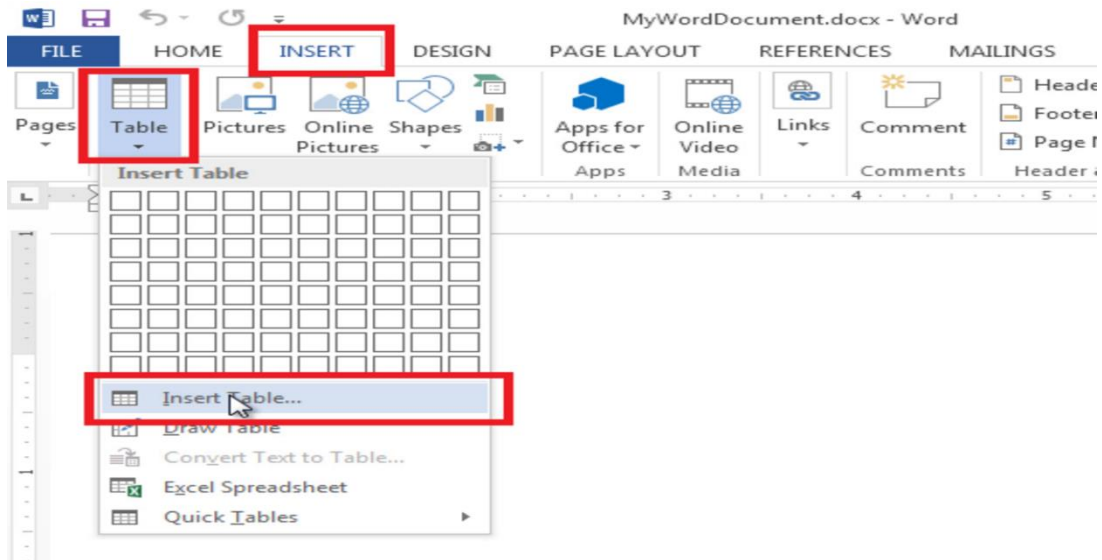


Fig1.23: Inserting Table into a document

Splitting and Merging Cells:

At the end of table insertion, you may want to separate values in a single cell into two, occupying two cells respectively. The following steps can be used to achieve splitting.

Step 1: Select the cell, which you want to split

Step 2: Select 'LAYOUT' option from Main Menu

Step 3: Click 'Split Cells' option

Step 4: As a result of step 3, a Dialogue box, demanding the required number of columns and rows will show. Enter into the box your desired number of columns and rows.

Step 5: Click button to split the cell into required parts.

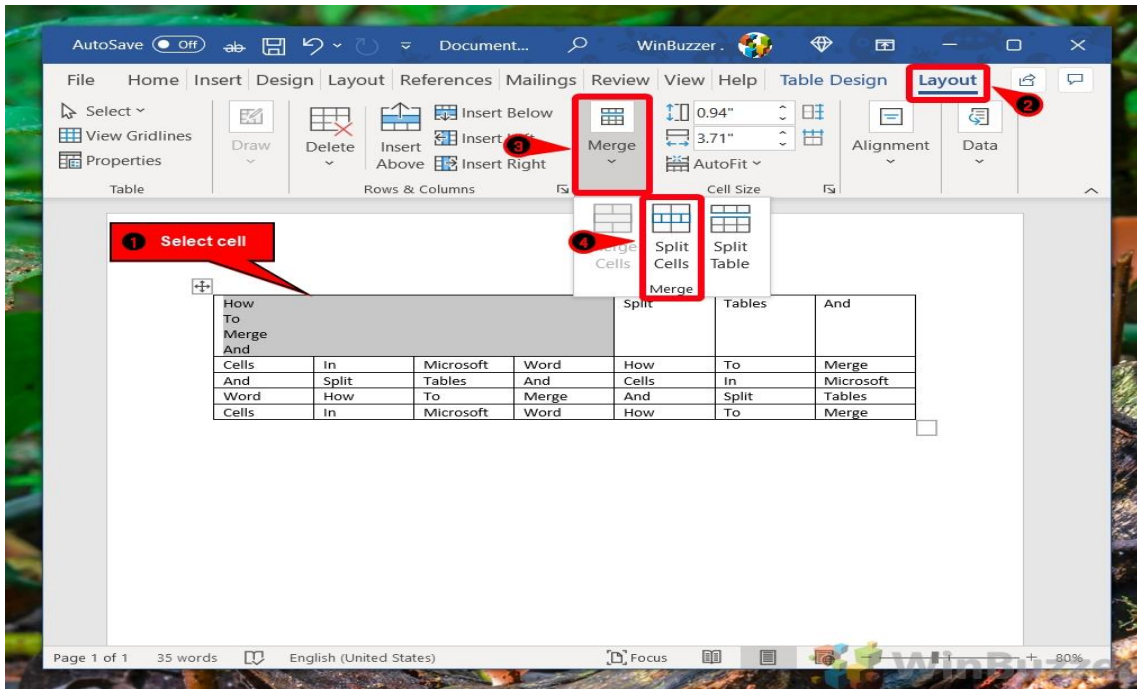


Fig1.24: Cell merging in Table

The process (split cells) can be reversed (merged) by selecting the cells you want to merge together and performing the following tasks:

Step 6: Select 'LAYOUT' option from Main Menu

Step 7: Click 'Merge Cells' option

Changing Text Orientation:

One can also change the direction of the text displayed in the cell. Usually, it is horizontally positioned and left justified. The following steps will change text orientation:

Step 1: Select Cell for which you want to change the direction

Step 2: Click 'Text Direction' option

Step 3: Click your desired style of orientation

The text then will be displayed in the orientation selected.



Fig1.25: Changing text orientation

To Perform Calculations:

You can add a formula to a cell to perform some basic logic or arithmetic calculations, such as SUM, PRODUCT, IF, AND, and more. This can be done with the help of a formula. Perform the following the following:

Step 1: Select the cell in which you want to display the output

Step 2: Select LAYOUT under TABLE TOOLS

Step 3: Click on 'Formula' option (Far right)

Step 4: A formula dialogue box is displayed where you can paste function, format number and enter formula. For Example, Enter = SUM (ABOVE) if the values for which you want the sum are above the cell where you want to display the sum or Enter = SUM (LEFT)' if the values are at the left of the cell where you want to display the sum.

Step 5: Click 'OK' button to get the sum.

You can change the form of the output by changing the ‘Number format’ option. You can also choose the functions with the help of ‘Paste Function’ option.

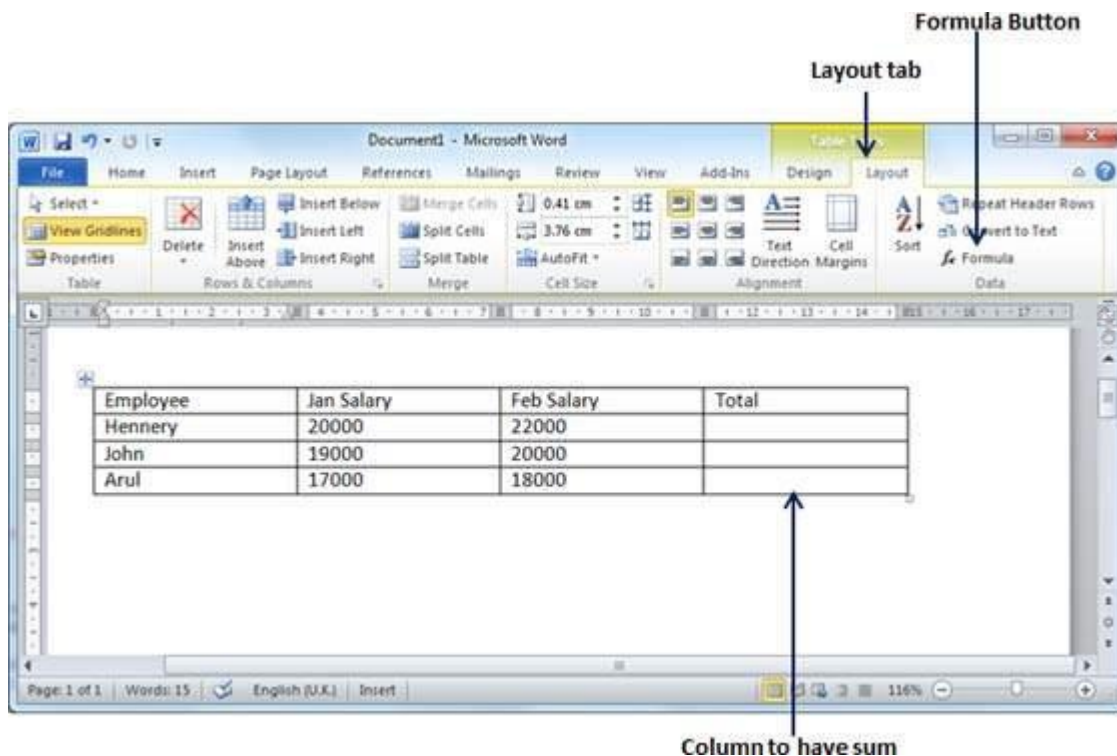


Fig1.26: Inserting Formula into a Table for Calculation

Note: A change anywhere above the cell carrying the sum does not reflect automatically. For example, Hennery: if the income of Hennery is increased by three thousand Naira (₦3000:00), the sum does not increase by that amount unless step 1 to 5 is repeated.

Inserting Picture, Clip Art, Shapes, Smart Art and Chart:

Using the ILLUSTRATIONS DIALOGUE BOX, windows allow Pictures and Clip Art (which include drawings, movies, sounds, photography etc to illustrate a specific concept) to be inserted from file into the document. In addition, ready-made shapes (such as flowchart symbols, callouts, arrows etc), Smart Art (which are graphics meant to visually communicate information) and Charts (Pie, Bar, Line etc) to illustrate and compare data.



Fig1.27: Icons depicting Symbols

Most of the shapes highlighted above were used in the course of writing this book, especially in chapters three, four and five.

In your Word document, click Insert > Chart. Select the type of chart you want, such as column or pie chart, and click OK. (If you're not sure which to choose, move down the All Charts list to preview each type.) Enter your data into the spreadsheet that automatically opens with the chart.

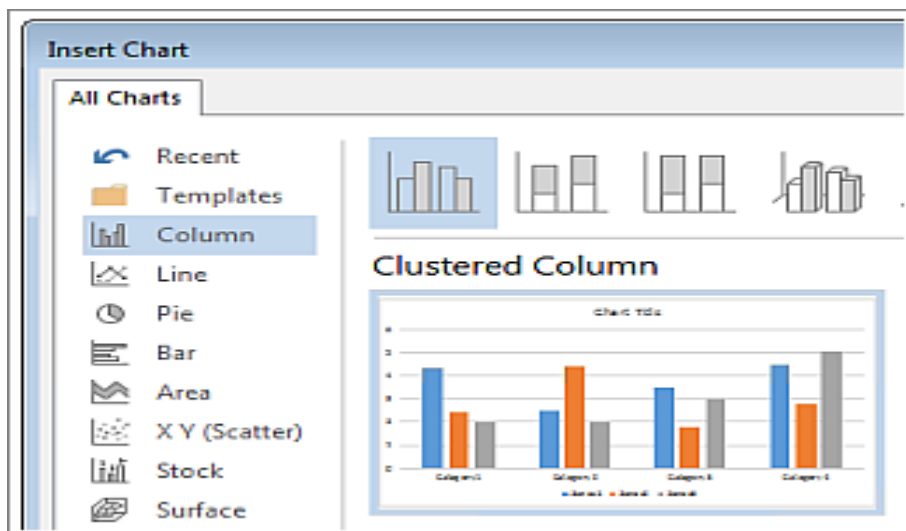


Fig.1.28: Modifying using Chart Illustrations box

Inserting Page Number, Header and Footer to the document

It is always good to insert page number, header and footer on your documents. This could give some important point about the document. Then content of Header/Footer would appear at the top (Header) or bottom (Footer) of each printed page, while the page number could be located at the top or bottom of page. The following steps insert a header unto your document:

Step 1: Go to the ‘Header & Footer’ box

Step 2: Click on the “Header”

Step 3: Select and click the format of your choice

Step 4: The clicked format appears automatically on your document

Step 5: Type the content you wish to see as your header

Step 6: Double click the space below the typed header

Step 7: The result of step 6 gives your document both body and header

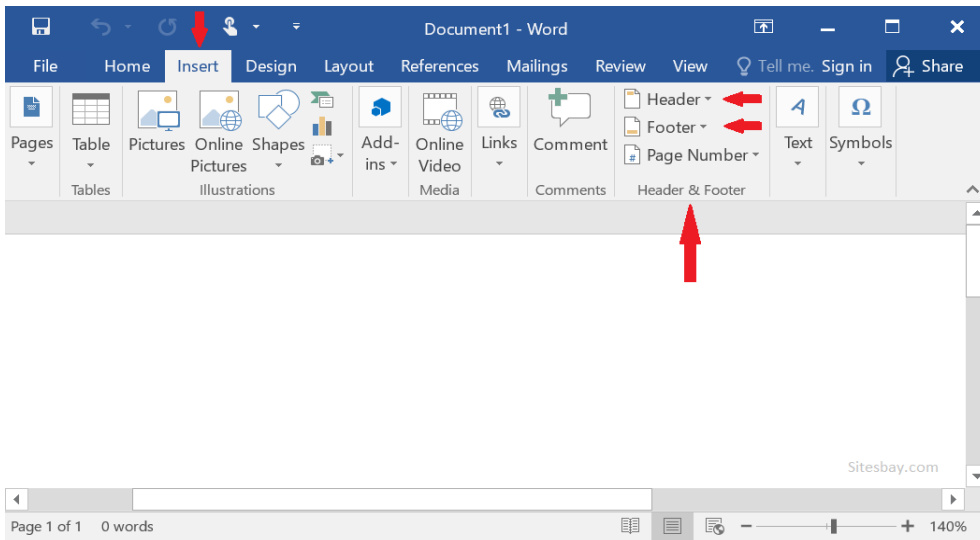


Fig 1.29: Inserting Header and Footer

Similarly, the steps are the same for inserting Footer, except with few modifications on step 2, 5, 6 and 7 as seen below.

Step 1: Go to the ‘Header & Footer’ box

Step 2: Click on the “Footer”

Step 3: Select and click the format to your choice

Step 4: The clicked format appears automatically on your document

Step 5: Type the content you wish to see as your footer

Step 6: Double click the space above the typed footer

Step 7: The result of step 6 gives your document both body and footer.

Depending on the format selected in step 3 above (inserting footer), page number could be inserted automatically. Otherwise, the following steps are required to insert page number:

Step 1: Go to the ‘Header & Footer’ box

Step 2: Click on the “Page Number”

Step 3: A drop down dialogue box will show on which you will select “Top of Page” or “Bottom of Page”

Step 4: Select and click the format of your choice from the drop down shown again as a result of page 3.

Step 5: The clicked format inserts page number automatically on your document

Step 6: Double click the space above the typed footer & Step 7. The result of step 6 gives your document Page Number.

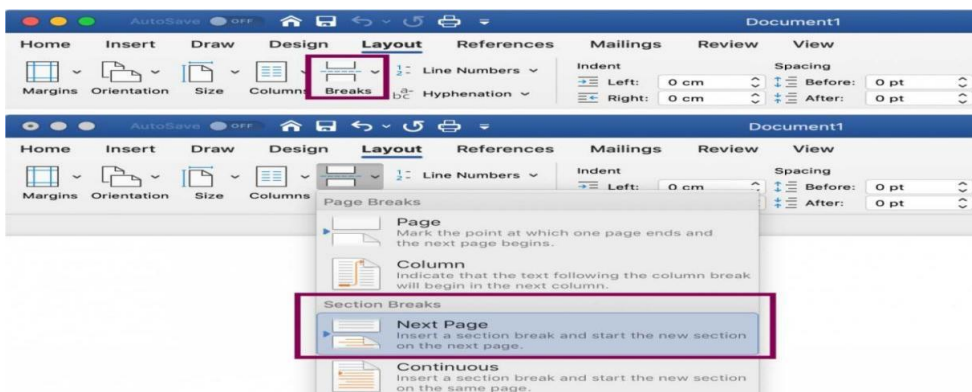


Fig. 1.30: Inserting Page Number

Modifying using TEXT DIALOGUE BOX

This module has the following activities that can be employed to improve on our word document: Text Box, Quick Art, WordArt, DropCap; Date & Time, Signature Line, and Object.

Text Box: It is a preformatted box that can be inserted anywhere in the document. It can be used to arrive at drawing or flowchart. To insert a Textbox, perform the steps below:

Step 1: Place the cursor where the text box will be inserted in the document

Step 2: Click on Textbox

Step 3: Select and Click your desired template from a drop down window containing different text box templates.

Step 4: Type a quote from the document or any other information you wish as the content

Step 5: Use the Textbox Tool to change the formatting of the box.

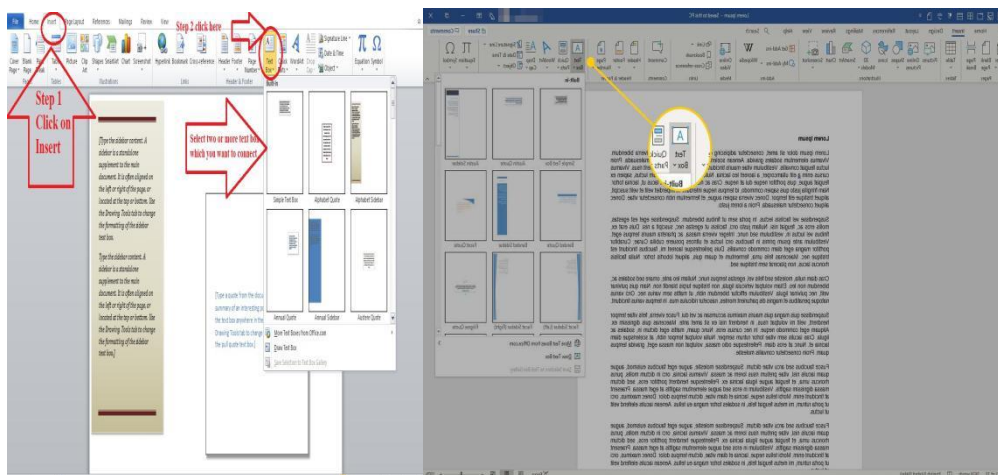


Fig 1.31: A typical text box

Word Art:

Allows you to insert decorative text in the document



Fig 1.34. : Using WordArt

Drop Cap:

This allows you to create a large capital letter at the beginning of a paragraph. For example, each paragraph of this book has drop cap. This is achieved by highlighting the first word or letter of the paragraph and clicking on Drop-cap.

Symbols and Equation Editor:

The need to insert symbols (such as trademark, Unicode Character, copyright etc) that are not on the keyboard will demand invoking this module. Also, in the same line, the equation editor will be required for document processing that involves mathematical expressions and in addition, specific equations can be arrived at using the library of mathematical symbols. The steps required to invoke equation editor are:

Step 1: Place the cursor where the equation will be inserted

Step 2: Click “EQUATION” for a drop-down window containing the Built-in mathematical symbols

Step 3: Select and Click on the type of equation template your desire

Step 4: Click on “DESIGN” on the main menu for EQUATION TOOLS to assist you in re-configuring the template to your desired equation.

The process is similar if you want to form a new mathematical template of your own and save it as part of the library, for future use.

Place your cursor in the file at the spot where you want to insert the symbol. Go to Insert > Symbol. Pick a symbol, or choose More Symbols.

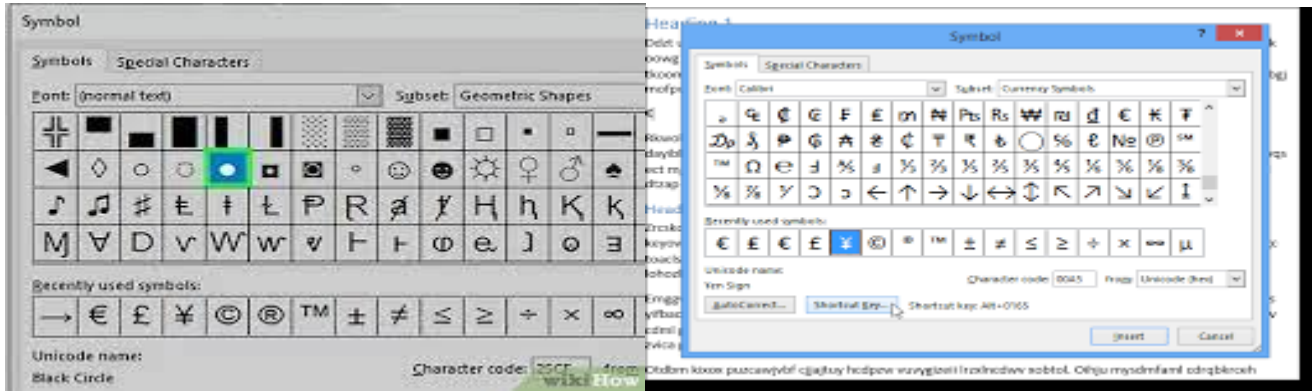


Fig. 1.35: Inserting Symbols

Insert an equation with Equation Editor

1. On the Insert tab, in the Text group, click Object.
2. In the Object dialog box, click the Create New tab.
3. In the Object type box, click Microsoft Equation 3.0, and then click OK.
4. Use the symbols, templates, or frameworks on the Equation toolbar to edit the equation.

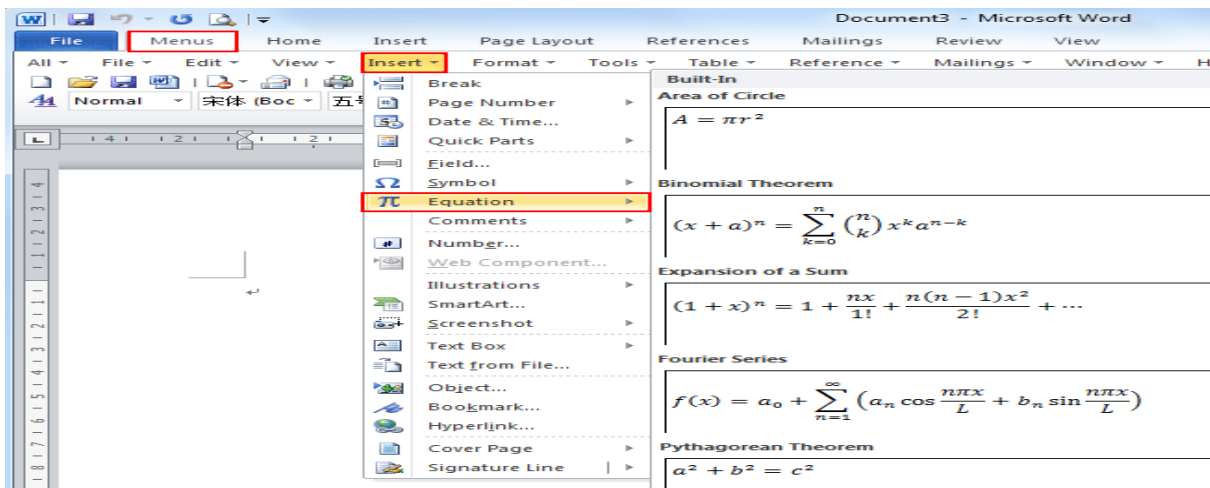


Fig.1.36: Using Equation Editor

By selecting the PAGE LAYOUT button on the Main Menu, the following sub-sectional activities can be accomplished, in arriving at a desired document: Theme; Page Setup; Page Background; Paragraph; Arrange.

Page Setup:

The function of the page setup dialogue box is to allow you define the orientation (be it portrait or landscape layout) and size of the paper (though electronics) of your document, set the margin sizes for the entire document or the current section, split the text on a selected portion or entire document into two or more, Add page, section, or column breaks to the document, add line numbers etc.

Page orientation is the direction in which a document is displayed or printed. The two basic types of page orientation are portrait (vertical) and landscape (horizontal). A page margin is the area between the main content of a page and the page edges. The margin helps to define where a line of text begins and ends.

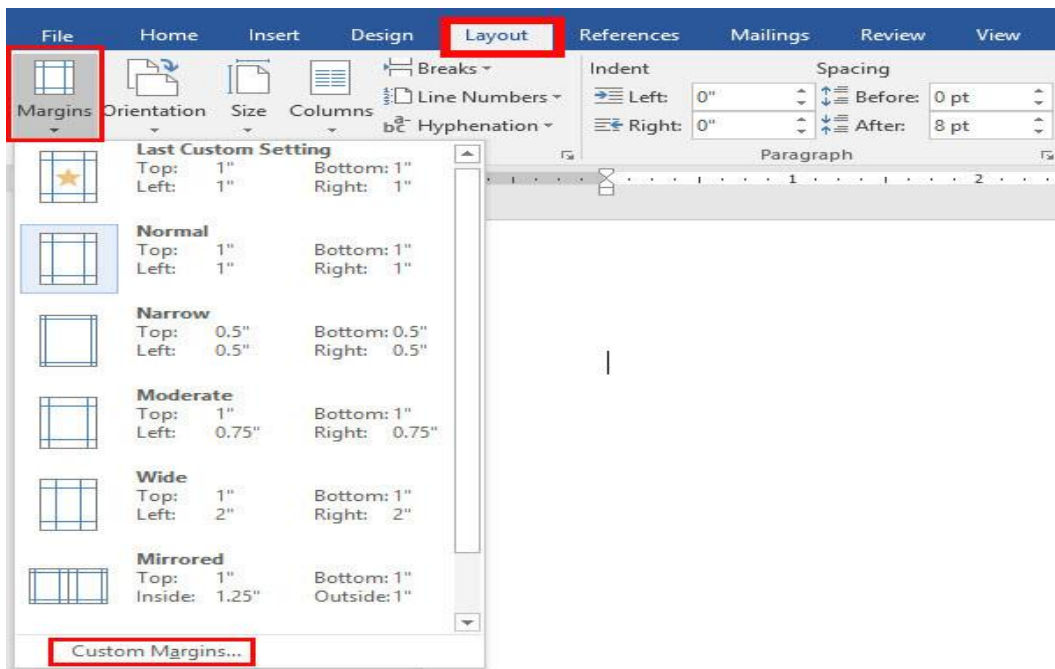


Fig.1.37 (a): Defining Margin and Orientation

YOUR DOCUMENT MAKES A FIRST IMPRESSION before anyone reads a word. The paper size, color, and borders give the reader an overall sense of the document theme and quality.

Margins, the text layout, and perhaps a watermark sends further visual clues. Making the right choices about your document setup helps you send the right message to your readers. Say you are working on an invitation;

using a smaller, elegant paper size and adding a subtle border lets your recipients know right away that they are in for a sophisticated event.

In this chapter, you will learn how to set and change all the page layout features that people notice first, starting with paper size, orientation, and margins. You will also learn how to adjust margins and make changes to the headers and footers. Finally, you will learn how to work with multiple columns and how to control Words hyphenation inclinations.

Choosing Paper Size and Layout

When you edit a document in Word, what you see on your computer screen looks almost exactly like the final printed page. To get that correct preview, Word needs to know some details about the paper you are using, like the page size and orientation. You have two different ways to change the page settings using the Page Layout tab or the Page Setup dialog box. When you click the Page Layout tab, the ribbons buttons and icons change to show you options related to designing your page as a whole. Your options are organized in five groups: Themes, Page Setup, Page Background, Paragraph, and Arrange.

Changing Paper Size

If you want to quickly change the page size to a standard paper size like letter, legal, or tabloid, the Page Layout Page Setup Size menu is the way to go. With one quick click, you change your documentation size. If there are texts in your document, Word reshapes it to fit the page. Say you change a ten-page document from letter size to the longer legal-size page. Word spreads out your text over the extra space, and you will have fewer pages overall.

The Size menu, like many Word 2016 menus, makes use of icons as well as text to give you quick visual cues. Your choices include Letter Tabloid, and more. If you are using standard-size paper (including standard international sizes like A3 and A4, you can click one of these choices, and you are done.

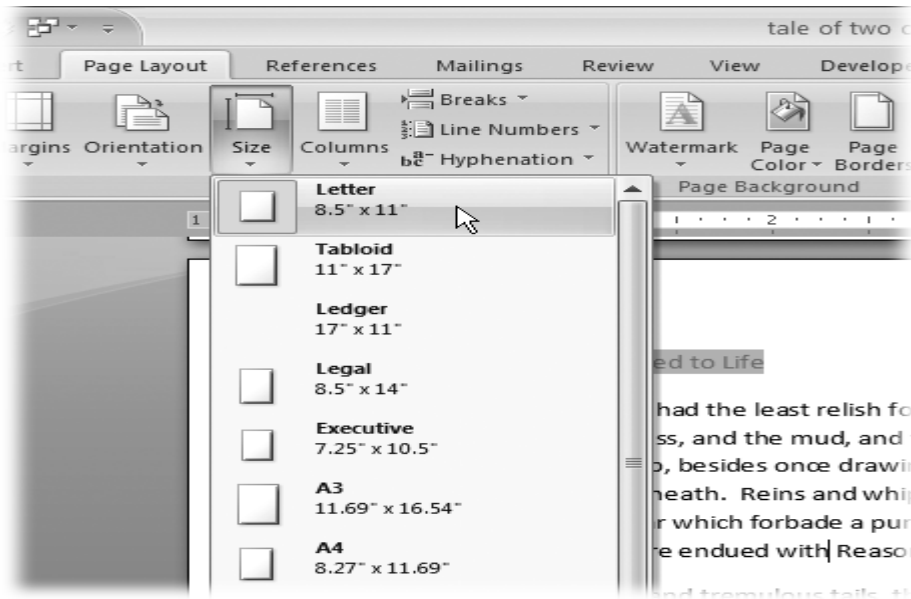


Fig1.37 (b): Defining Paper size and Inserting Page/Section



Fig1.38: Setting two column text

Originally alphabets were written entirely in majuscule letters, spaced between well-defined upper and lower bounds. When written quickly with a pen, these tended to turn into rounder and much simpler forms. It is from these that the first minuscule books developed, the half-uncials and uncial minuscule, which no longer strayed bound between a pair of lines [14]. These in turn formed the foundations for the Carolingian minuscule script, developed by Alcuin for use in the court of Charlemagne, which quickly spread across Europe. The advantage of the minuscule over majuscule was improved, faster readability.

In Latin, papyrus from Hierakonpolis dating before 70 AD (when it was destroyed) have been found that have been written in old Roman uncial, where the early forms of minuscule letters "d", "n" and "y", for example, can already be recognized. According to palaeography's Knut Kleve, "The theory, then, that the lower-case letters have been developed from the fifth century uncials and the sixth century Carolingian minuscule seems to be wrong." [15] Both majuscule and minuscule letters existed, but the difference between the two variants was initially stylistic rather than orthographic and the writing system was still basically unicameral: a given scribe/letter-former would use either one style or the other but these were not mixed. European languages, except for Ancient Greek and Latin, did not make the same distinction before about 1300.

The timeline of writing in Western Europe can be divided into four eras:

- Greek majuscule (8th–3rd century BC) in contrast to the Greek uncial script (3rd century BC – 12th century AD) and the later Greek minuscule
- Roman majuscule (17th century BC – 4th century AD) in contrast to the Roman uncial (4th–6th century BC), Roman half-uncial, and minuscule
- Carolingian majuscule (9th–10th century AD) in contrast to the Carolingian minuscule (around 780 – 12th century)
- Gothic majuscule (13th and 14th century) in contrast to the early Gothic cursive of 12th to 13th century), Gothic (14th century), and late Gothic (15th century) minuscule

Traditionally, certain letters were rendered differently according to a set of rules. In particular, those letters that began sentences or nouns were made larger and often written in a distinct script. There was no fixed capitalization system until the early 18th century. The English language eventually dropped the rule for nouns, while the German language kept it. Similar developments have taken place in other alphabets. The lower-case script for the Greek alphabet has its origins in the 7th century and acquired its quadrilinear form in the 8th century. Over time, uncial letterforms were increasingly mixed into the script. The earliest dated Greek lower case text is the Uspenski Gospels (MS 46.1) in the year 635.

Arrange:

The Arrange dialogue box can be employed under two sections, namely PAGE LAYOUT and FORMAT. If invoked, the following activities can be performed:

- (i) Positioning selected object on the page such that when the object is moved from one place to the other, using built-in templates, text is automatically set to wrap around the object.
- (ii) Bring selected object to Front one level, or bring forward or bring in front of text
- (iii) Send selected object back one level or send backward or send behind text
- (iv) Text wrapping (i.e. configure the way text wrap around selected object).
- (v) Align (vi) Group (vii) Rotate

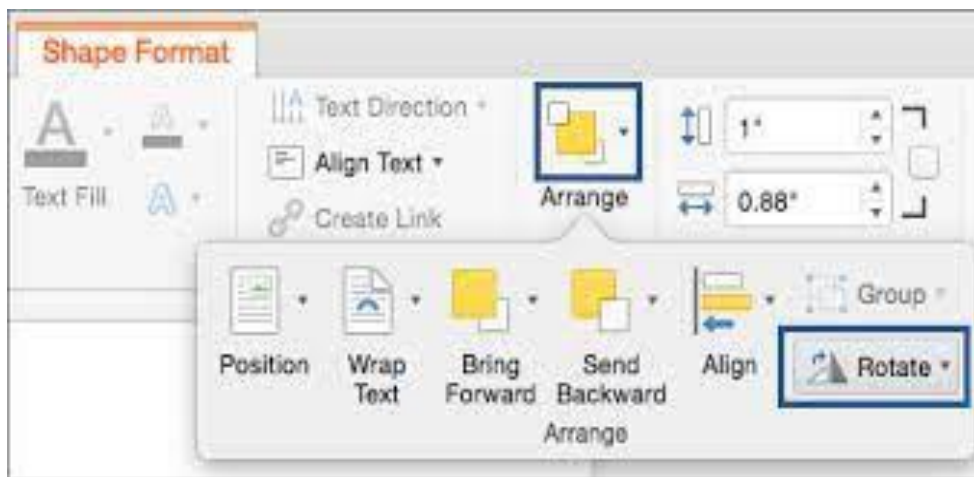


Fig 1.39(a): Arranging text and rotate

Grouping and Rotating:

When two or more objects are grouped together, they are seen and treated as a single object. As such, all other actions in this module can be performed on it. For example, the flowchart symbols in Fig.1.40 (a) can be grouped together by the following steps:

Step 1: Select each of the flowchart symbols

Step 2: Join them according to the process/activity they represent.

Step 3: Select the first symbol (apparently the topmost or bottom most), while holding the CONTROL key; select others carefully and one by one, until the last symbol is selected.

Step 4: Click on “GROUP” to group them.

When this is accomplished, it can be flipped or rotated by just clicking “ROTATE” to select the desired rotation or flip. See Fig.1.39 (b).

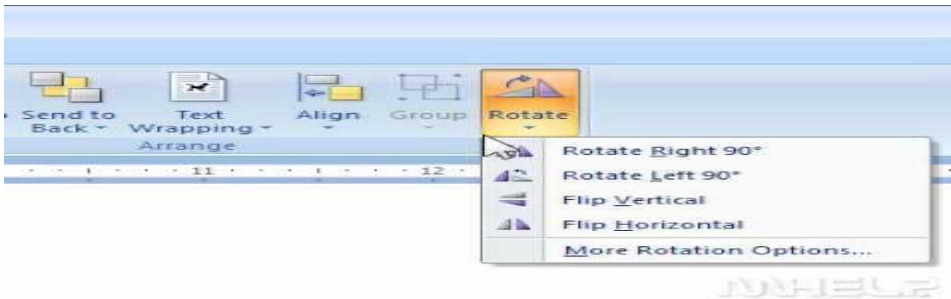


Fig 1.39(b): Grouping and Rotating symbols

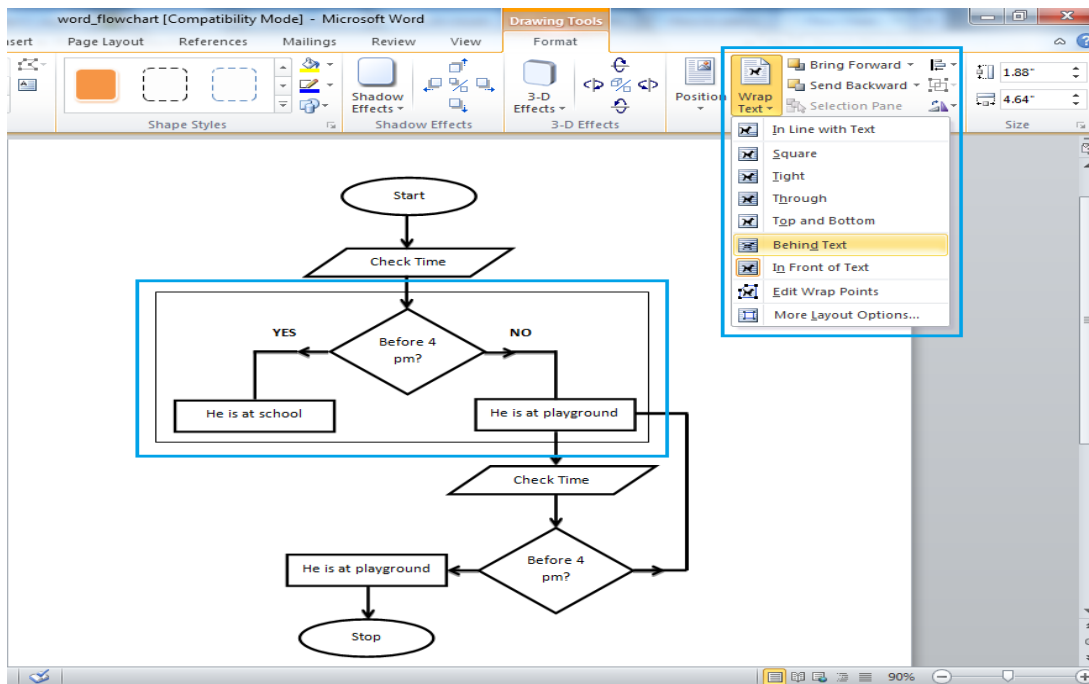


Fig.1.40 (a): Grouping Flowchart Symbols

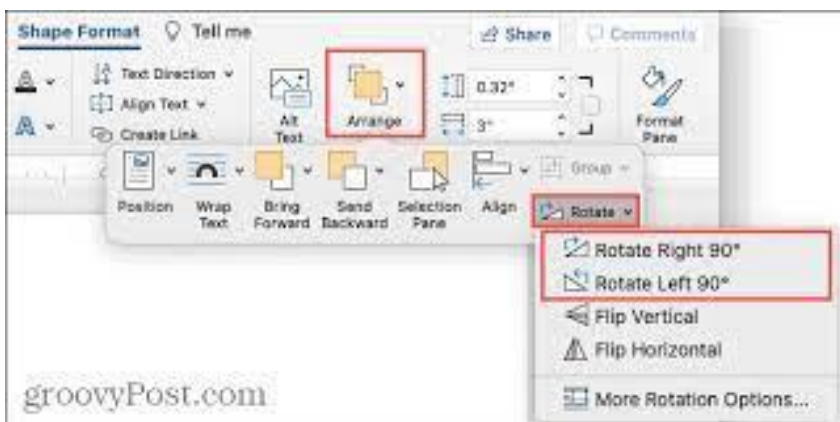


Fig.1.40 (b): Rotating or Flipping an object

Spelling and Grammar:

- (a) By selecting the REVIEW button on the Main Menu, the following sub-sectional activities can be accomplished, in arriving at a desired document: Proofing (Spelling & Grammar, Thesaurus, Research, Word Count, Set Language, Translation Screen Tip); comments (New Comment, Delete, previous, Next); Tracking (Track Changes, Balloons, Show Markup, Reviewing Pane); Changes (Accept, Reject, Previous, Next); Compare (Compare, Show Source documents) and Protect (Protecting Document).

At the end of the entire document you can check the spelling mistakes and grammatical mistakes with the help of 'Spelling and Grammar check tool.

Step 1: Place the cursor where you want the spell check to start

Step 2: Select and Click 'Spelling and Grammar' option

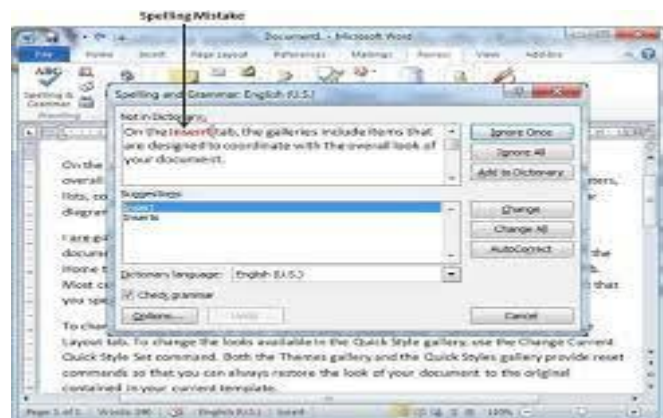
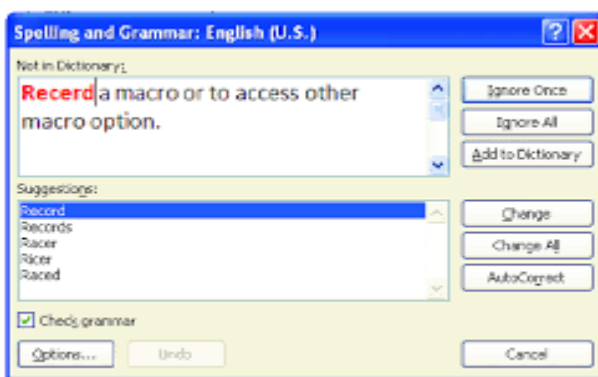
Step 3: This will start the Spell and Grammar check. Spell checker will provide certain suggestions if there are any errors

Step 4: If you want the text according to the suggestions then, click on 'Change' button

Step 5: Else click 'Ignore Once or Ignore All' button

Step 6: If word is alien to computer but correct, click "Add to Dictionary"

At the end, all errors (Spelling and grammar) will be corrected and new words added to the computer dictionary for future recognition.



1.41: Spelling and Grammar Dialogue Box

Thesaurus

Thesaurus is used to find a more precise expression for a given word. That is, it suggests other words with a similar meaning to the word you have selected. To make use of the Thesaurus perform the following steps:

Step 1: Select the word for which you want an expression

Step 2: Select and Click on ‘Thesaurus’ option. The drop down window as shown in fig.1.4 will be displayed.

Step 3: Select the ‘Language’ option from dialogue box

Step 4: Move the cursor to meaning you prefer and click to insert

Step 5: Click “insert”. The word will be replaced immediately

(e) By selecting the VIEW button on the Main Menu, the following sub-sectional activities can be accomplished, in arriving at a desired document: Document Views (Print Layout, Full Screen reading Web Layout, Outline, Draft); Show/Hide (Ruler, Gridlines, Message Bar, Document Map, Thumbnails); Zoom (Zoom, 100%, One Page, Two Pages, Page Width); Windows (New Window, Arrange All, Split, View Side by Side etc); and Macros (Macros).

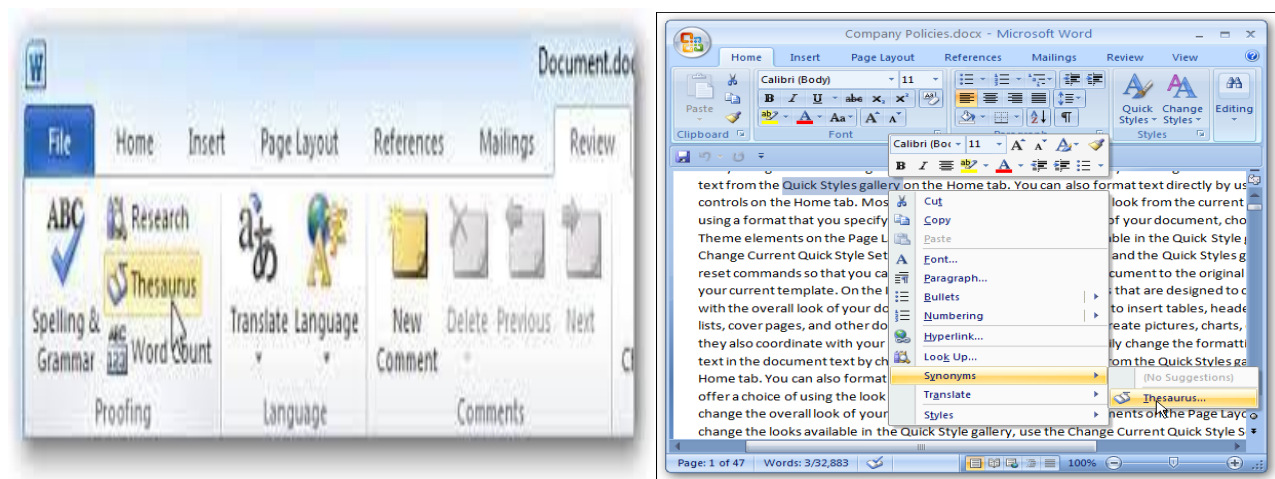


Fig.1.42: Thesaurus Screen

SPLITTING WINDOW

The window is split to allow for more than one document to be processed simultaneously. To accomplish this, carry out the following:

Step 1: Open any document

Step 2: Click on ‘Split’ option. A horizontal line appears on the screen, which moves along with the mouse movement.

Step 3: Where the horizontal line stops, the window is split into two at that spot, though a single document. See Fig. 6.32(a)

Step 4: Select either of the two windows for processing/editing. Any alteration in one affects the document

Step 5: When you are through with editing, click “Remove Split”, to return to the actual document.

However, if you must work with two similar documents, then open the document you wish to work with at the same time and then:

Step 1: Click New Window. A new window containing a view of the current document will be open, hide but kept.

Step 2: Click on “Arrange All”. The two windows can then be worked upon simultaneously. See Fig.1.43(a) and 1.43(b)

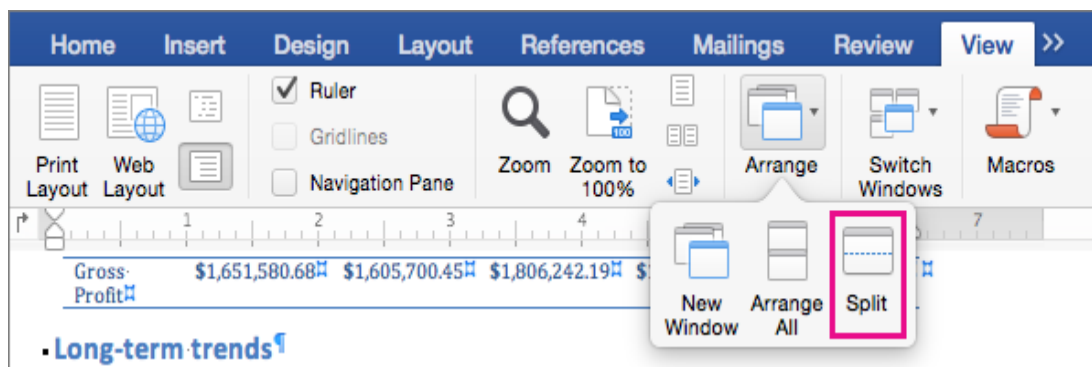


Fig.1.43 (a): Splitting Windows



Fig1.43 (b): Splitting Windows

PROTECTING WORD DOCUMENT

After all activities discussed in the preceding sections that can be performed on the document, it is pertinent to protect the document against illegal/unauthorized access, which could lead to malicious alterations, outright loss or copying for commercial purposes. We can protect the document using password. To specify the password (secret code, word or key assumed to be known only by the owner) to a file, the following steps suffice.

Step 1: Select 'REVIEW' option from the Main Menu

Step 2: Select and click 'Protect Document' option

Step 3: On the drop down box, select 'Restrict formatting and editing'.

Step 4: Another drop down box will be displayed. On it perform activities 1(Formatting restriction), 2(Editing restriction) and 3(Start enforcement)

Step 5: Step 4 will lead to "Start Enforcing Protection" Dialogue box on which you will provide your Password.

Step 6: Click Password

Step 7: Enter your Password and confirm same

Step 8: The document is thus protected automatically from unintentional editing.

Do the following steps to find out whether the file is password protected.

Step 9: Open the same file, if not open already.

Step 10: Click on the document for the purpose of editing it. This will not be possible. The computer will write "This modification is not allowed because the selection/document is locked"

Step 11: The 'Restrict Formatting and Editing' drop down box will be displayed immediately as in step 4.

Step 12: Click on "STOP PROTECTION" on the new 'Restrict Formatting and Editing'

Step 13: "Unprotected Document" window will be displayed on which you will type your Password again.

Step 14: The document is free for editing.

However, a document can be quickly protected without a password by highlighting all or sections and clicking on "TRACK CHANGES". This action will track all changes made to the document, including insertions, deletion, and formatting changes.

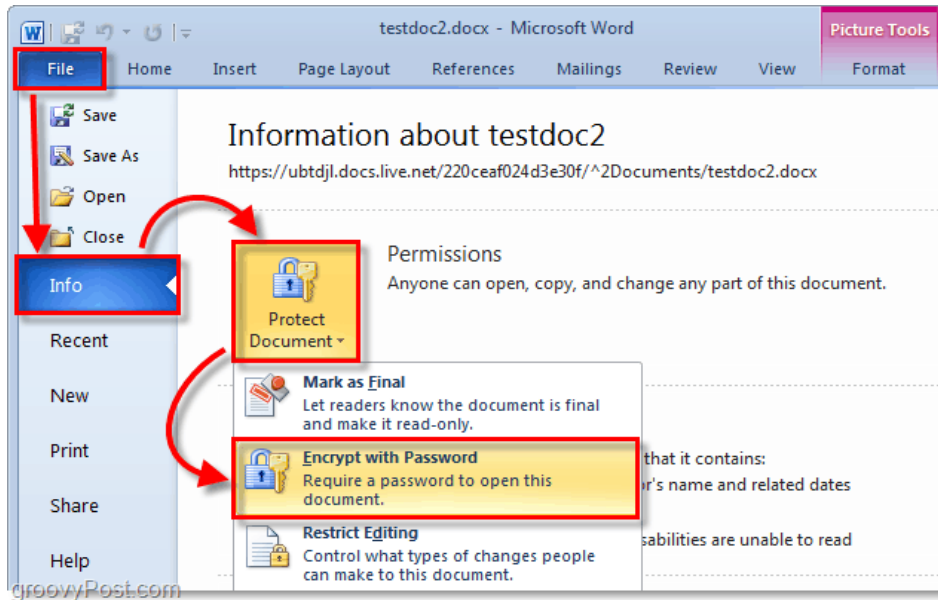


Fig1.44 (a) Inserting Password

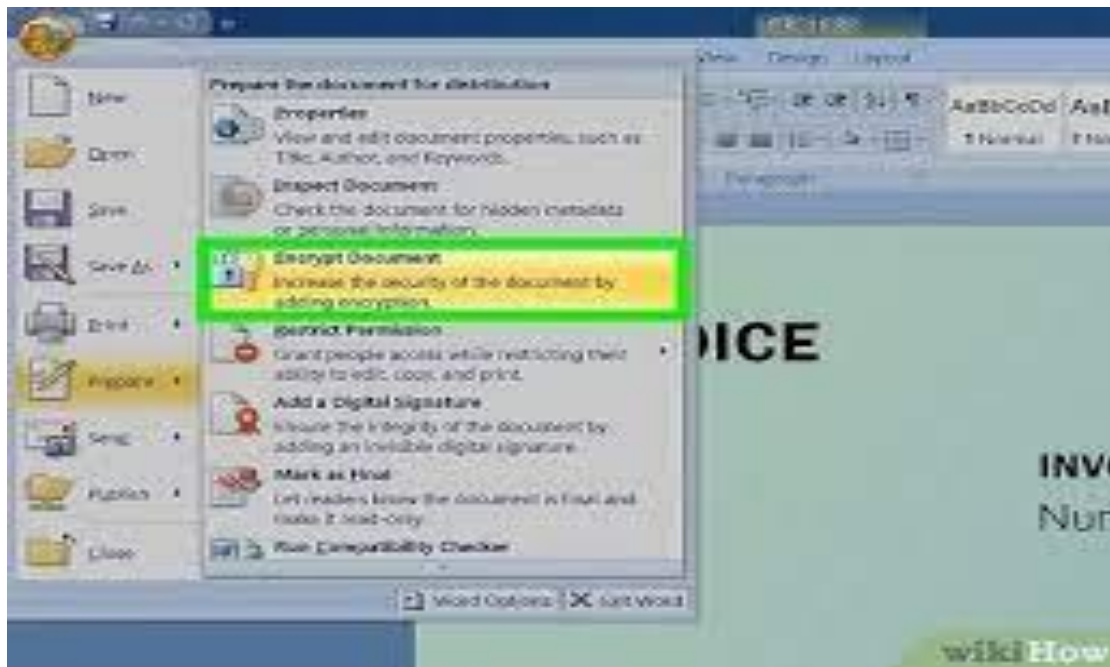


Fig 1.44 (b): Removing Password

PRINTING WORD DOCUMENT

After preparing the document, we may wish to have a hard copy of it. That is, print a copy. It is highly recommended to preview the document before actual printing such that one can have the idea of the exact way the print-out will be. This is accomplished via the following steps:

Step 1: Click the “Office Box”

Step 2: Select ‘PRINT’

Step 3: “Preview and Print the Document” window will be displayed. On it Select and Click “Print Preview”.

Step 4: The preview will be displaced and open for medication. This will allow you view the document as it will appear on the printed page.

Step 5: Close the Preview, if you are satisfied with the modification.

Step 6: Repeat steps 1 and 2

Step 7: Select and click “PRINT” on the “Preview and Print The Document” window.

Step 8: The “Print” Dialogue box will be displayed to allow you select printer, number of copies and other printing options before printing.

Step 9: Click “OK”

The document will be printed on the selected printer.

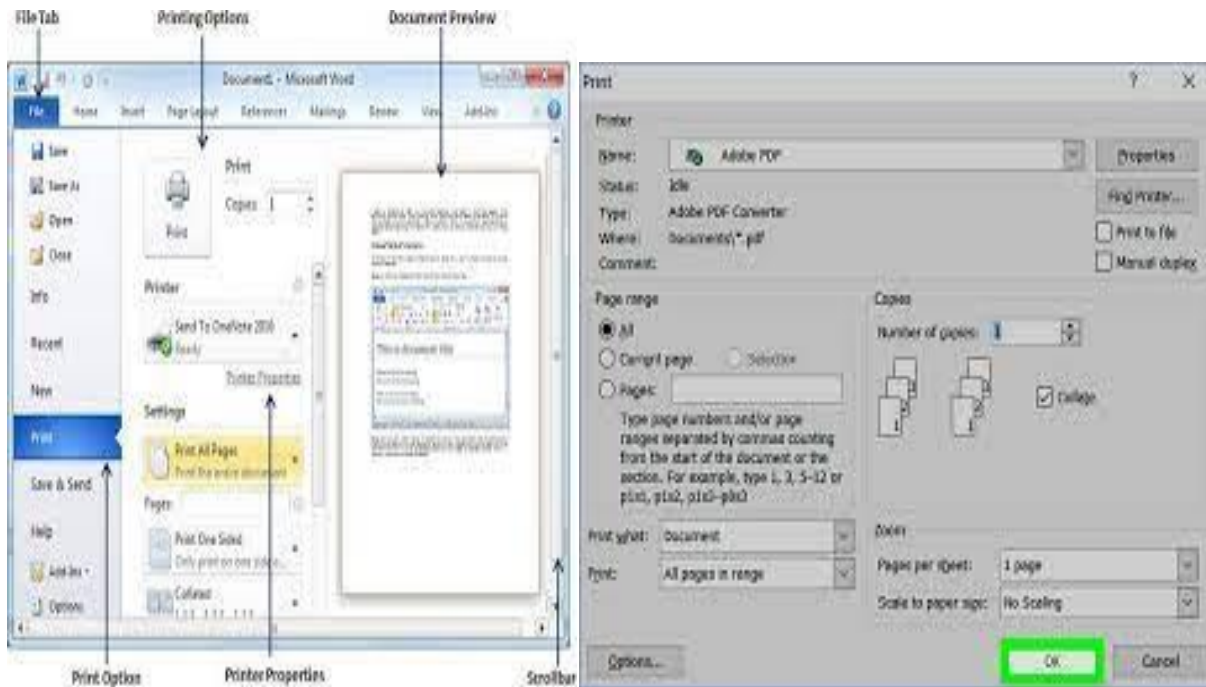


Fig1.45 Printing Document

MAILINGS:

This is a module of the Main menu comprising of CREATE (Envelopes and Labels),

START MAIL Merge (Start Mail Merge, Select Recipient and Edit Recipient List),

WRITE & INSERT FIELDS (Highlight Merge Fields, Address Block, Greeting Line, Insert Merge Field etc),

PREVIEW RESULTS (Preview Results, Find Recipient, Auto Check for Errors), and FINISH (Finish & Merge). All these modules combined will allow you to create and print envelopes/labels; merge two distinct but related documents by superimposition method.

One is the FORM LETTER (which contains the body common to all and will be printed or e-mail multiple times, sending each copy to a different recipient) and the other is LIST OF RECIPIENTS or DATA SOURCE (which contains some macros that will reflect on the FORM LETTER distinctly for each recipient of the main document.

To mail merge, you will first create the form letter, thereafter the list of recipients.

Creating Form Letter:

The following steps will be required to create Form Letter:

Step 1: Click “Mailings” from main menu

Step 2: Click “Start Mail Merge”. A drop down window will be displayed. See Fig. 1.46.

Step 3: Click on “Letter” or as the case may be. An active Window will be displayed for you to develop your form letter.

Step 4: After form letter has been developed, save it using any name. For example, an admission letter has been created and saved as Letter.docx. See. Fig.1.46.

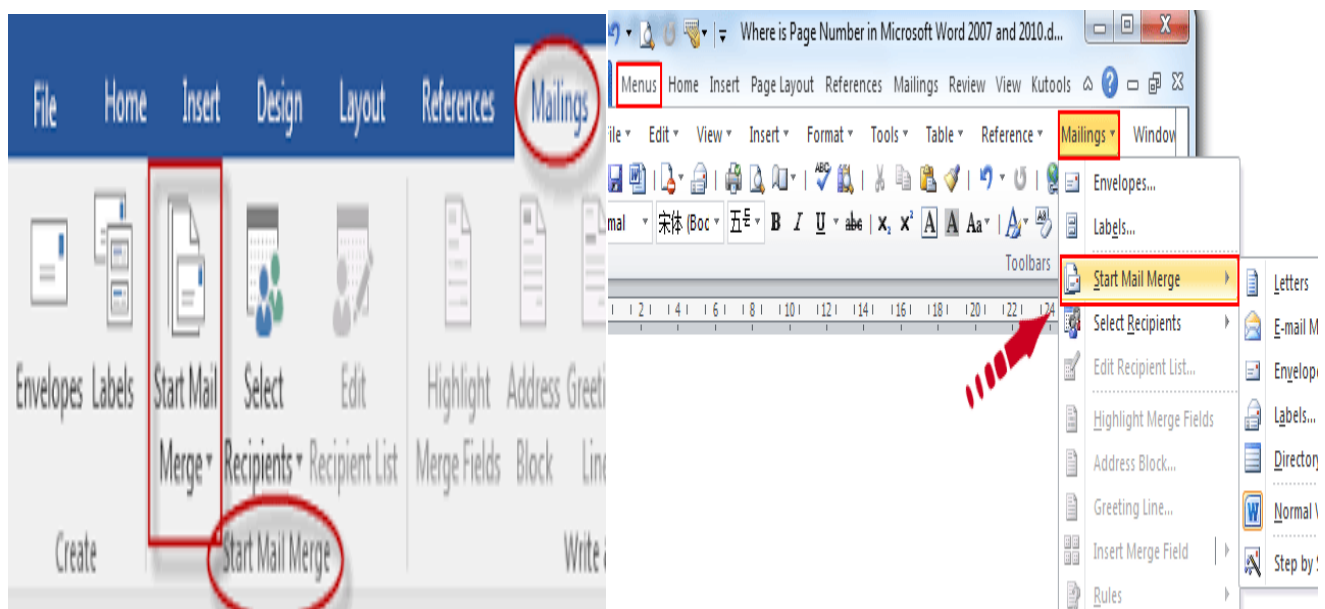


Fig 1.46: Start Mail Merge Window

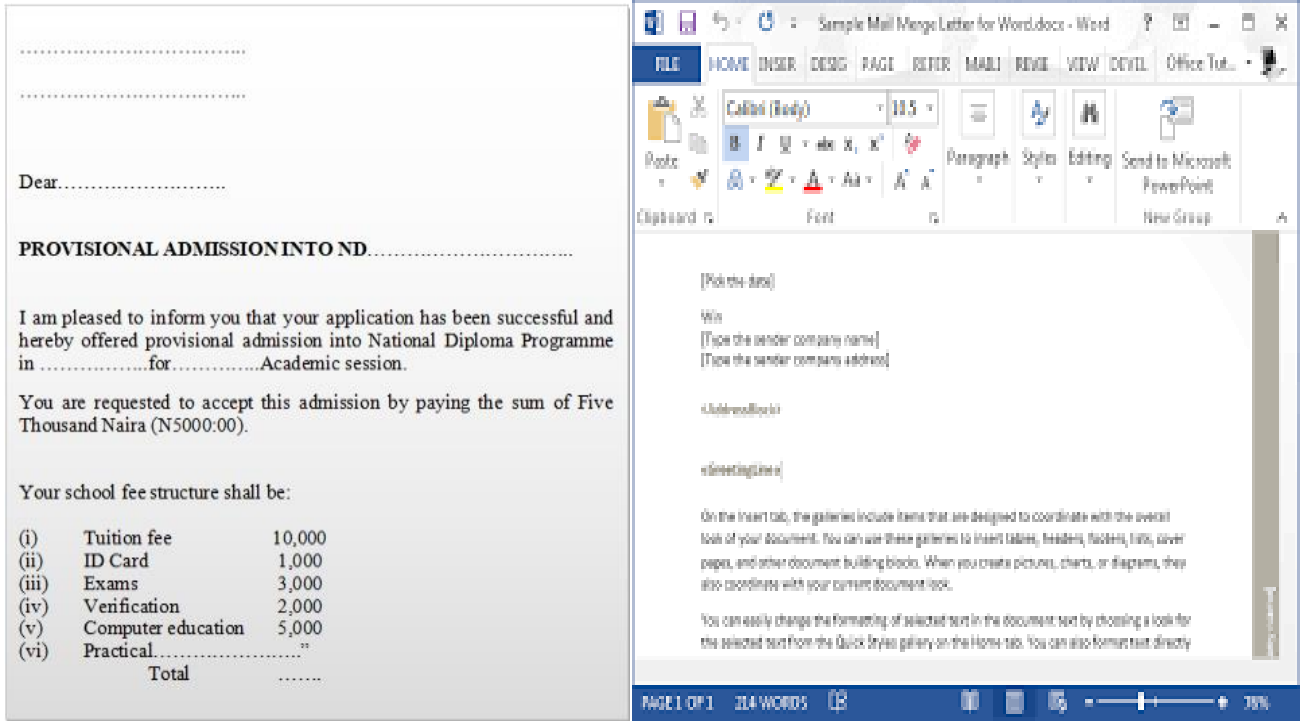


Fig. 1.47: Form Letter saved as Letter.docx

The form letter is created. Now you will create the data source or list of recipients.

Creating Data Source

To create the data source, perform the following steps:

Step 1: Click “Select Recipients” and select ‘Type New List’ from the drop down window. See Fig.

Step 2: A “New address List” window will be displayed.

The ‘field names in the header row’ list box shows all the possible fields names you may require. The fields that are not required can be deleted while new ones can be added by clicking on Customize Columns button on the “New address List” window.

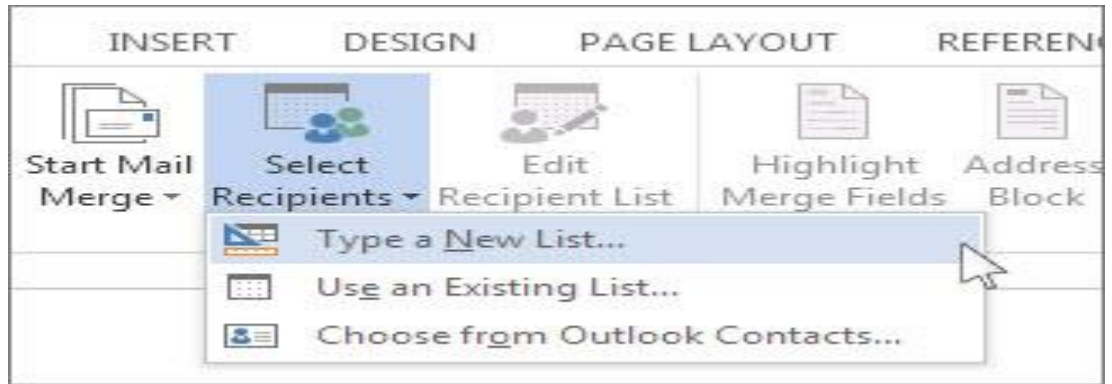


Fig1.48: Select Recipients Window

Step 3: Use “Customize Address List” window to fine tune your fields.

Select Title, first name, last name, address 1, address 2 and remove the rest of the fields. Add State, Dept, Academic session, School, Practical fee, Total to the fields.

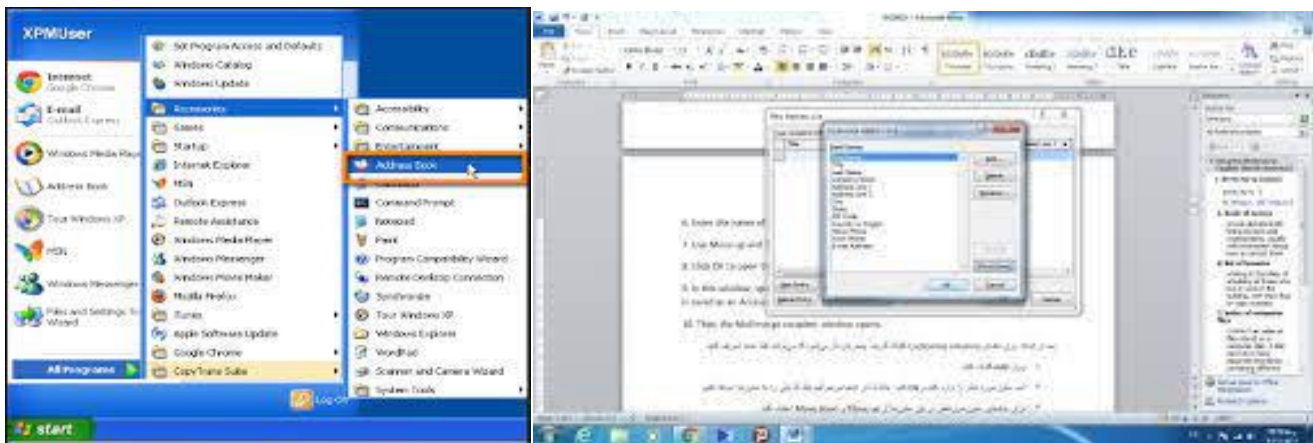


Fig 1.49(a): New Address List Window

Step 4: Click ‘OK’ after entering all the records.

Step 5: Save the Data source. For example, a source data created for the admission letter was saved as ADDLIST.mdb. See Fig. 1.48

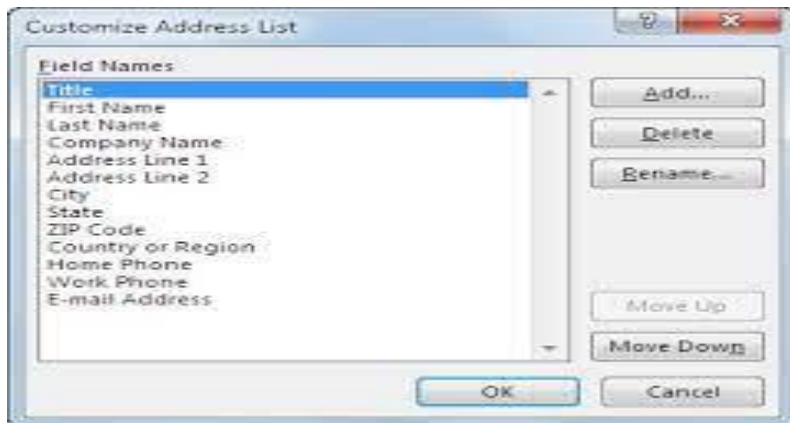


Fig.1.49(b) : Customized Address List Window

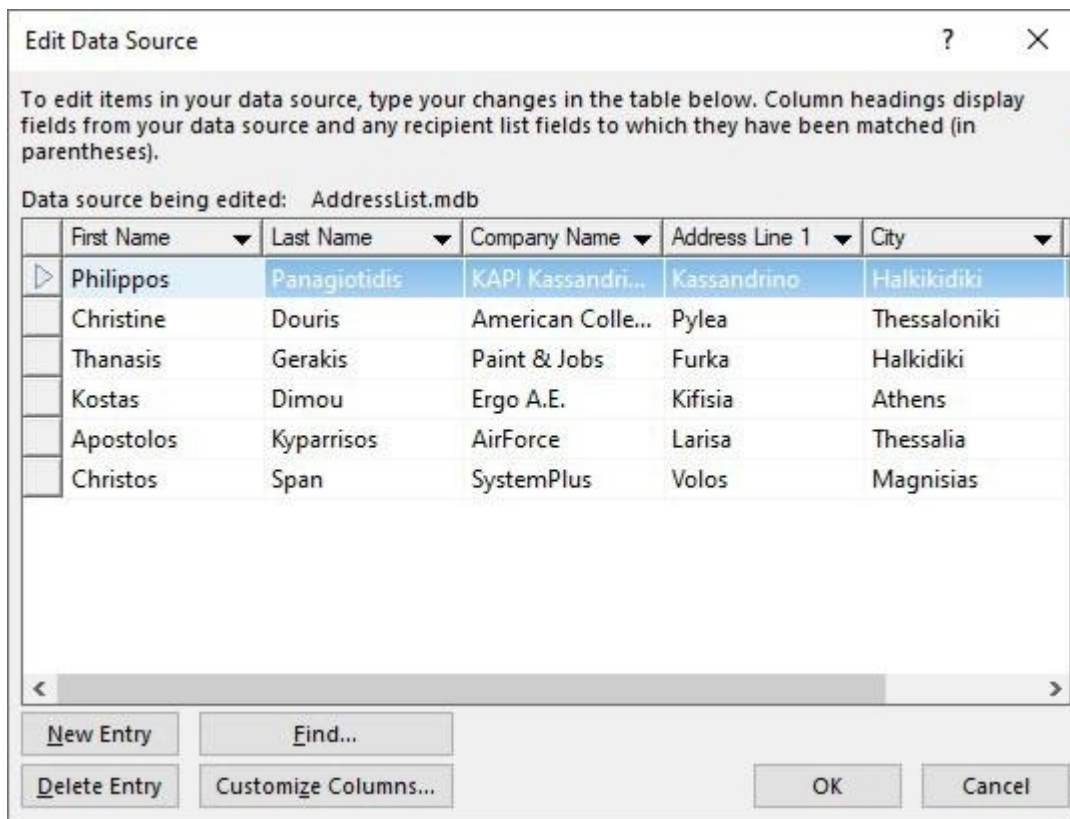


Fig 1.49(c). Data Source, Saved as ADDLIST.mdb

The data source has been created. The control is then transferred to the form letter. Now you must insert the mail merge fields into the form letter.

Position the cursor succession where you want each of the created fields be placed and perform the following tasks:

Step 1: Click on “Insert Merge Field”.

Step 2: Select the field required from the drop-down window displayed as a result of step 1.

Step 3: Position the cursor to the next point where you will want the field be placed.

Step 4: Repeat step 1, 2, and 3 above until the last field is inserted.

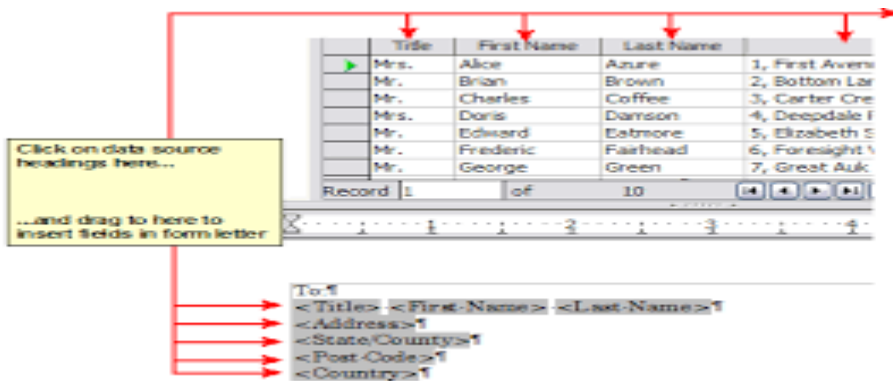


Fig.1.50 (a): Inserting Fields into Form Letter

Step 5: Click ‘Preview Result’ to preview the merged data in the form letter.

You can scroll through the pages by using “GO TO RECORD” button to preview a specific record in the recipient list.

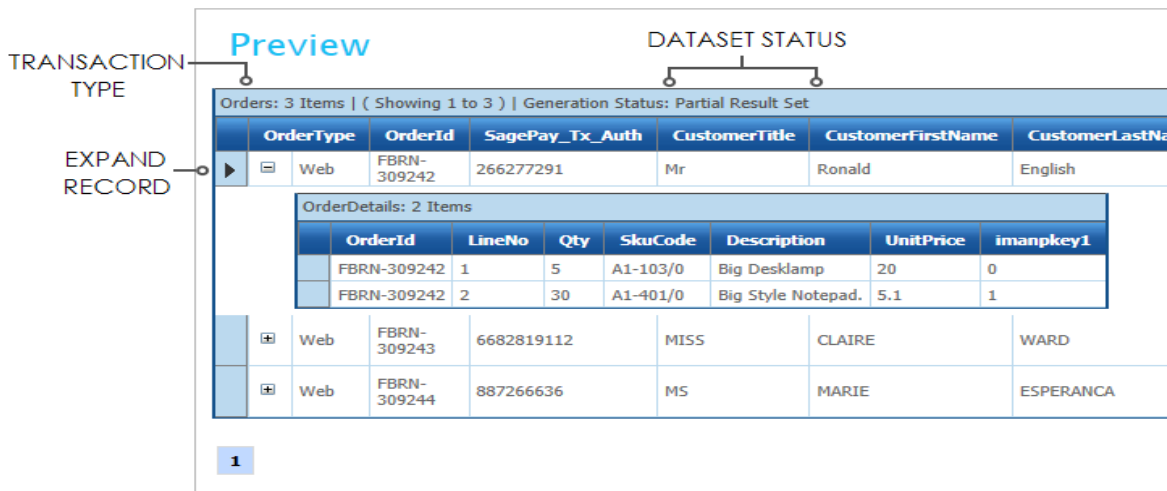


Fig.1.50 (b): Preview Result for record

Once you are satisfied with the output, you can actually merge the document.

Step 6: Click “Finish & Merge” to complete the mail merge.

Preview Record(s)



The following are the results of your selected filter.

Actions	Title ^	Eventdate	Starttime	Location
	Holiday Party	2012-12-07 00:00:01	2007-10-05 19:00:00	King Building Auditorium
	Homecoming	2012-10-25 00:00:01	2007-09-22 17:00:00	Randall Hall
	Winter Graduation	2012-11-08 00:00:01	2007-09-24 13:00:00	Main Gym

Showing 3 records. Close

Fig1.50C: Preview Result for record

1.3 Basics of Information Retrieval and its Components

The basic processes in information retrieval or information filtering are the representations of information objects and information needs, or more generally, the problem or goal that the person has in mind. The retrieval techniques themselves then compare needs with objects.

It can be defined as a software program that deals with the organisation, storage, retrieval, and evaluation of information from document repositories, particularly textual information. Information Retrieval is the activity of obtaining material that can usually be documented in an unstructured nature i.e. usually text which satisfies an information need from within large collections which is stored on computers. For example, Information Retrieval can be when a user enters a query into the system.

Not only librarians, professional searchers, etc engage themselves in the activity of information retrieval but nowadays hundreds of millions of people engage in IR every day when they use web search engines. Information Retrieval is believed to be the dominant form of Information access. The IR system assists the users in finding the information they require but it does not explicitly return the answers to the question.

Instead, it notifies regarding the existence and location of documents that might contain the required information. Information retrieval also provides support to users in browsing or filtering document collection or processing a set of retrieved documents. The system searches over billions of documents stored on millions of computers. For instance, an email program offers a spam filter, which can be manual or automatic, to classify emails and place them directly into particular folders.

An IR system has the ability to represent, store, organize, and access information items, through the use of a set of keywords. Keywords are what people are searching for in search engines. These keywords summarize the description of the information.

Components of Information Retrieval/ IR Model

- a. **Acquisition:** In this step, the selection of documents and other objects from various web resources that consist of text-based documents takes place. The required data is collected by web crawlers and stored in the database.
- b. **Representation:** It consists of indexing that contains free-text terms, controlled vocabulary, manual & automatic techniques as well. Example: Abstracting contains summarizing and Bibliographic description that contains author, title, sources, data, and metadata.
- c. **File Organisation:** There are two types of file organisation methods: sequential and inverted. In sequential organisation, documents are stored based on document data. In the inverted method, data is arranged by terms, creating lists of records under each term. Some systems use a combination of both.
- d. **Query:** An IR process starts when a user enters a query into the system. Queries are formal statements of information needs, for example, search strings in web search engines. In information retrieval, a query does not uniquely identify a single object in the collection. Instead, several objects may match the query, perhaps with different degrees of relevancy.

Difference Between Information Retrieval and Data Retrieval

Information Retrieval	Data Retrieval
The software program that deals with the organisation, storage, retrieval, and evaluation of information from document repositories particularly textual information.	Data retrieval deals with obtaining data from a database management system such as ODBMS. It is A process of identifying and retrieving the data from the database, based on the query provided by user or application.
Retrieves information about a subject.	Determines the keywords in the user query and retrieves the data.
Small errors are likely to go unnoticed.	A single error object means total failure.
Not always well structured and is semantically ambiguous.	Has a well-defined structure and semantics.
Does not provide a solution to the user of the database system.	Provides solutions to the user of the database system.
The results obtained are approximate matches.	The results obtained are exact matches.
Results are ordered by relevance.	Results are unordered by relevance.
It is a probabilistic model.	It is a deterministic model.

User Interaction with Information Retrieval System

The User Task: The information first is supposed to be translated into a query by the user. In the information retrieval system, there is a set of words that convey the semantics of the information that is required whereas in a data retrieval system, a query expression is used to convey the constraints which are satisfied by the objects. Example: A user wants to search for something but ends up searching with another thing. This means that the user is browsing and not searching. The above figure shows the interaction of the user through different tasks.

1. **Logical View of the Documents:** A long time ago, documents were represented through a set of index terms or keywords. Nowadays, modern computers represent documents by a full set of words which reduces the set of representative keywords. This can be done by eliminating stopwords i.e. articles and connectives. These operations are text operations. These text operations reduce the complexity of the document representation from full text to set of index terms.

1.4 Database Structure

In computing, a database is an organized collection of data stored and accessed electronically. Small databases can be stored on a file system, while large databases are hosted on computer clusters or cloud storage.

Databases often store information about people, such as customers or users. For example, social media platforms use databases to store user information, such as names, email addresses and user behavior. The data is used to recommend content to users and improve the user experience.

Databases are structured to facilitate the storage, retrieval, modification, and deletion of data in conjunction with various data-processing operations. A database management system (DBMS) extracts information from the database in response to queries.

The DBMS manages the data; the database engine allows data to be accessed, locked and modified; and the database schema defines the database's logical structure. These three foundational elements help provide concurrency, security, data integrity, and uniform data administration procedures.

Retrieval Techniques and Query Representation

The database design process

- a. A well-structured database:
- b. Saves disk space by eliminating redundant data.
- c. Maintains data accuracy and integrity.
- d. Provides access to the data in useful ways.

Designing an efficient, useful database is a matter of following the proper process, including these phases:

1. Requirements analysis, or identifying the purpose of your database
2. Organising data into tables
3. Specifying primary keys and analysing relationships

4. Normalising to standardize the tables

Let's take a closer look at each step. Note that this guide deals with Edgar Codd's relational database model as written in SQL (rather than the hierarchical, network, or object data models). To learn more about database models, read our guide [here](#).

Requirements Analysis: Identifying the Purpose of the Database

Understanding the purpose of your database will inform your choices throughout the design process. Make sure you consider the database from every perspective. For instance, if you were making a database for a public library, you would want to consider the ways in which both patrons and librarians need to access the data.

Here are some ways to gather information before creating the database:

- a. Interview the people who will use it
- b. Analyse business forms, such as invoices, time sheets, surveys
- c. Comb through any existing data systems (including physical and digital files)

Start by gathering any existing data that will be included in the database. Then list the types of data you want to store and the entities, or people, things, locations, and events, that those data describe, like this:

Customers

- a. Name
- b. Address
- c. City, State, Zip
- d. Email address

Products

- i. Name
- ii. Price
- iii. Quantity in stock
- iv. Quantity on order

Orders

- i. Order ID
- ii. Sales representative
- iii. Date
- iv. Product(s)
- v. Quantity
- vi. Price
- vii. Total

This information will later become part of the data dictionary, which outlines the tables and fields within the database. Be sure to break down the information into the smallest useful pieces. For instance, consider separating the street address from the country so that you can later filter individuals by their country of residence. Also, avoid placing the same data point in more than one table, which adds unnecessary complexity.

Once you know what kinds of data the database will include, where that data comes from, and how it will be used, you're ready to start planning out the actual database

Database Structure: The Building Blocks of a Database

The next step is to lay out a visual representation of your database. To do that, you need to understand exactly how relational databases are structured.

Within a database, related data are grouped into tables, each of which consists of rows (also called tuples) and columns, like a spreadsheet.

To convert your lists of data into tables, start by creating a table for each type of entity, such as products, sales, customers, and orders. Here's an example: Each row of a table is called a record. Records include data about something or someone, such as a particular customer. By contrast, columns (also known as fields or attributes) contain a single type of information that appears in each record, such as the addresses of all the customers listed in the table.

First Name	Last Name	Age	ZIP Code
------------	-----------	-----	----------

Roger	Williams	43	34760
-------	----------	----	-------

Jerrica	Jorgensen	32	97453
---------	-----------	----	-------

Samantha	Hopkins	56	64829
----------	---------	----	-------

To keep the data consistent from one record to the next, assign the appropriate data type to each column. Common data types include:

- a) CHAR - a specific length of text
- b) VARCHAR - text of variable lengths
- c) TEXT - large amounts of text
- d) INT - positive or negative whole number
- e) FLOAT, DOUBLE - can also store floating point numbers
- f) BLOB - binary data

Some database management systems also offer the Auto number data type, which automatically generates a unique number in each row.

For the purposes of creating a visual overview of the database known as an entity-relationship diagram, you won't include the actual tables. Instead, each table becomes a box in the diagram. The title of each box should indicate what the data in that table describes, while attributes are listed below like this:

Finally, you should decide which attribute or attributes will serve as the primary key for each table, if any. A primary key (PK) is a unique identifier for a given entity, meaning that you could pick out an exact customer even if you only knew that value.

Attributes chosen as primary keys should be unique, unchanging, and always present (never NULL or empty). For this reason, order numbers and usernames make good primary keys, while telephone numbers or street addresses do not. You can also use multiple fields in conjunction as the primary key (this is known as a composite key).

When it comes time to create the actual database, you'll add both the logical data structure and the physical data structure into the data definition language supported by your database management system. At that point, you should also estimate the size of the database to be sure you can get the performance level and storage space it will require.

Creating Relationships between Entities

With your database tables now converted into tables, you're ready to analyse the relationships between those tables. Cardinality refers to the quantity of elements that interact between two related tables. Identifying the cardinality helps make sure you've divided the data into tables most efficiently.

One-to-One Relationships

When there's only one instance of Entity A for every instance of Entity B, they are said to have a one-to-one relationship (often written 1:1). You can indicate this kind of relationship in an ER diagram with a line with a dash on each end:

Unless you have a good reason not to, a 1:1 relationship usually indicates that you'd be better off combining the two tables' data into a single table.

However, you might want to create tables with a 1:1 relationship under a particular set of circumstances. If you have a field with optional data, such as “description,” that is blank for many of the records, you can move all of the descriptions into their own table, eliminating empty space and improving database performance.

To guarantee that the data matches up correctly, you’d then have to include at least one identical column in each table, most likely the primary key.

One-to-Many Relationships

These relationships occur when a record in one table is associated with multiple entries in another. For example, a single customer might have placed many orders, or a patron may have multiple books checked out from the library at once. One-to-many (1: M) relationships are indicated with what’s called “Crow’s foot notation,” as in this example:

To implement a 1: M relationship as you set up a database, simply add the primary key from the “one” side of the relationship as an attribute in the other table. When a primary key is listed in another table in this manner, it’s called a foreign key. The table on the “1” side of the relationship is considered a parent table to the child table on the other side.

Many-to-Many Relationships

When multiple entities from a table can be associated with multiple entities in another table, they are said to have a many-to-many (M: N) relationship. This might happen in the case of students and classes, since a student can take many classes and a class can have many students.

In an ER diagram, these relationships are portrayed with these lines:

Unfortunately, it’s not directly possible to implement this kind of relationship in a database. Instead, you have to break it up into two one-to-many relationships.

To do so, create a new entity between those two tables. If the M: N relationship exists between sales and products, you might call that new entity “sold- products,” since it would show the contents of each sale. Both the sales and products tables would have a 1: M relationship with sold-products. This kind of go-between entity is called a link table, associative entity, or junction table in various models.

There are three (3) basic types of information retrieval such as Boolean, Vector and Probabilistic which can also be attributed to IR Model.

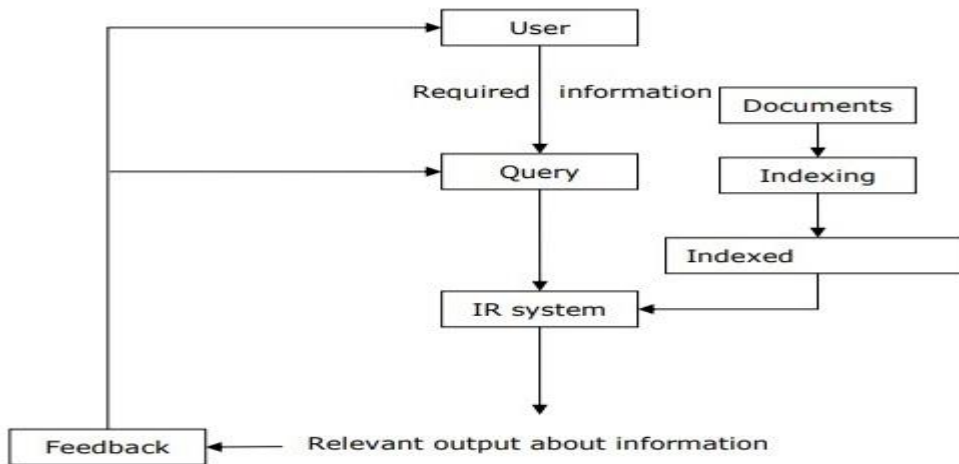


Fig1.51 Channeling Information Retrieval Techniques

Recursive Relationships

Sometimes a table points back to itself. For example, a table of employees might have an attribute “manager” that refers to another individual in that same table. This is called a recursive relationship.

Redundant Relationships

A redundant relationship is one that is expressed more than once. Typically, you can remove one of the relationships without losing any important information. For instance, if an entity “students” has a direct relationship with another called “teachers” but also has a relationship with teachers indirectly through “classes,” you’d want to remove the relationship between “students” and “teachers.” It’s better to delete that relationship because the only way that students are assigned to teachers is through classes.

Database Normalisation

Once you have a preliminary design for your database, you can apply normalisation rules to make sure the tables are structured correctly. Think of these rules as the industry standards.

That said, not all databases are good candidates for normalisation. In general, online transaction processing (OLTP for short) databases, in which users are concerned with creating, reading, updating, and deleting records, should be normalised.

Online analytical processing (OLAP) databases that favor analysis and reporting might fare better with a degree of denormalisation since the emphasis is on the speed of calculation. These include decision support applications in which data needs to be analysed quickly but not changed.

First Normal Form

The first normal form (abbreviated as 1NF) specifies that each cell in the table can have only one value, never a list of values, so a table like this does not comply:

Product ID	Color	Price
1	brown, yellow	\$15
2	red, green	\$13
3	blue, orange	\$11

You might be tempted to get around this by splitting that data into additional columns, but that's also against the rules: a table with groups of repeated or closely related attributes does not meet the first normal form. The table below, for example, fails to comply:

Instead, split the data into multiple tables or records until each cell holds only one value and there are no extra columns. At that point, the data is said to be atomic, or broken down to the smallest useful size. For the table above, you could create an additional table called "Sales details" that would match specific products with sales. "Sales" would then have a 1: M relationship with "Sales details."

Second Normal Form

The second normal form (2NF) mandates that each of the attributes should be fully dependent on the entire primary key. That means each attribute should depend directly on the primary key, rather than indirectly through some other attribute.

For instance, an attribute "age" that depends on "birth date" which in turn depends on "student ID" is said to have a partial functional dependency, and a table containing these attributes would fail to meet the second normal form.

Furthermore, a table with a primary key made up of multiple fields violates the second normal form if one or more of the other fields do not depend on every part of the key.

Thus, a table with these fields wouldn't meet the second normal form, because the attribute "product name" depends on the product ID but not on the order number:

- a) Order number (primary key)
- b) Product ID (primary key)
- c) Product name

Third Normal Form

The third normal form (3NF) adds to these rules the requirement that every non-key column be independent of every other column. If changing a value in one non-key column causes another value to change, that table does not meet the third normal form.

This keeps you from storing any derived data in the table, such as the “tax” column below, which directly

Order	Price	Tax
14325	\$40.99	\$2.05
14326	\$13.73	\$.69
14327	\$24.15	\$1.21

depends on the total price of the order:

Retrieval Techniques and Query Representation

We have State-of-the-art approaches to retrieving information that employ two generic techniques:

- (1) Matching words in the query against the database index (key-word searching)
- (2) Traversing the database with the aid of hypertext or hypermedia links.

In databases, data retrieval is the process of identifying and extracting data from a database. This is based on a query provided by the user or application. It enables the fetching of data from a database in order to display it on a monitor and/or use within an application.

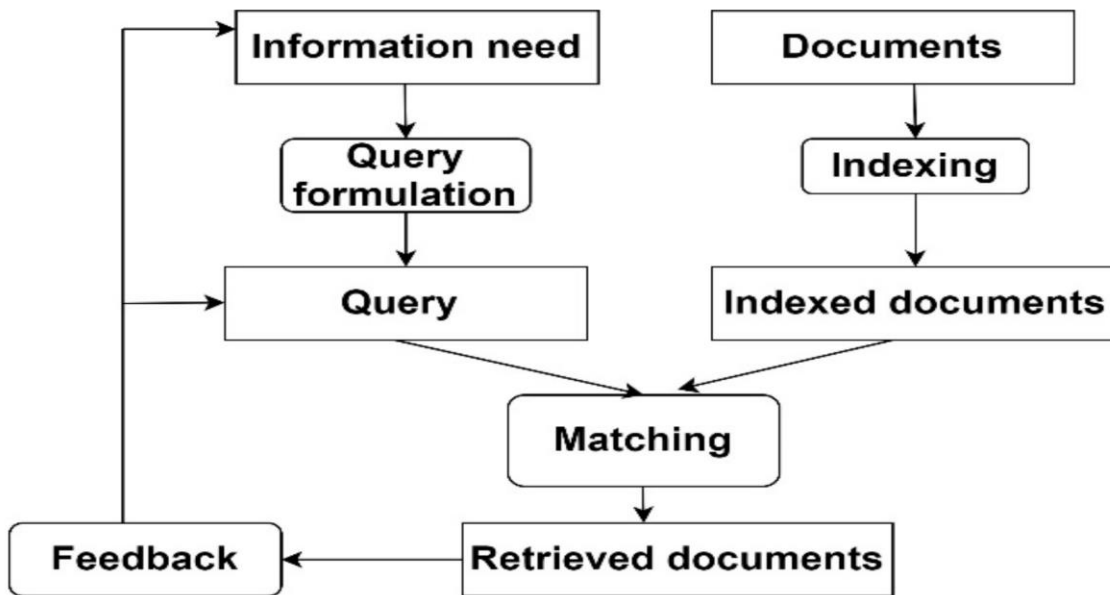


Fig 1.52: Retrieval and representation database schema

1.5 SPREADSHEET APPLICATION USING MS-EXCEL 2016

INTRODUCTION

The word “Microsoft Excel”, irrespective of the version describes one of the most flexible electronic spreadsheet application package or tool in the Office Suite used on the computer system. Spreadsheet

applications (especially designed to perform mathematical calculations) are reports that are used to list and analyse data in a table format for business, financial application and probably academic result computation.

Excel 2016 is one of the best spreadsheet applications available with several enhanced features, compared to previous versions. It can be used to make quick and easy financial analysis, analyse data and create presentations with charts (Graph utilities), retrieve data from external data sources and use it in worksheets, calculate, based on data from multiple worksheets, create web pages with ease, and run queries on data available on the web.

The electronic spreadsheet is like a large sheet consisting of several rows (approximately 65,536) and columns (approximately 256) to facilitate easy usage as a powerful data management tool. Using an electronic spreadsheet, one cannot only store a lot of data in the worksheets but also make use of different functions to arrange and analyse the data.

STARTING EXCEL 2016

When the computer system has completed the booting activity, it presents its desktop, with icons scattered on it. Search if the Excel symbol/icon is on the desktop. If YES, then double click on it to see Fig.1.53 if No, place your mouse on the START icon and perform the following actions to see Fig.1.53.

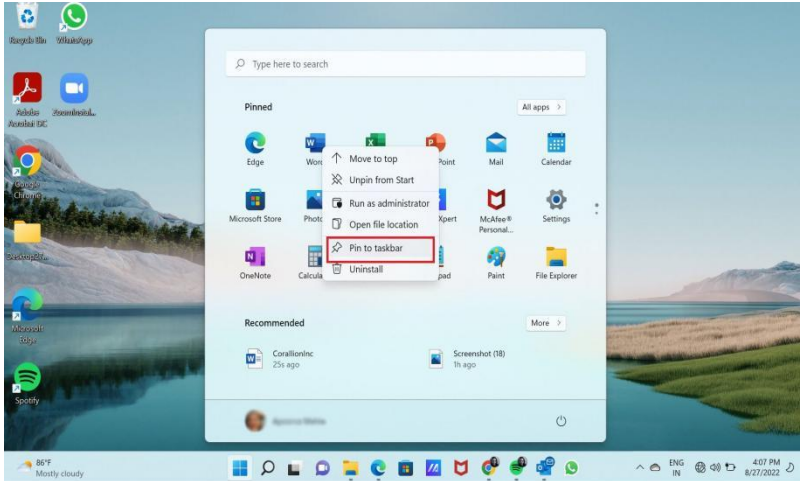


Fig 1.53(a): Ms Icon window pinning Taskbar (Excel)

Step 1: Click Start icon on the Window 2016 Taskbar

Step 2: If Excel is tagged to the Start Menu, double click it to achieve Fig.1.53 (b)

Step 3: If step 2 is NO, then highlight “All Programs”

Step 4: Search and Click on Microsoft Office

Step 5: Selected and Click on Microsoft Office Excel 2016 to achieve Fig. 1.53(b)

Pinning Microsoft office Icons on Taskbar

The method to pin Excel and Word files to their app icons on the taskbar is the same as detailed above for pinning the Word file.

1. Open the Word or Excel or PowerPoint file you want to pin. Then close the file.
2. Right-click the Word or Excel or PowerPoint icon on the taskbar to open the menu and check for the file under **Recent**.
3. Then either right-click the file and choose **Pin to this list**. Or pin it using the **Pin** icon

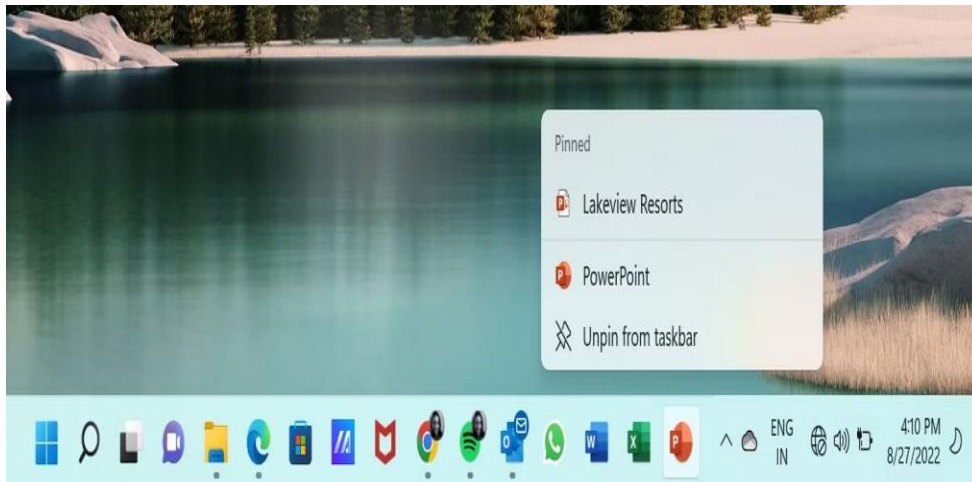


Fig 1.53 (c): Pinning Ms-Office Icons on Taskbar



Fig. 1.53(b): Pinning Excel 2016 tagged to START Icon

THE EXCEL WINDOW



Fig. 1.53(b): Microsoft Office Excel 2016 Environment/Screen

The default workbook contains three worksheets (which may be increased) that contain rows and columns made of cells. The active cell (which may be changed using mouse or keyboard) is ready to receive data or commands. The Name box shows the cell reference, which identifies the location of the active cell in the worksheets by column and row. For example; A1, that is, column A and row 1.

The Menu bar, Toolbars (Standard or formatting), and the Status bar in Microsoft Excel serve functions similar to those previously discussed in Microsoft Word, except the Formula Bar. The Formula Bar, located at the top of the Micro Soft Excel Window, is used to enter or edit values or formulas in cells or charts and displays the content value of formula stored in the active cell.

NOTE: It is possible to scroll to different areas in a worksheet using the mouse or keyboard. However, scrolling does not change the active cell.

ENTERING INFORMATION:

Every bit of information that is entered into the worksheet has its unique location and address. So Excel requires that the Cell Pointers is moved (using mouse of keyboard) to receiving cell before the information is

typed at all. Otherwise, the information will be locked into the active cell (or default cell) and if such cell already has any information, it would be automatically overwritten.

By default, each cell is approximately nine (9) characters wide. However, it is possible to enter and view characters that are longer than the cell width. In fact, Excel 2016 supports up to 32,000 characters in a single cell entry.

Before information is accepted into the worksheet, it must be a valid entry. A valid entry must either be a LABEL, VALUE or FORMULA. The first character entered into a cell determines the status of the entry.

Label

When an alphabetical character or a symbol (e.g. +, #, %, *, “, ‘, A, >, <, ? and so on) is entered as the first character in a cell, the cell contains a label. In fact, a label is generally a text data. If a label is entered into a cell, it appears in the cell and on the formula bar. The formula bar displays the entry and three buttons: CANCEL, ENTER, and INSERT FUNCTION.

A label could be numeric and as such not used in calculation. For example, a student matriculation number, social security number and an account number are numeric labels. To indicate that such numbers are to be treated as label (text) and not values, it is necessary to begin the entry with a label prefix, usually an apostrophe (‘). The label prefix is not displayed on the worksheet but shown on the formula bar. Number may also be formatted as text or label by using the Format, Cells, and Number Text Commands.

Value

An entry that is constituted by absolute figures 0-9 is regarded as a value entry. Excel will accept up to eleven numbers in a cell by automatically widening the cell. If a value is longer than eleven characters, Excel displays the number in scientific notation. If the value was returned by some formula and it is longer than eleven, number sign (####) appears in the cell. In this case, column width must be reset to accommodate the number, which will be displayed immediately such widening is done.

To change the width of a column, using mouse, perform the following:

Step 1: Move the mouse pointer to the column border to the right of the column letter

Step 2: After the mouse pointer has changed to a black two head horizon arrow drag it to the left or right.

Step 3: Release the mouse button when the desired column size is accomplished.

Alternatively, click on CELLS (Insert, Delete and Format) and select Format for a drop down dialogue box. On it Click on “Column Width” to achieve Fig1.54 (a)

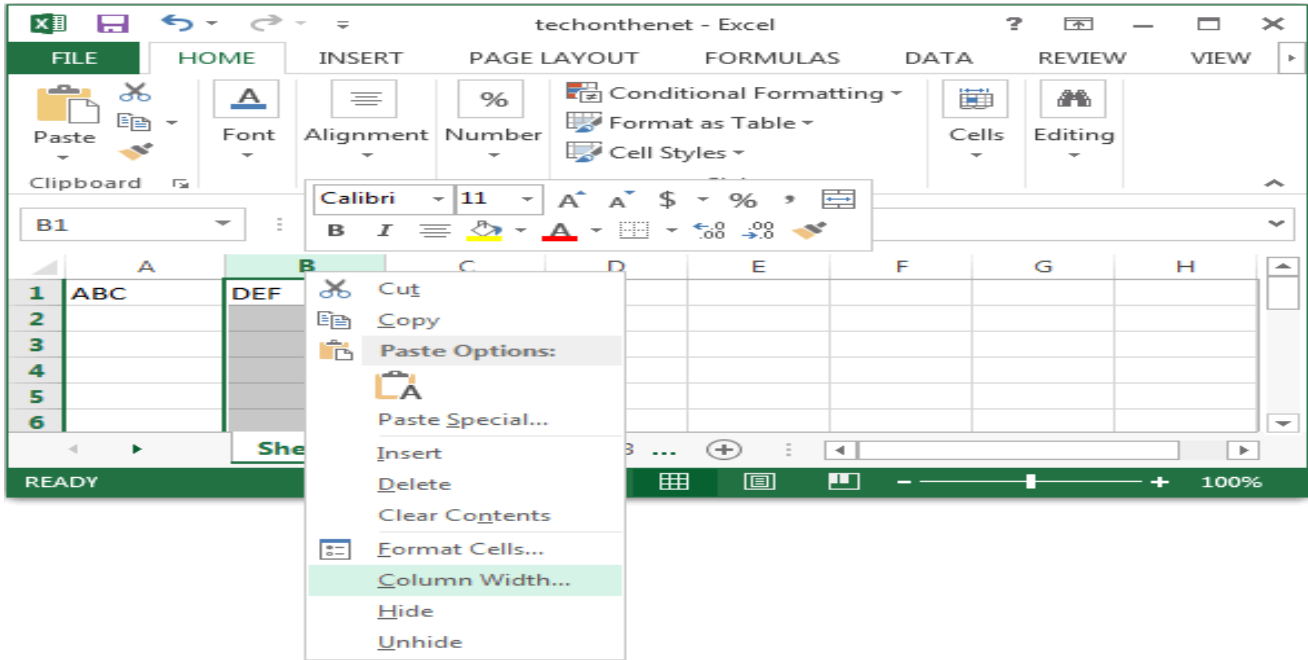


Fig 1.54(a): To Widen the Width of Cell.

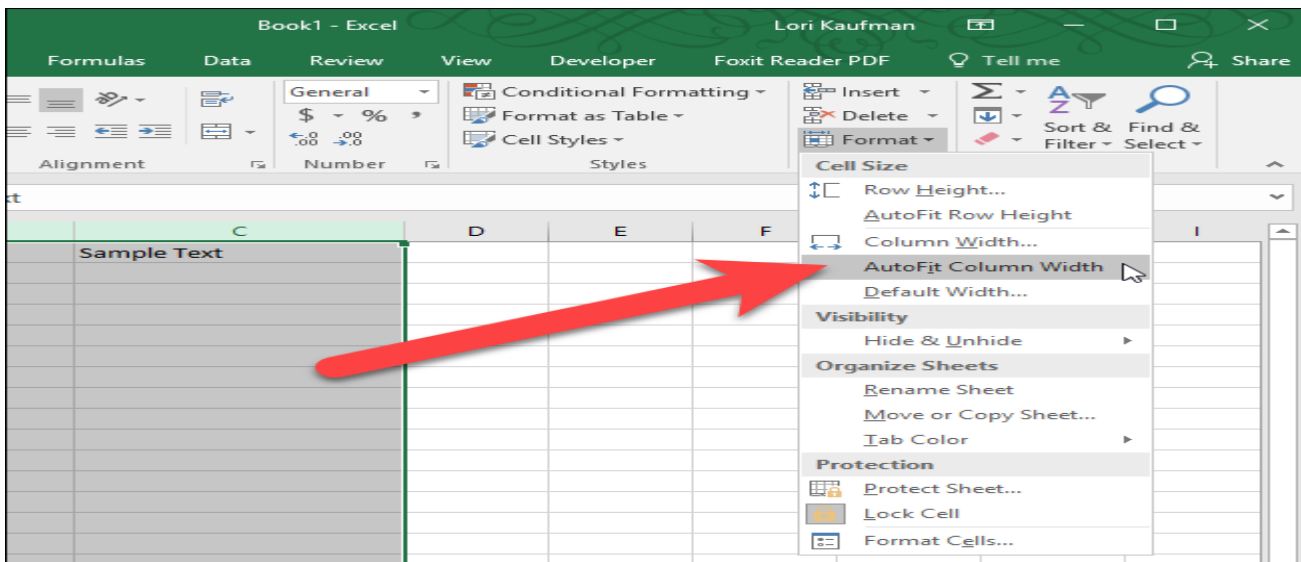


Fig 1.54(b): To Widen the Width of Cell

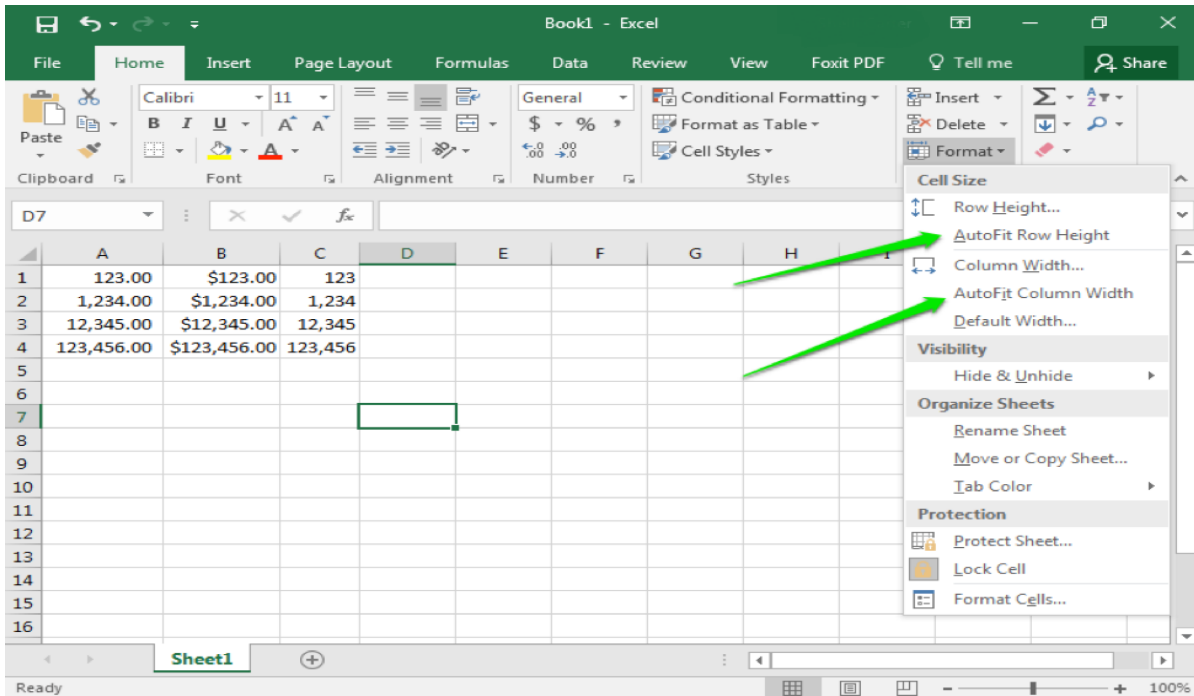


Fig. 1.54(c): To Widen the width of cell

Making Simple Corrections:

Before information (label, value, and formula) is entered, a BACKSPACE KEY may be used to correct an error. To delete the entire entry, the ESCAPE key or CANCEL BOX on the formula bar may be pressed. However, after information has been entered, a correction may be typed directly over the existing text (this is called the strikeover method of correction). Alternatively, the cell is double-clicked and necessary corrections made.

Changing Font Size and Attributes:

A font is a typeface of a particular size (e.g. comic san 10 points, Times Roman 14 points) and attributes (boldface, underline, or italics, which determine how characters look on the screen and in a printed worksheet.

To change the font size and its attribute in Excel is similar to what operates in Ms Word as already discussed in the preceding chapter. The following steps explain:

Step 1: Click on the cell or select the range whose text format has to change

Step 2: Click on the font name tool to the right and select any font type from the list of font names

Step 3: Click on the font size tool of the format toolbar

Step 4: Change the font size as desired

Step 5: Click on the Bold icon

Step 6: Click on the Italic icon

Step 7: Click on the Underline icon. See Fig1 .4

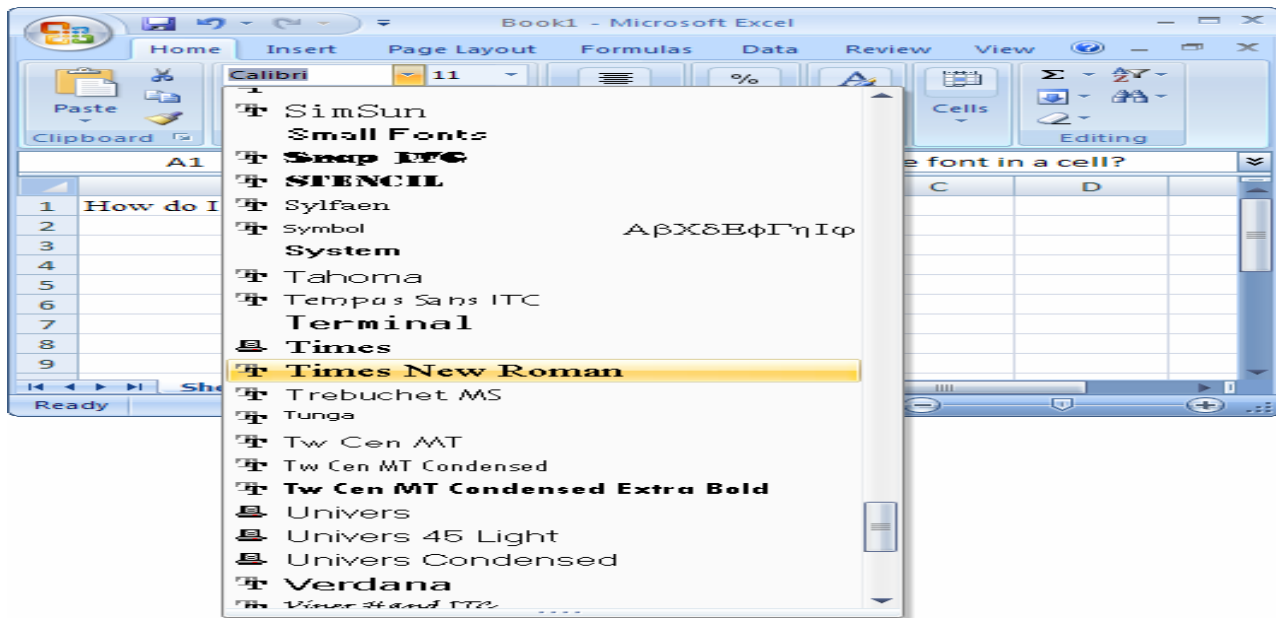


Fig. 1.55(a) Modifying Font style and size

It must be noted that in previous versions of MS Excel when the size or attribute is altered, fonts may become taller than the height of the row. Then, it becomes necessary to change row height in order to accommodate the new font height. The steps involved are similar to already discussed changing “Column width”. However, in Excel, 2016 the row height adjusts automatically with the new font size.

Label Alignment

A label can be aligned using the alignment buttons on the Format Cell. Alternatively, a label may also be aligned by selecting the cells containing the label(s) to be aligned and choosing an alignment through the Format Cell.

A value, when entered, is automatically aligned to the right of the cell, making it a right-justified entry. Since labels are left-justified and values are right-justified in a cell, column titles (which are labels) will not appear centered over numeric data. Column title labels above numeric data may be centered or right-aligned to improve the appearance of the worksheet.

Excel also has a new horizontal alignment option called indent, which lets you align text always from the left edge of a cell. You can indent cell text quickly using the Indent buttons on the Format Cell or ALIGNMENT module. You can also set the indent of text in cells.

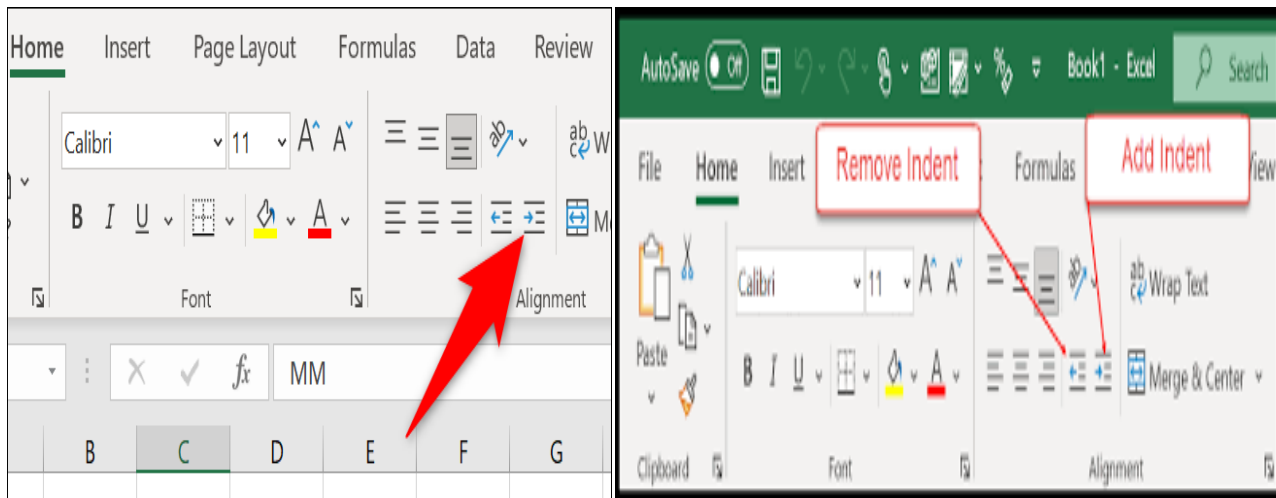


Fig 1.55(b): Indent Cells (Increase and Decrease)

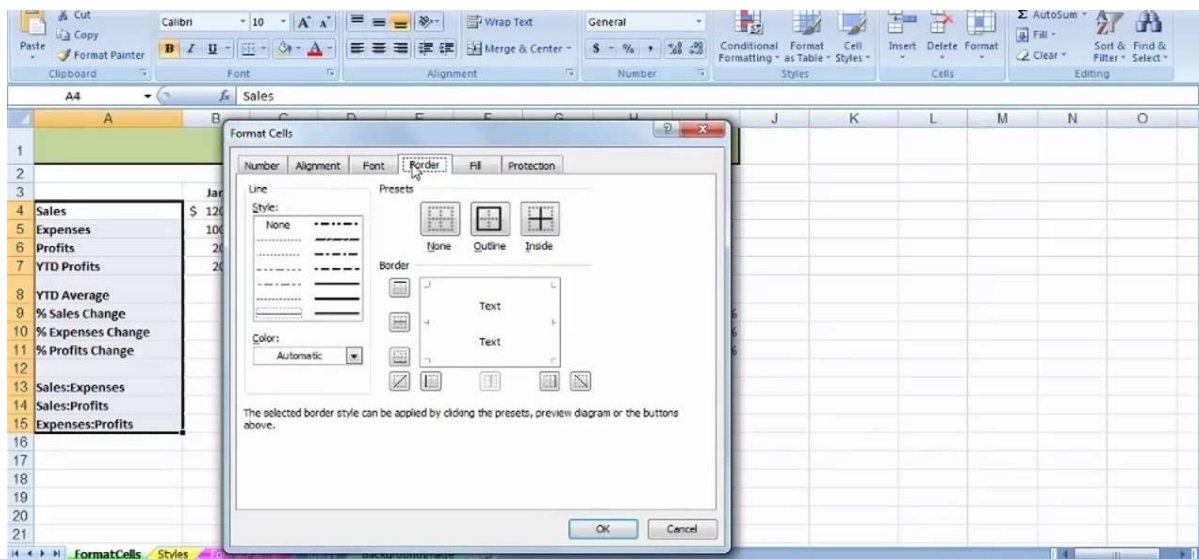


Fig 1.55(c): Format Cell dialogue box

1.6 FORMULA

In Excel, a formula is an expression that operates on values in a range of cells or a cell. If an entry has a + or = or @ sign as its first character, it is regarded as a formula. A formula is entered in the cell where the answer should appear or returned. As the formula is entered, the answer is displayed in the cell, and the formula is displayed in the formula bar. For example, the formula: = (B2+G2)*(C2*0.5) results in the addition of the values in cell references and multiply the intermediate result with 50% of the content of cell C2.

Therefore, any change to a value made in these cells causes the answer to change automatically. Execution of the formula is from left to right in order of precedence: (i) Parenthesis (ii) Exponential (iii) Multiplication and Division (iv) Addition and subtraction.

For example, $4+6*2$ yields 16, whereas, $(4+6)*2$ yields 20

A formula is an equation that performs operations (mathematical, compare worksheet values or join text and so on) on data in cells on the same worksheet, cell on other sheets in the same workbook, or cells on sheet in other workbooks. It can contain numbers, text operators; cell formula is a text (a label or value). A formula is entered in the cell where the answer should appear. There can be three (3) types of formulae namely:

- (a) Numeric formula: This formula performs calculation with values using one or more of the arithmetic operators namely: +, -, /, *, ^ @ function. For example, += (A1+B1) /C1

(b) Text Formula: Performs calculations with text enclosed in “ “ and labels using text operator & (ampersand) or @ functions. For example, @ LOVER (C3) or + “NET” & D4, which returns NETPAY if cell D\$ already contains the label PAY.

(c) Logical formula: Are statements that return 1 if TRUE and 0 if FALSE. Generally, logical formula uses the logical operators <, >, =, <>, <=, >=, #NOTE#, #OR#, #AND#, and @ functions. Examples are:

- (i) = (BASICAL + ALLW + COMM) - TAX
- (ii) = IF (GRD>50, “PASS”, “FAIL”),
- (iii) =IF (AND(A2 = “FEMALE”, E2 < 500), “QUALIFY”, “Not UALIFIED”)

Apart from the cell referencing method of creating formula, Excel has another method called the natural language, where column headings are used. For example, a formula could read = (Quantity * Unit Price) Discount

For example, Fig 1. shows how NET PAY is obtained by using the formula (BASIC SAL + ALLW + COMM) TAX instead of writing a cell referencing formula of the form: = (E4 +F4+G4) H4 to obtain the value in 14 for John Smith (Developer). To evaluate this feature, read and understand section 1.. Once initiated, Excel will automatically pick up the contents of BASIC SAL, ALLW, COMM and TAX in the adjacent cells and perform the arithmetic operation on them.

	A	B	C
1	Name	Title	Salary
2	Steve Peterson	CEO	\$74,000.00
3	Heather Jackson	Account Manager	\$74,000.00
4	John Smith	Developer	\$57,000.00
5	Colin Miller	Administrative Assistant	\$75,000.00
6	Hannah Nolan	Account Manager	\$63,000.00
7	James Rampling	Project Lead	\$58,000.00
8	Julia Clark	Designer	\$77,000.00
9	Christopher Cameron	Writer	\$65,000.00
10	Leah Thompson	Human Resources	\$55,000.00
11	Julian Kennedy	Creative Lead	\$58,000.00
12			

Fig 1.56: Accepting Labels in Formula

Accepting Labels in a Formula:

In order to accept Label in the formula, the following steps will suffice:

Step 1: Click FORMULA on the Main Menu

Step 2: Select DEFINED NAMES (comprising Name Manager, Define Name, Use in Formula and Create from Selection) Module

Step 3: Click on “Define Name” to see 1.

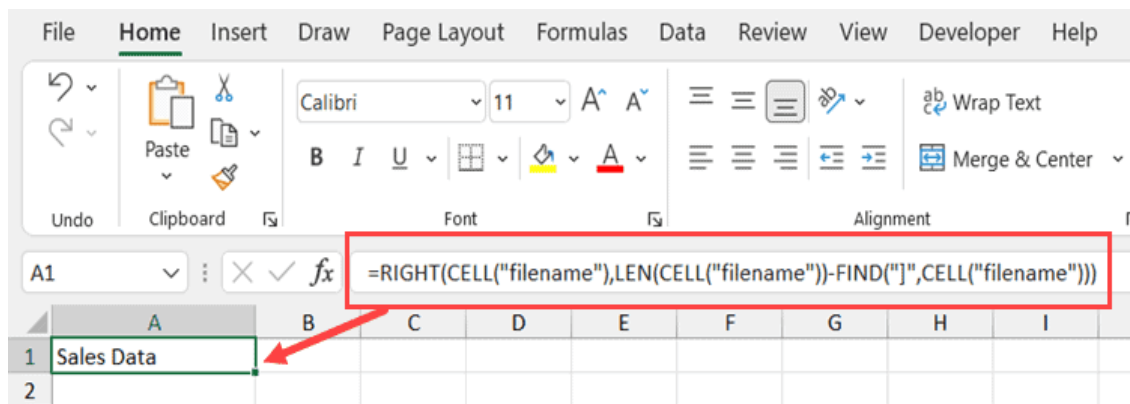


Fig 1.57: Defining Field name in Ms-Excel

Step 4: Perform the following tasks/modifications:

- (a) Write the name as reflected on your worksheet
- (b) Define the scope. E.g. Sheet1 or Sheet2 or Workbook
- (c) T default, this label will refer to an absolute reference (Sheet1! \$I\$4). You may retain it if you have just a row to work with. However, it could be changed to cell referencing format (Sheet1! 14), so that it could be copied to other cells, within the same row.

Step 5: Click OK

Step 6: Perform steps 1 to 5 until all Names are defined

Step 7: Place the cursor in the cell where you want the formula to be used

Step 8: Select “Use In Formula”. This will display all the names you have defined. See Fig. 7.9

Step 9: Select the names one after the other in the order they reflect in your formula, using step 8

Step 10: Press Enter, when the last name has been inserted

Step 11: The appropriate answer will be displayed.

After creating a working formula, the same can be applied to all other rows, without necessarily writing the formula in each of the other rows in column I. You can just fill the formula in other cells by “Copying” and “Pasting” (Manual filling). Besides filling formulae manually, Excel’s enhanced FILL feature can be employed for a large database. The Fill feature can be accessed from HOME and selecting EDITING (comprising of Auto Sum, Fill, Clear, Sort & Filter and Find & Select) as shown in fig 1.

	A	B	C	D	E	F
1	Make	Model	Type	MPG (City)	MPG (Highway)	Invoice
2	Acura	MDX	SUV	17	23	\$33,337
3		RSX Type S 2dr	Sedan	24	31	\$21,761
4		TSX 4dr	Sedan	22	29	\$24,647
5		TL 4dr	Sedan	20	28	\$30,299
6		3.5 RL 4dr	Sedan	18	24	\$39,014
7		3.5 RL w/Navigation 4dr	Sedan	18	24	\$41,100
8		NSX coupe 2dr manual S	Sports	17	24	\$79,978
9						
10						
11						
12						
13						

Fig 1.58: Defining Names

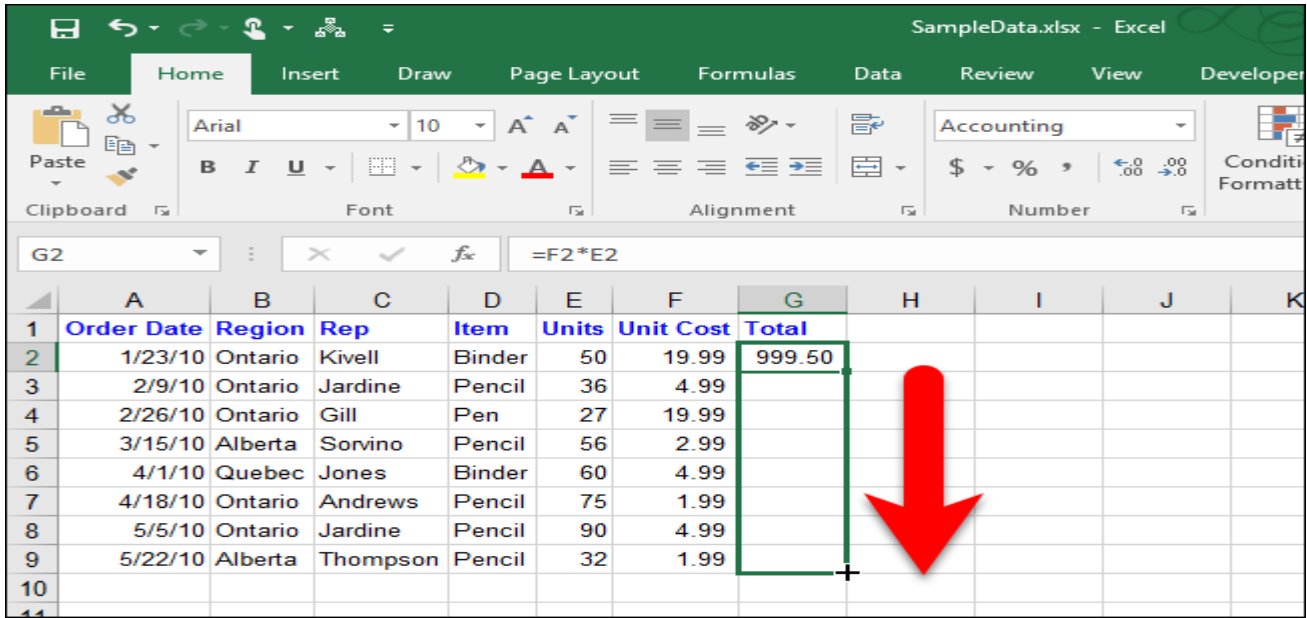


Fig1.59 (a): Invoking FILL feature

To fill the other rows in column 1, you can select the remaining range (e.g. 15 to I11), using Shift + Down Arrow. Then, the Click FILL and selected DOWN on the drop down dialogue box so that the entire chosen range row carries the formula. See Fig 1.59(b)

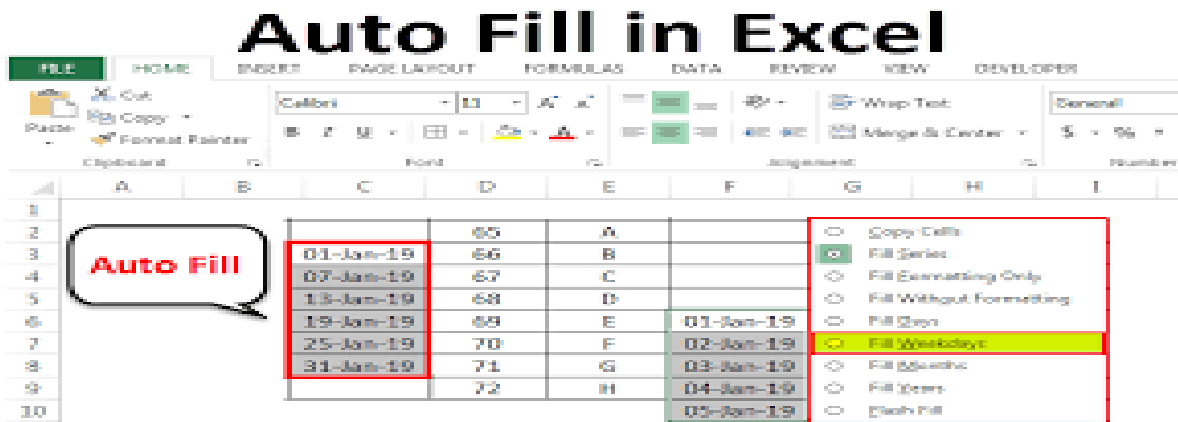


Fig 1.59(b): Auto filling the cells

Relative and Absolute Cell Referencing:

Depending on the task you want to perform, you can use either RELATIVE CELL REFERENCES, which are reference to cells relative to the position of the formula, or ABSOLUTE REFERENCES, which are cell references that always refers to cell in a specific location.

When a formula is created, references to cells or ranges are usually based upon their position relative to the cell that contains the formula. For example, if cell 14 contains the formula: + (E4 + F4 + G4) H4, after filling down, the references in the previous formula is updated automatically and refer to different cells relative to the position of the formula. That is cell 19 will have its formula as: = (E9 + F9 +G9) H9. This is known as RELATIVE CELL REFERENCING.

If you desire not to have the references changing when you copy a formula to a different cell, an Absolute reference is used.

To identify a cell as absolute value, you must place a dollar sign (\$) before its column and row. For example, to create an absolute reference to cell D 11, add dollar sign to the formula as follows: = Grade point * \$D\$11, where D11 contains the Credit unit. In the example in Fig. 1, D11 has 2 in its cell and this will be used throughout. If the credit hour changes, you only change the content of cell D11 and not the value used in the formula.

Absolute Reference in Excel

	B	C	D	E	F
			GST	10%	
Quantity	Item	Quantity	Price (Rs.)	Total Price	Total Price with GST
5	Marie Gold Biscuits	5	40	200	=E35*\$E\$33
3	Monaco Biscuits	3	30	90	9
4	Oreo Biscuits	4	50	200	20
4	Navratna Mixture	4	75	300	30
5	Chips	5	25	125	12.5
10	Nestle Cold Coffee	10	45	450	45
3	Pepsi	3	65	195	19.5
3	Limca	3	66	198	19.8
4	Frooti	4	70	280	28

Fig 1.60(a): Using Absolute Cell Reference

It is always important to know how a statement could be converted to an expression (e.g. arithmetic or logic) and using an excel template, arrive at a decision for ourselves or our organisation. To accomplish this task, logic formula will be required. For example, The Managing Director (MD) of our organisation demands that we should determine the suitability of a staff of our organisation for an “End of the year Award”, noting that such staff must be (i) a female (ii) less than 20 years of age and (iii) earning salary less than #50,000:00.

Using our SALARY Database, we shall convert the statement to a logic expression as follows:

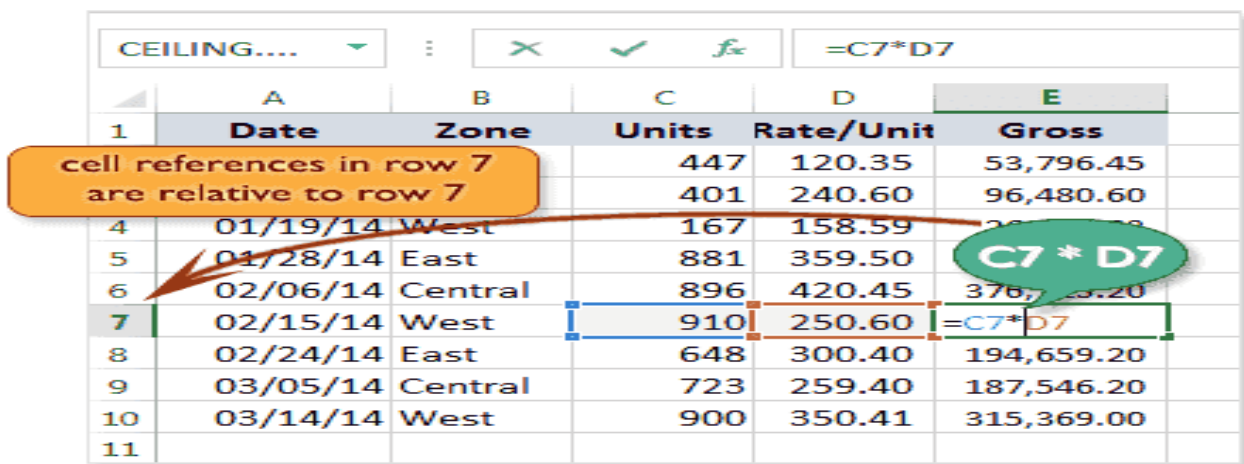
= IF (AND(SEX = “Female”, AGE < 20, NET PAY<50000), “ Qualified”, “Not Qualified”).

The purpose of AND logic is to ensure that if ALL the conditions set in the inner bracket is TRUE, then the first action is performed (i.e. Qualified) otherwise, the second (Not Qualified) is performed.

This formula is then written with respect to the cells as:

IF (AND (C2 = “F”, D2<20, 12>50000), “Qualified” “Not Qualified”).

This formula will then be filled down to other cells using Relative Cell Referencing. It can be seen that only one of our staff satisfied these conditions set by the MD. Therefore, she is he only qualified staff. See Fig 1.60(b)



	A	B	C	D	E
1	Date	Zone	Units	Rate/Unit	Gross
4	01/19/14	West	167	158.59	26,484.53
5	01/28/14	East	881	359.50	316,720.50
6	02/06/14	Central	896	420.45	376,723.20
7	02/15/14	West	910	250.60	228,246.00
8	02/24/14	East	648	300.40	194,659.20
9	03/05/14	Central	723	259.40	187,546.20
10	03/14/14	West	900	350.41	315,369.00
11					

Fig1.60 (b): Using Relative Cell reference in a large Database

Using Function

A function is a built-in formula in Excel that performs a specialized calculation automatically. For example, SUM, COUNTIF, SUMIF, AVERAGE, LOG and so on. It can be used as a formula itself, combine it with other function and formula, or use it in a macro. Usually a function has two major parts:

- (i) The name of the function
- (ii) One or more arguments enclosed in parenthesis (). For example: SUM(A2:A8)

Instead of writing $A2 + A3 + A4 + A5 + A6 + A7 + A8$

OR SUM (A2, A3, A4, A5, A6, A7, A8)

The function can also be used to evaluate the summation of a range of many columns, such as SUM (D4:G10), used in arriving at the Weighted Score of 147.50, 179.50, and 237.00 respectively in Fig1.70 (a).

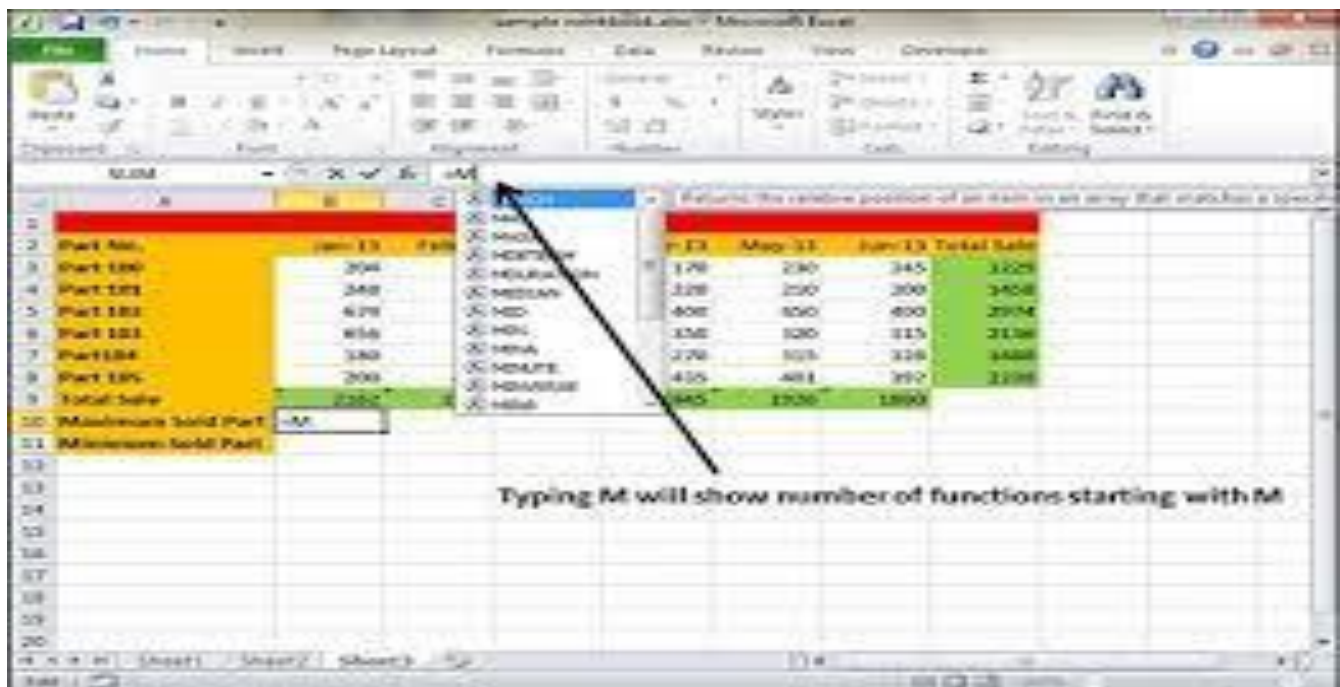


Fig 1.70(a): Using Function

Auto-Calculate

Auto-Calculate is a new feature that automatically provides the AVERAGE, COUNT, COUNT NUMS, MAX, MIN, or SUM for a selected range. After selecting the range to be calculated, you can right click on the Auto-Calculate section of the Status bar, which is at the right side of the Status bar at the bottom of the screen. Select the desired function from a Pop-up list and the answer will appear on the Status bar. See Fig 1.70(b).

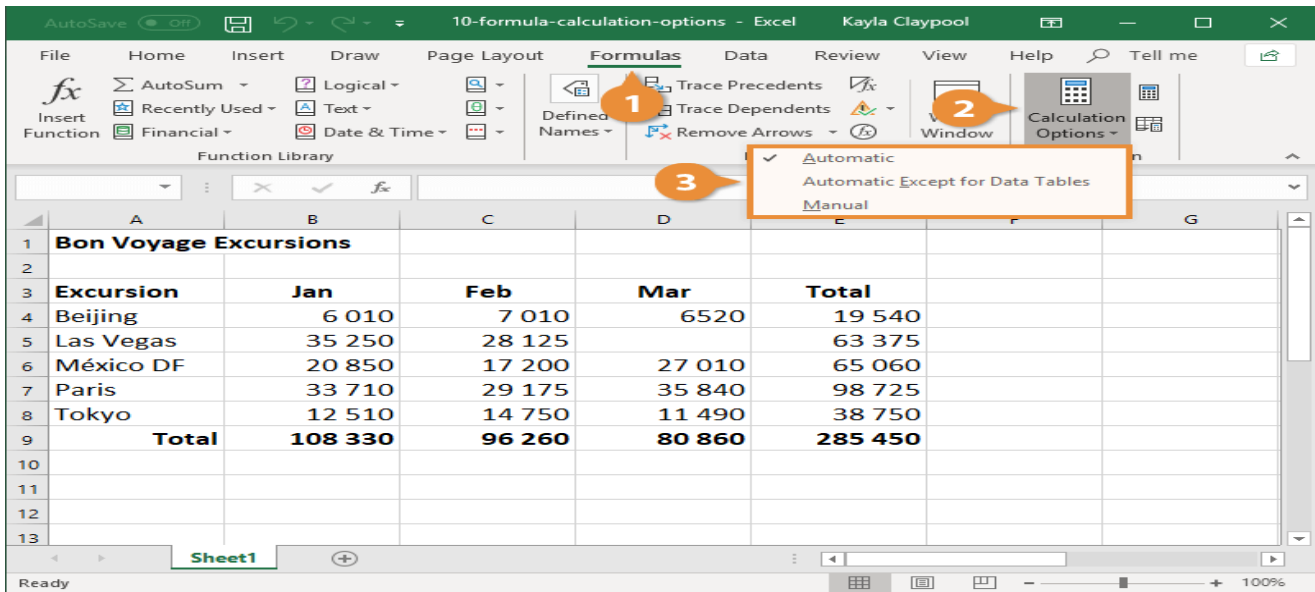


Fig 1.70 (b): Pop List of the Auto Calculate

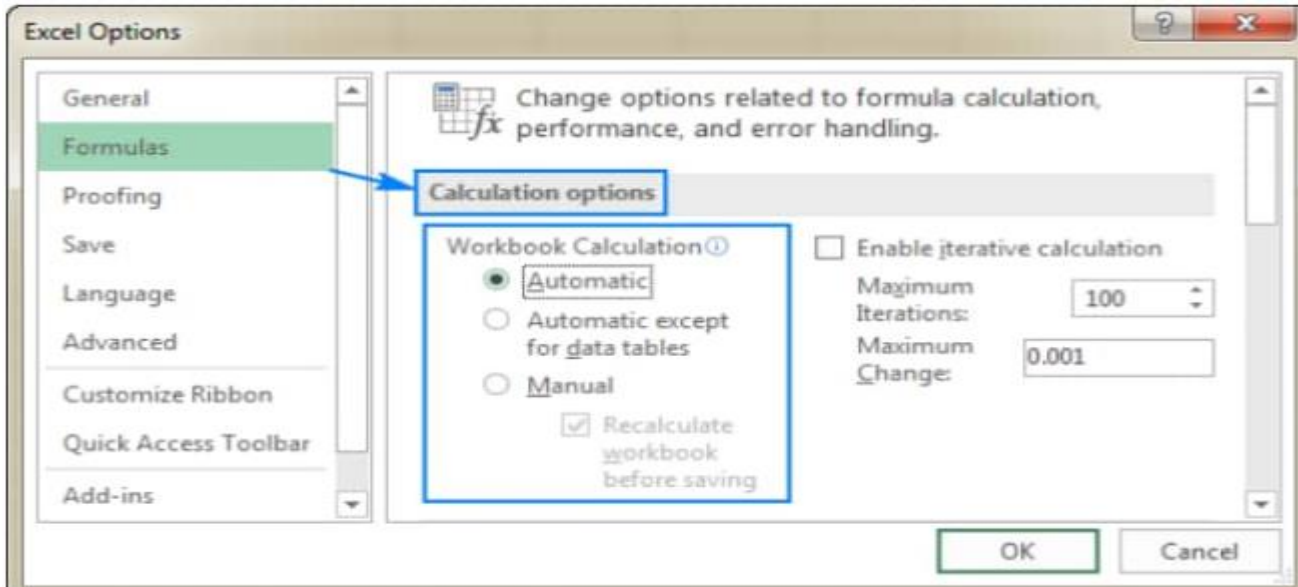


Fig1.70(c): Auto-Calculate

NOTE: Five items were selected (Average, Count, Minimum, Maximum, Sum) and five results were obtained as Average = 55,820.70, Count = 10, Minimum = 22,020.00 Maximum = 80,373.00, and Sum = 558,207.00. This result is for your use/consumption and cannot be transferred to the worksheet.

All these activities can also be implemented using Σ AutoSum on the EDITING module. However, it must be emphasized that the result, in this case, is displayed immediately after the selected cells.

Employee Name		Basic	Allowance	
Catherine Mitchell		\$ 2,000.00	Medical Expense	10%
David Zones		\$ 1,500.00	Yearly Profit Bonus	15%
Kelie Sayers		\$ 1,000.00	Festival Bonus	30%
Justin Timberlake		\$ 1,700.00	House Rent	20%
Laurel Clarke		\$ 1,900.00	Deduction	
Peter Brown		\$ 2,000.00	Income Tax	12%
Jason Spillberg		\$ 1,300.00	Provident Fund	8%
Zinia Berg		\$ 1,800.00		

Fig 1.70(d): Using Autosum to calculate Total Netpay

Argument:

This is the value(s) that a function uses to perform operations or calculations. The type of argument a function uses is specific to the function. Common argument that are used within function include numeric values, text values, cell references, ranges of cells, names of labels and nested functions.

Types of functions:

The functions can be grouped into eight categories: Data and Time, Logical, Text, Look and Reference, Database, Financial, Special, Mathematical and Trig, Statistical, Engineering, Cube and String.

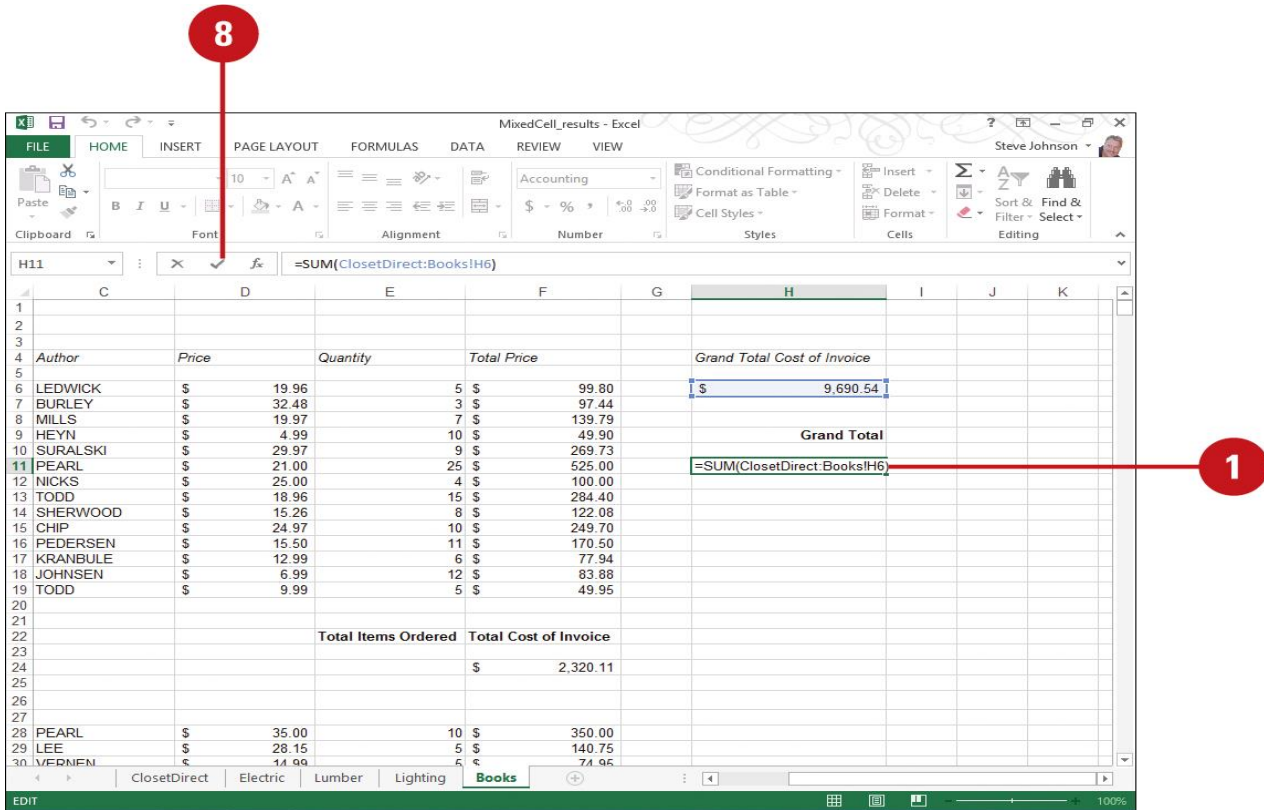


Fig 1.80(a):Using Function referencing

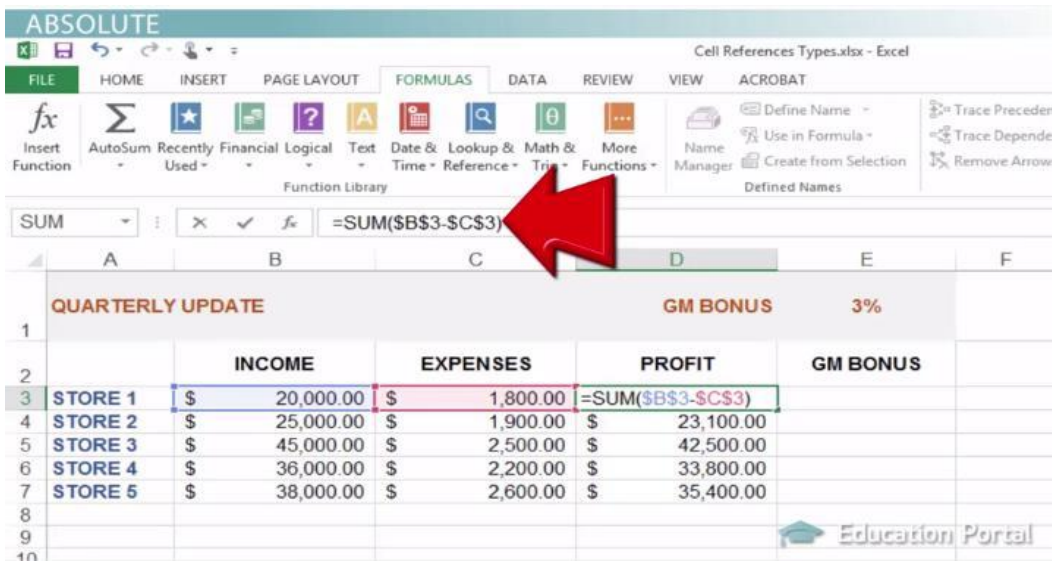


Fig 1.80(b): Using Function with Cell Referencing

How to Pass Reference to a Function?

To pass the value by reference, argument reference is passed to the functions just like any other value. So accordingly you need to declare the function parameters as reference types as in the following function swap (), which exchanges the values of the two integer variables pointed to by its arguments.

The screenshot shows the Microsoft Excel interface. The formula bar at the top displays the formula `=IF(OR(B2>50, C2>50), "Pass", "Fail")`. A pink arrow points from the formula bar to the formula in cell D2 of the spreadsheet. The spreadsheet has columns for Name, Test 1, Test 2, and Result. The data is as follows:

	Name	Test 1	Test 2	Result
2	Colin	57	62	Pass
3	Den	38	63	Pass
4	Dustin	43	72	Pass
5	Frank	77	69	Pass
6	James	76	49	Pass
7	Karl	66	74	Pass
8	Mike	93	58	Pass
9	Scott	61	84	Pass
10	Yvette	50	50	Fail

Fig 1.80(c) Types of functions with Cell variables (IF conditional statement)

Formula Palette:

It is a tool that helps you create or edit formula in the current cell by choosing functions and editing the arguments. The palette appears below the formula bar when you click the INSERT FUNCTION button on the formula bar or “Insert Function” of the FUNCTION LIBRARY module under FORMULARS in the Main Menu. When in use, it provides the current result of the function and the current result of the entire formula. See fig 1.80(d).

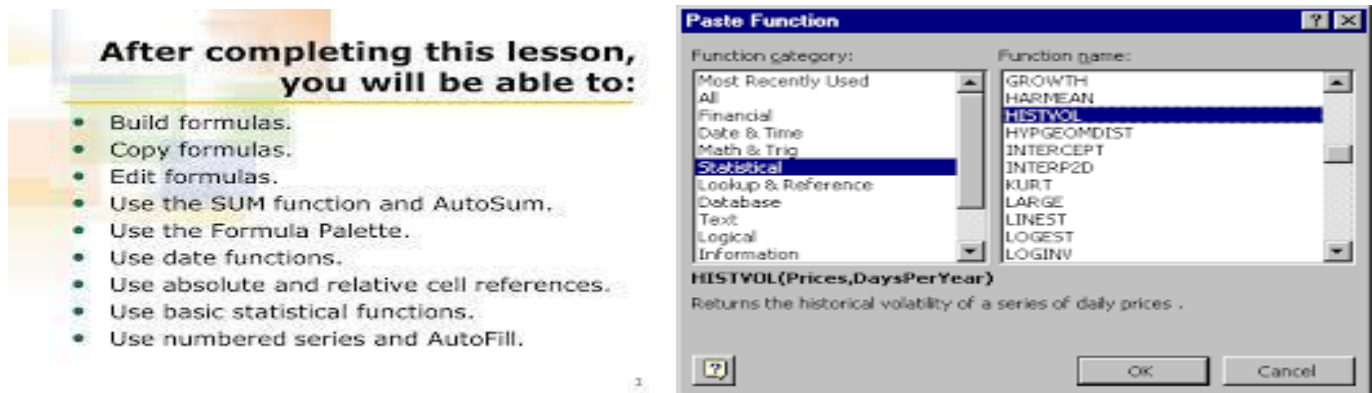


Fig 1.80(d): Formula Pallet

Formatting Cells

Excel offers formatting features for enhancing the look of the worksheet. Numbers are used to represent a wide variety of things when on a paper which include money counting, expressed in Naira; Examination results, expressed in percentages are possible with Excel by formatting the cell to tell the spreadsheet the particular type (e.g. Naira, Dollar, Pounds, etc) and also its percentage or date and so on. Excel will then recognize the content of a cell to be such and produces the correct result based on the formatting information it has regarding the cell. To format a cell, perform the steps below:

Step 1: Select FORMAT from the CELLS Module

Step 2: From the Dropdown box as a result of Step 1, select FORMAT CELLS...

Step 3: A Format Cells Dialogue Box will be displaced

Step 4: Use the NUMBER TAB in the FORMAT CELL dialog box to format the cell to your desire, as shown in figure 1.

Format Cells in Excel

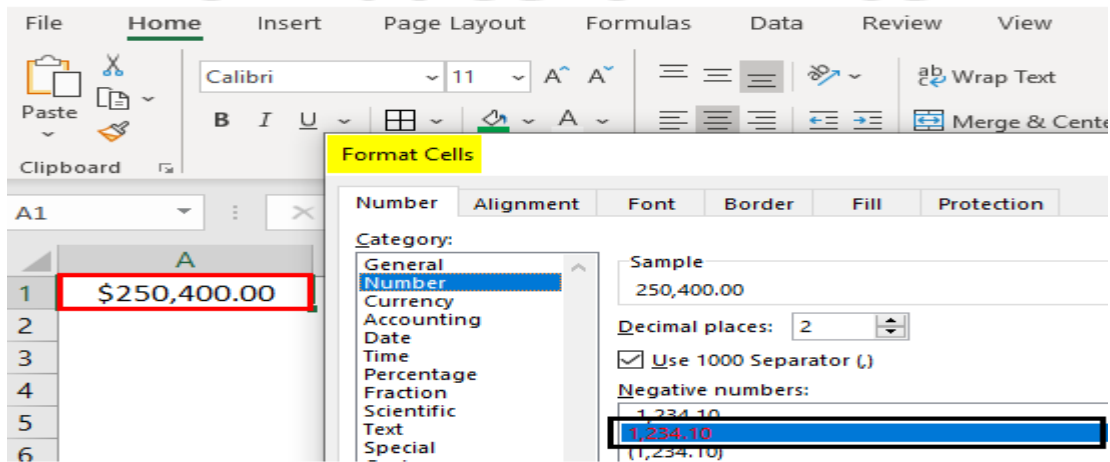


Fig 1.81 (a): Cell Formatting

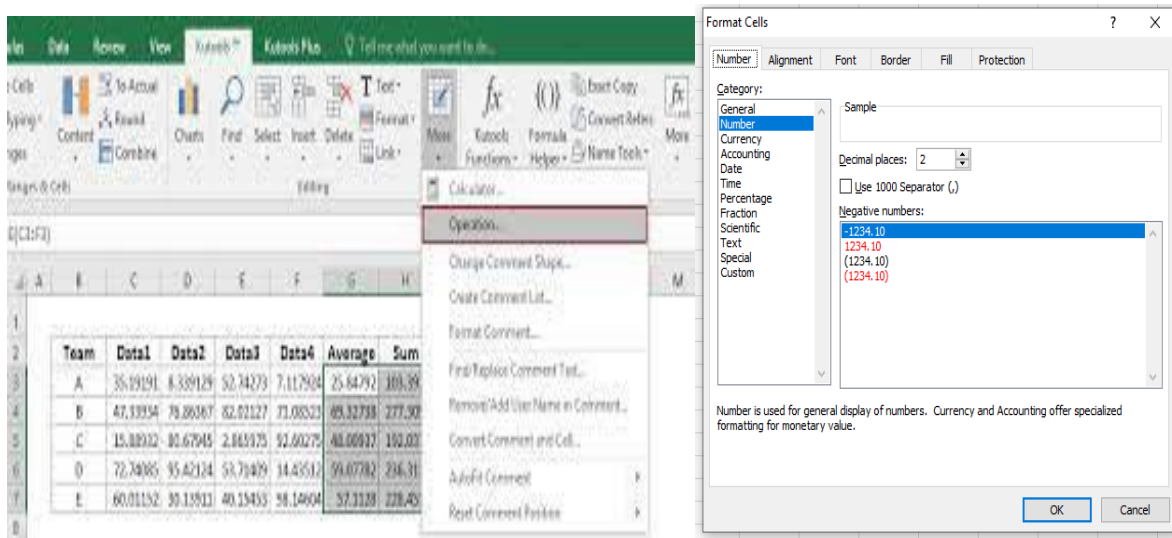


Fig 1.81(b): Formatting a cell to reflect 2 decimal places

Creating Border

Excel provides a variety of cell format categories under “Number” and for each category; it offers different styles in which a format can be displayed. Beyond “Number”, we can align text within a cell, change font type and size, fill colours in our cells, protect each cell and lastly, add BORDERS to our cells. For example, you can apply borders to cells by performing the following steps:

Step 1: Select the cell(s) you want to add borders to

Step 2: To apply the most recently selected border style, click border,

Step 3: To apply a different border style, click the arrow next to borders and then click on the palette

To change the line style of an existing border, select the cells on which the border is displayed. On the Border tab, click the new line style in the style box, and then click the border you want to change in the cell diagram under Border.

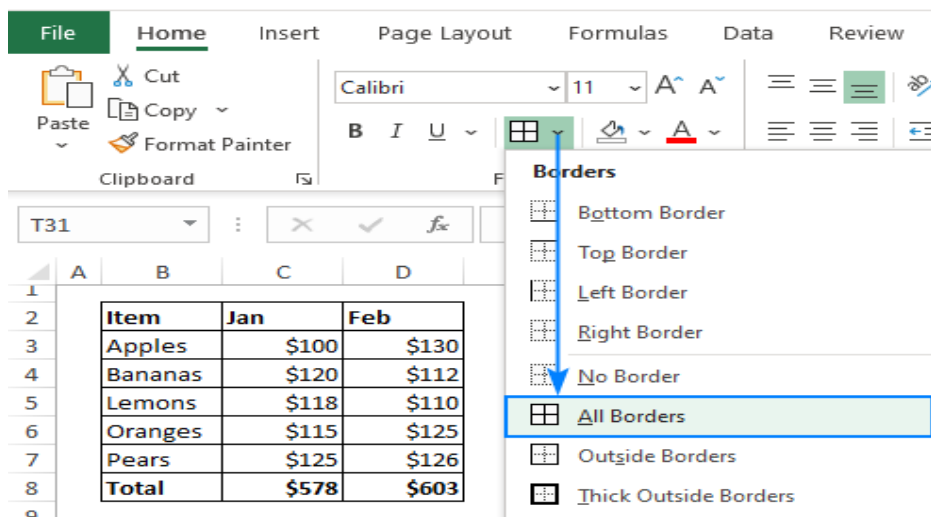


Fig 1.81(c): Creating borders

We shall apply this border creation to our Monthly budget Database, which hitherto has Gridline. When this is done, we shall arrive at Fig 1.

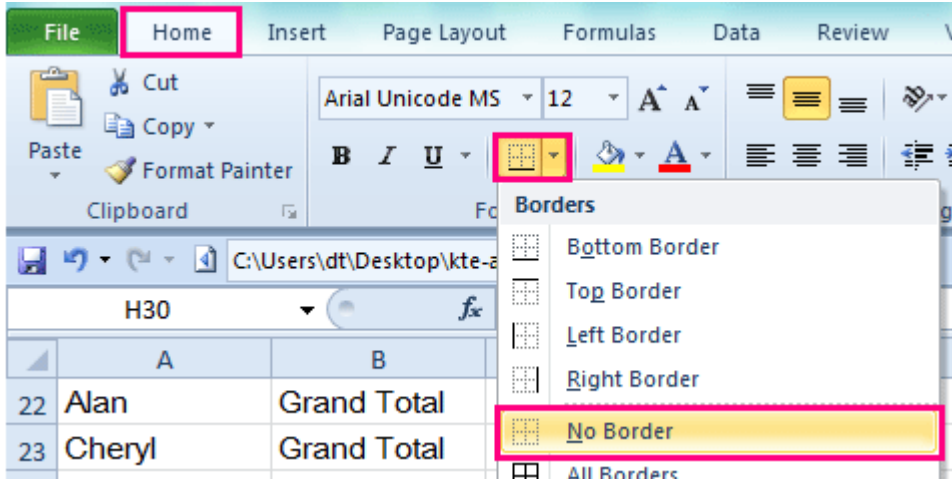


Fig 1.81(d): Adding borders to Worksheet

Align Data at the Top, Centre, or bottom of a Cell

To align a text within a cell, the following steps will be required:

Step 1: Select the cell(s) you want to format

Step 2: On the ALIGNMENT Module, Click on option you desire (Top, Middle or Bottom Align)

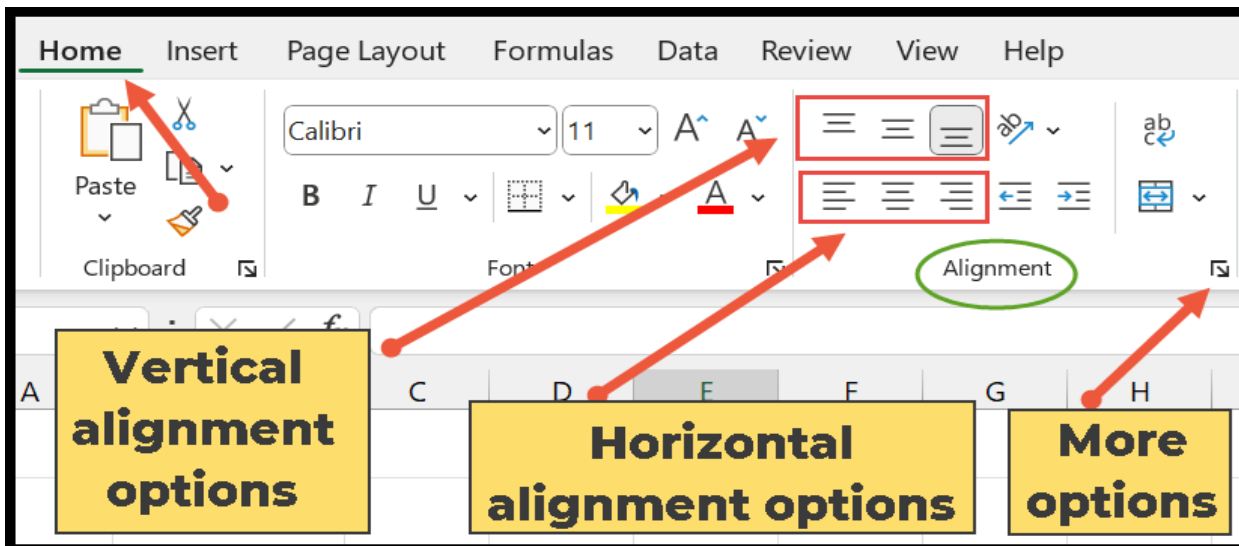


Fig. 1.81(e): Text Alignment

Rotate Text in a Cell:

Step 1: Select the cell(s) whose text you want to rotate

Step 2: On the ALIGNMENT Module, Click on ORIENTATION Symbol

Step 3: On the Dropdown Orientation box, select your desired rotation. See Fig. 1.23

Alternatively,

Step 1: Select FORMAT from the CELLS Module

Step 2: From the Dropdown box as a result of step 1, select FORMAT CELLS...

Step 3: On the Format Cells Dialogue box, GOTO Orientation and Click on VERTICAL.

See Fig 1.82(a)

Step 4: You may also, alter the degree to arrive at Fig 1.82(a)

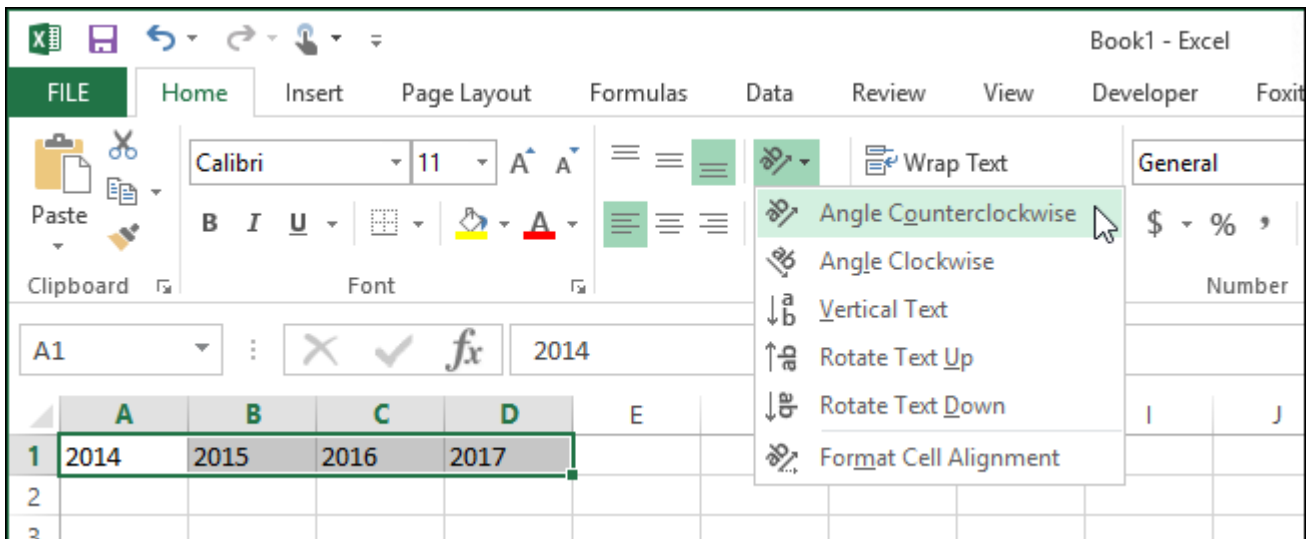


Fig 1.82(a): Rotating Text in a Cell

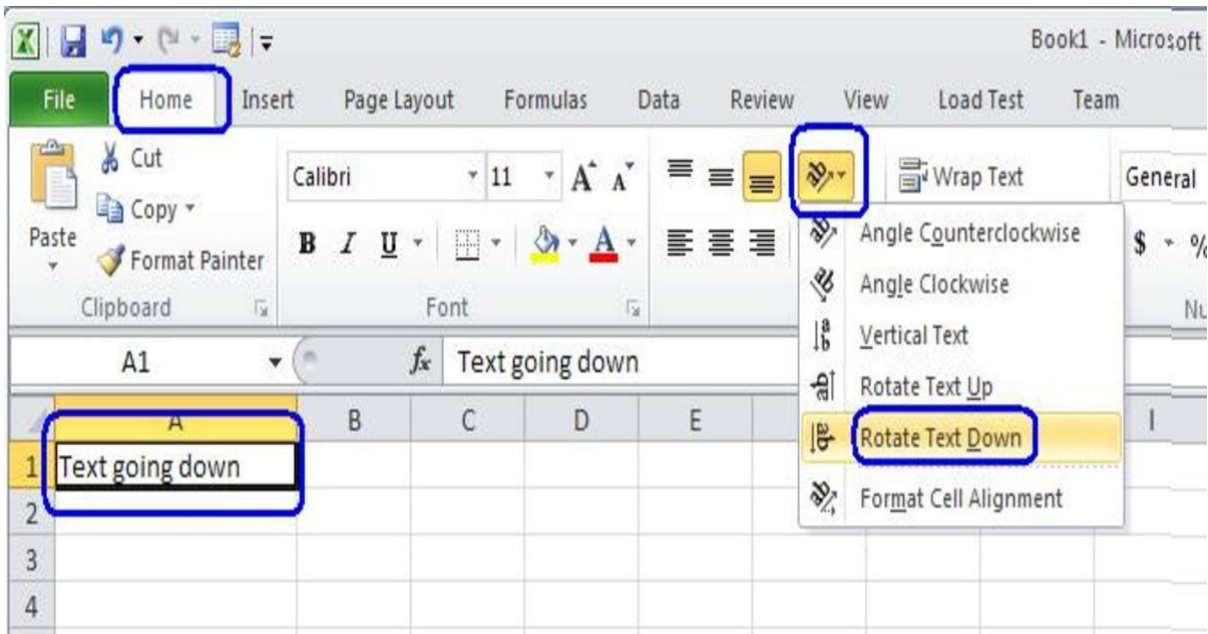


Fig 1.82(b): Rotating Text Vertically in a Cell

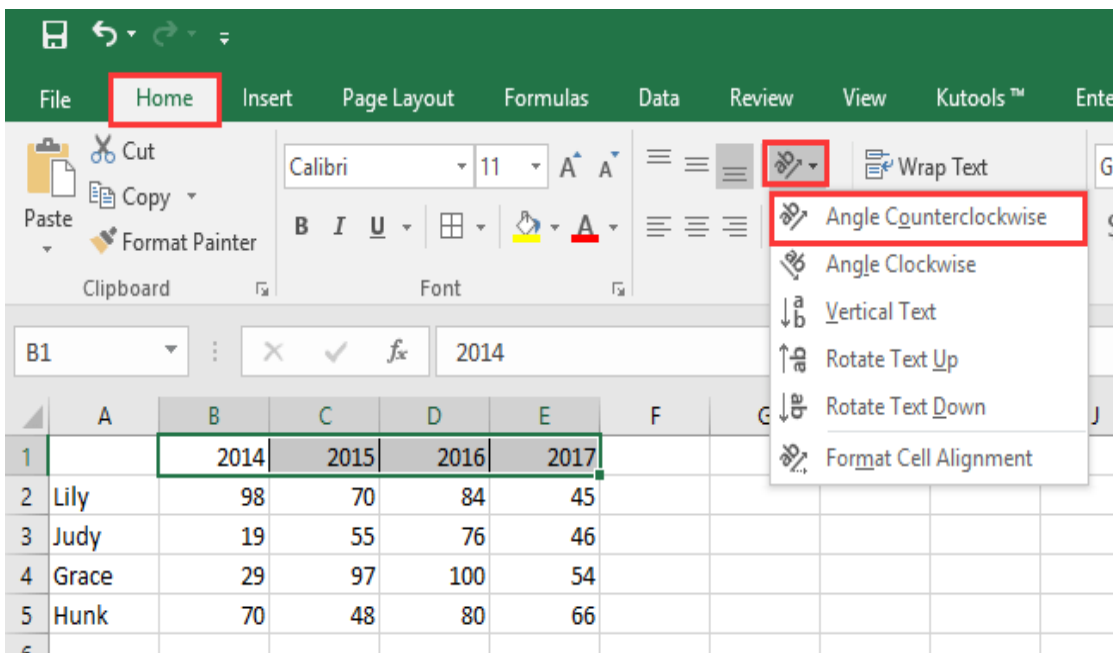


Fig 1.82(c): Rotating Text in Degrees

Creating Workbooks and Worksheets

A file in an Excel package is referred to as a workbook. So when a new workbook is opened, it is titled Book 1 until the user assigns a new name. Each workbook contains a number of worksheets (or spreadsheets) usually three (3) at default, namely sheet1, sheet2, and sheet3 but can be increased or reduced or renamed by the user. This feature helps in giving each sheet the relevant name on the basis of the information that is stored in that sheet.

To Increase the number of sheets

Step 1: Right click the worksheet tab that will fall after the new Worksheet.

Step 2: A pop up box will be displayed. On it, click “Insert” and Excel will respond by displaying the Insert Dialog box

Step 3: Select worksheet Icon and press OK button. OR Double-click Worksheet Icon.

Step 4: A new worksheet will be inserted immediately to the left side.

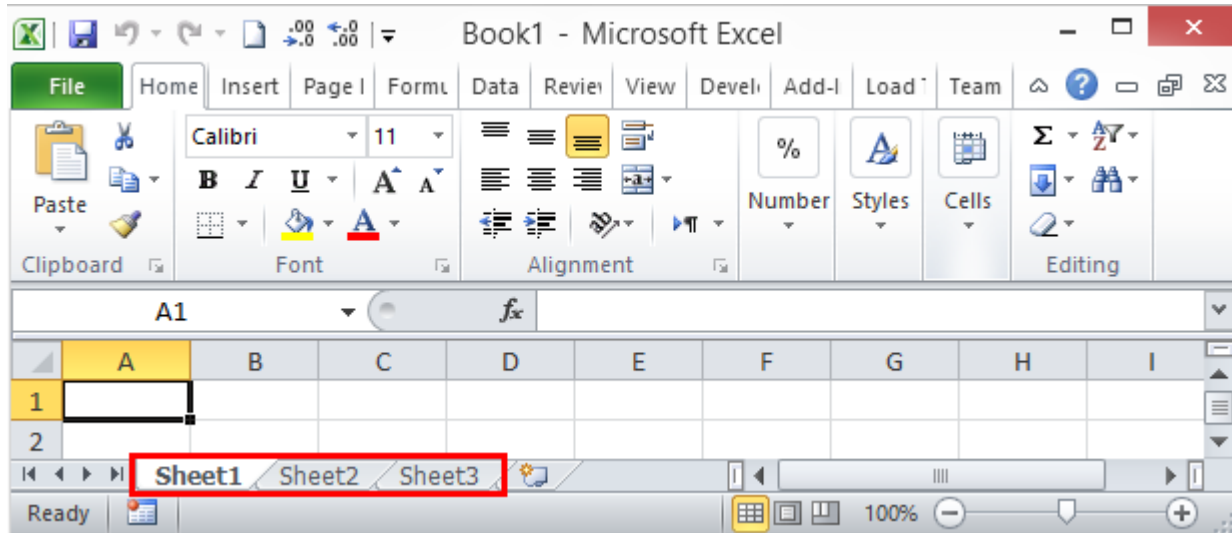


Fig 1.90(a): Creating/Insert new worksheet

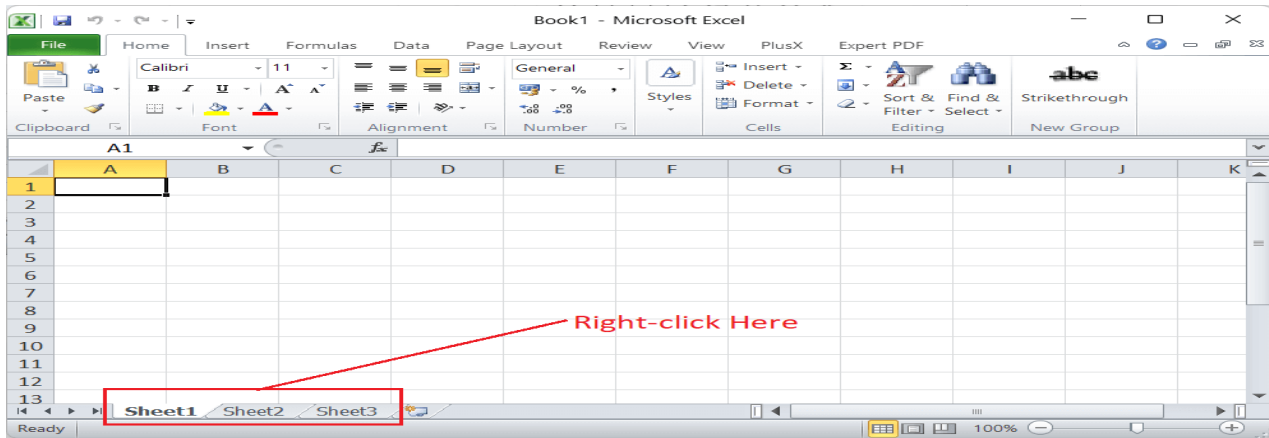


Fig 1.90(b): Inserting a worksheet

Alternatively,

Step 1: Click CELLS (Comprising Insert, Delete and Format)

Module on the HOME Menu

Step 2: Click on “Insert”

Step 3: On the drop down box, click “Insert Sheet”

Step 4: A new Worksheet is inserted automatically to the left

Conversely, to remove a sheet, the following steps must be accomplished:

Step 1: Right click the tab of the sheet you want to delete

Step 2: Click delete from the Popup menu displayed

Step 3: The worksheet is deleted.

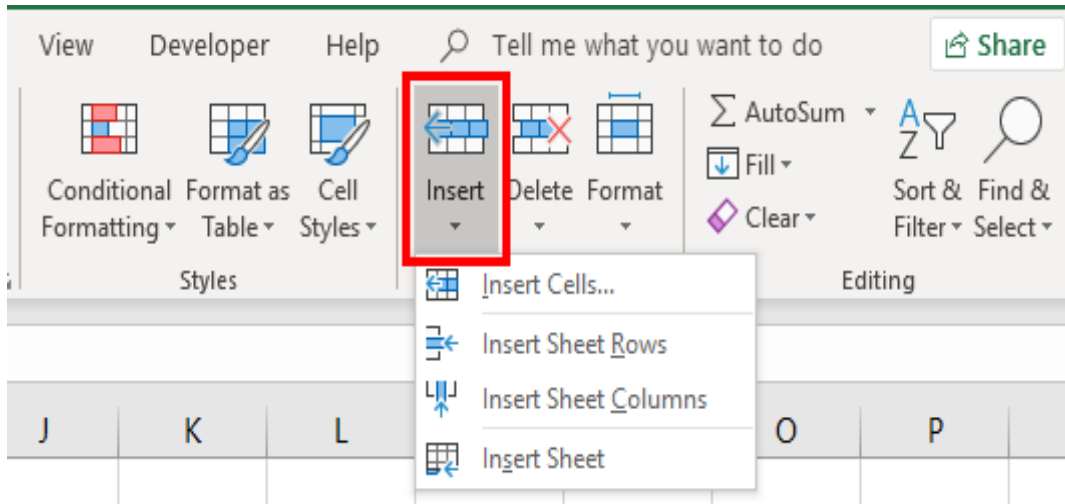


Fig. 1.90 (c): Alternative Method of Inserting a Worksheet

To Rename a Worksheet

Step 1: Right click the tab of the sheet you want to rename

Step 2: Click Rename from the Pop up menu displayed

Step 3: Type the new name over highlighted current name

Step 4: Press Enter key to display the new name.

Alternatively,

Step 1: Right click the tab of the sheet you want to rename

Step 2: Click CELLS (Comprising Insert, Delete and Format) Module on the HOME Menu

Step 3: Click on “Format”

Step 4: On the drop down box, select “Rename sheet”

Step 5: Type the new name over highlighted current name

Step 6: Press Enter key to display the new name.

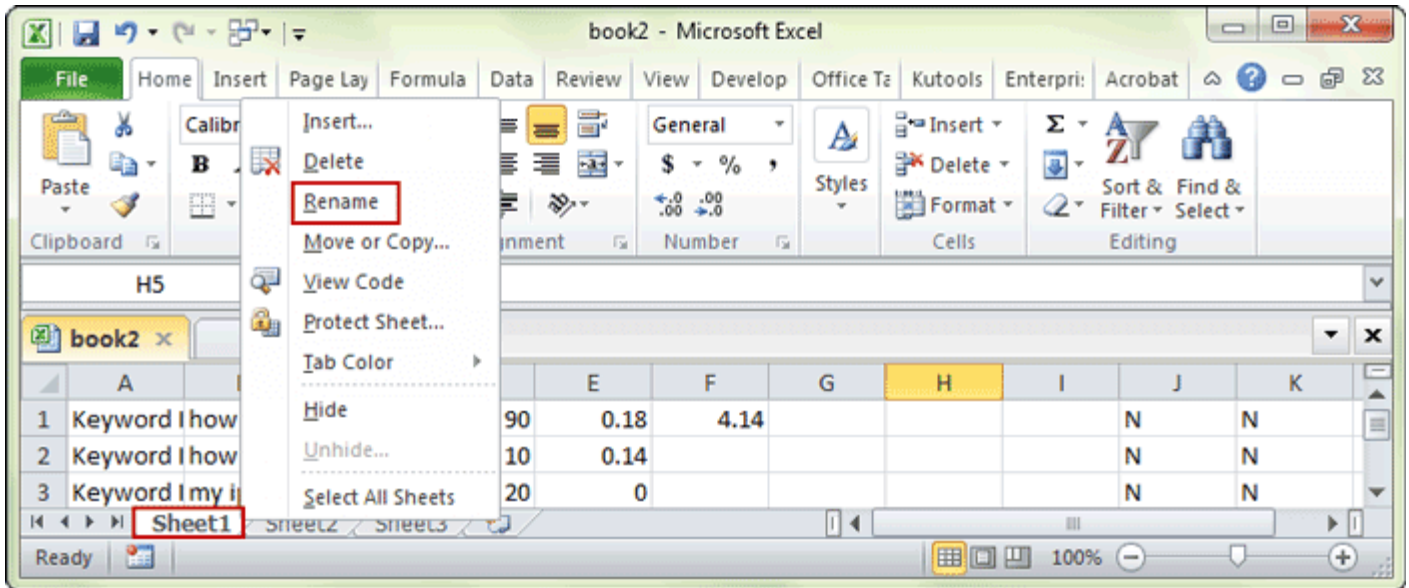


Fig 1.90(d): Renaming a Worksheet

OPENING AND SAVING WORKBOOK:

To open a workbook that has been saved and closed, go to the same drive designation and filename used during the saving process. The office box containing a drop-down list of New, Open, Convert, Save, Save As, Print, Prepare, Send, Publish, and Close can be used to Open and Save Excel documents. Alternatively, the Start menu may be used to access the Document and Recent Items, which gives the list of all files already saved on the computer system and list of all files recently worked on respectively. Clicking the filename of one of these listed files is a quick way to open an existing file.

NOTE: A newly opened workbook becomes the active workbook and hides any other open workbooks.

When a SAVE command is used to re-save a workbook, it overwrites the previous version. However, when the SAVE AS option is used, it allows for the changing of the file name as well as other save conditions. Also, a new version of a previously saved workbook may be saved under a new name in order to keep both files. All activities involve in opening and saving a workbook follows exactly what has been discussed in preceding chapter.

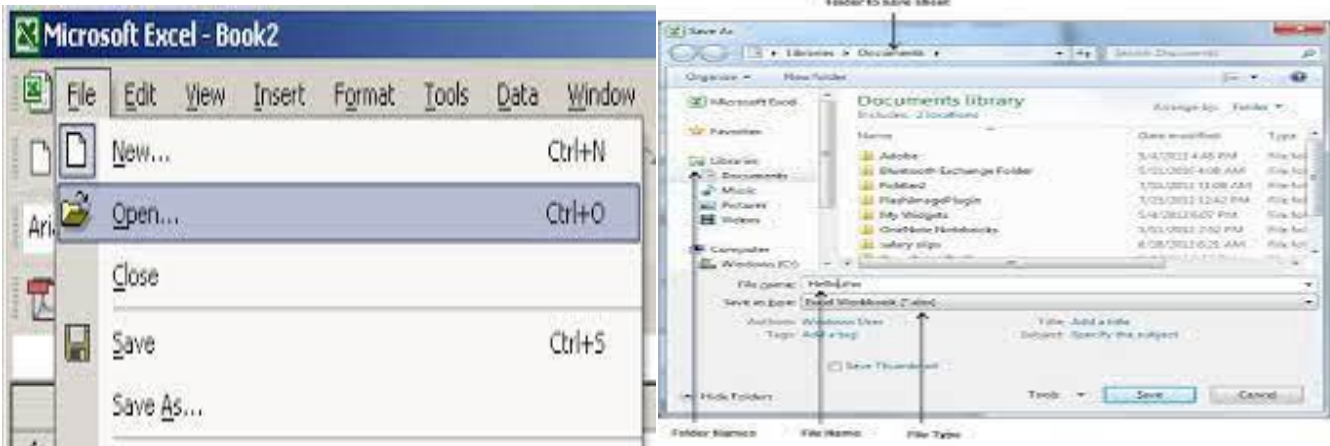


Fig 1.91(a): Opening and Saving Worksheet

PRINTING FROM WORKBOOK

The workbook, the selected work sheet, or the selected range of data may be printed using the Print Command on the Office Box. When the Office Box is accessed and the “Print” is selected, there are three (3) commands, which are related to printing that will be displayed. These are:

- (i) Print
- (ii) Quick Print
- (iii) Print Preview

Print

Allows you to select a printer, number of copies, and other printing options before printing.

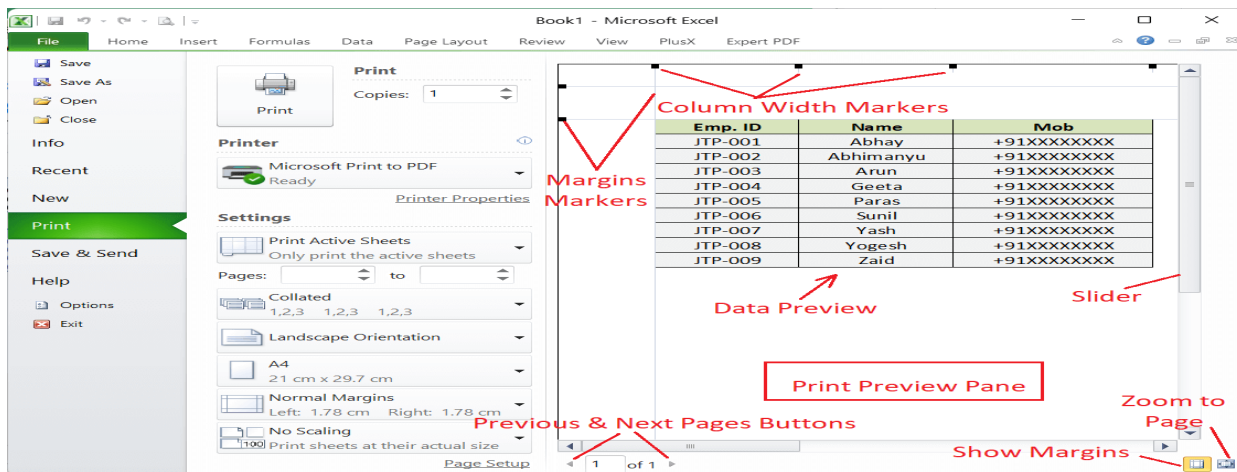


Fig 1.91(b): Printing Worksheet

Quick Print

This command sends the workbook directly to the default printer without making changes.

Print Preview:

Print Preview is used to view each page exactly as it will be printed, displaying margins, header footer and page breaks. Using Print Preview will save time when printing as the pages can be viewed, amendment made and viewed all again before actually printing on paper. The status Bar indicates which page is currently visible. With these options, Excel offers tools for previewing, printing, using between portrait or landscape orientation, changing margin size, printing a scaled down version, introducing gridlines, header and footers in your printed output. For example, Excel does not print the gridlines on your worksheet, but you can choose to print it by clicking the gridlines checkbox.

Putting Gridlines:

Gridlines are line between rows and columns to make reading easier. At default, worksheets have these lines but are imaginary and will not be printed with the document until it is invoked (that is, computer system instructed to print the lines with the document. The following steps can be used to invoke a gridline:

Step 1: Click on “Page Layout” on the Main Menu

Step 2: Select “Sheet Options” module

Step 3: Select “Gridlines” and Click on “View” and “Print”

Step 4: Excel automatically Add the Gridlines during printing

Alternatively,

Step 1: Click on Office Box

Step 2: Click “Print” and select “Print Preview”.

Step 3: On the “Print Preview” Menu, select “Page Set Up”

Step 4: On the “Page Set Up” dialogue box, click “Sheet”

Step 5: Click on Gridline

Step 6: Excel automatically Add the Gridlines during printing

Alternatively,

Step 1: Click on “View” on the Main Menu

Step 2: Click “Show/Hide” and select “Gridlines”.

Step 3: Excel automatically Add the Gridlines during printing

Page Breaks and Page Break Preview

Before printing, you may set page breaks and preview it; Excel inserts automatic page breaks based on the current paper size, scaling, and margin settings. To view the automatic page breaks (which appear on the worksheet as dashed line), you must select the Page Breaks Preview of the “Workbook Views” on the “View” menu. You can however, override the automatic page breaks by inserting Manual page Breaks (which appears on the worksheet as bold line) by dragging the automatic Page Breaks to desired location where it becomes solid lines. If you drag a page break off the worksheet, Excel resets the page breaks.

When Page breaks are moved, Excel automatically scrolls the worksheet to fit on the page or pages. You can switch between Normal view and page break preview using the “Workbook Views” Module.

Freeze Titles and Split Panes In Spreadsheet

Excel provides two methods for working with large worksheets: Freezing titles to keep it in view and splitting the window into two panes or four panes. To keep headings or titles in view at the left or top edge of the worksheet when scrolling, you must freeze them in place. To achieve this implement step 1 and 2:

Step 1: Select the row below or the column to the right of the data to be frozen

Step 2: Select “window” Module under VIEW and click the “Freeze Panes”.

To remove the freeze, repeat step 2 but click “Unfreeze Panes”.

When different parts of a large worksheet are to be viewed at once the worksheet may be split horizontally or vertically. To split, perform step 1 and 2:

Step 1: Select the row below or the column to the right of the data to be frozen

Step 2: Select “Window” Module under VIEW and click “Split”

To remove, select “Window” Module under VIEW and click “Split” again.

NOTE: To split into four panes that will scroll like horizontal split, place the cursor t the middle of the worksheet and perform steps above.

BEFORE

ExceptionID	PackageID	Date	Center	Route
EX1000001	PI34920119	3/30/2010	Northeast	RT310
EX1000002	PI34920120	3/30/2010	Midwest	RT892
EX1000003	PI34920121	3/30/2010	Northwest	RT424
EX1000004	PI34920122	3/30/2010	Northeast	RT995
EX1000005	PI34920123	3/30/2010	Midwest	RT827
EX1000006	PI34920124	3/30/2010	Central	RT341

AFTER

ExceptionID	PackageID	Date	Center	Route
EX1000001	PI34920119	3/30/2010	Northeast	RT310
EX1000002	PI34920120	3/30/2010	Midwest	RT892
EX1000003	PI34920121	3/30/2010	Northwest	RT424
EX1000004	PI34920122	3/30/2010	Northeast	RT995
EX1000005	PI34920123	3/30/2010	Midwest	RT827
EX1000006	PI34920124	3/30/2010	Central	RT341
EX1000007	PI34920125	3/30/2010	Central	RT864
EX1000008	PI34920126	3/30/2010	Central	RT277
EX1000009	PI34920127	3/31/2010	South	RT983
EX1000010	PI34920128	3/31/2010	Southwest	RT827
EX1000011	PI34920129	3/31/2010	South	RT942
EX1000012	PI34920130	3/31/2010	South	RT940
EX1000013	PI34920131	3/31/2010	Southwest	RT751

Fig 1.91(c): Putting Gridlines

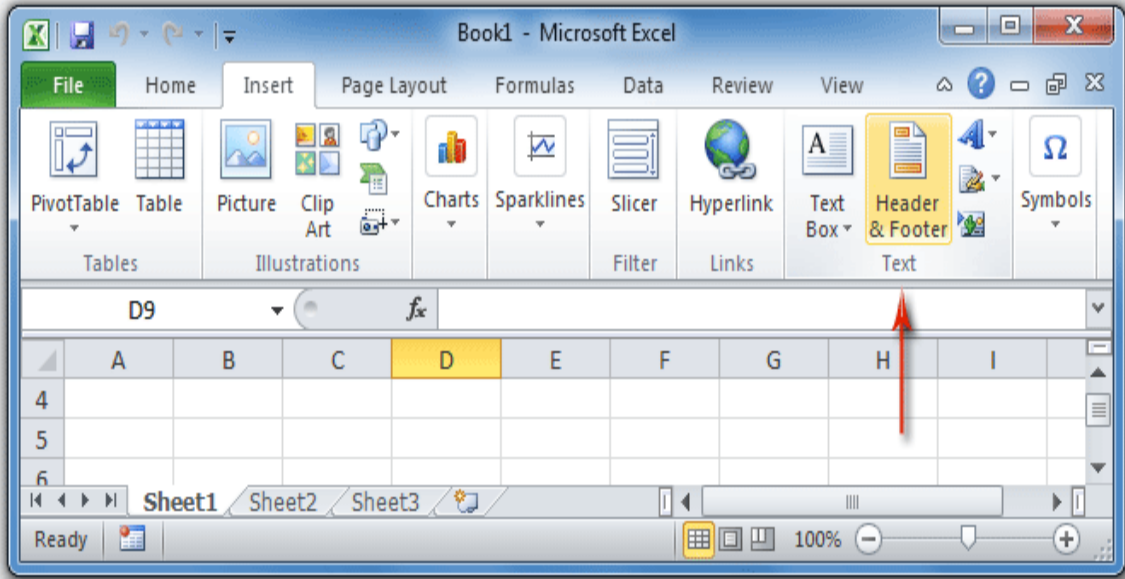


Fig 1.91(d): Putting Header and Footer



Fig 1.91(e): How to Freeze Pane or Split Worksheet

1.7 Database Management

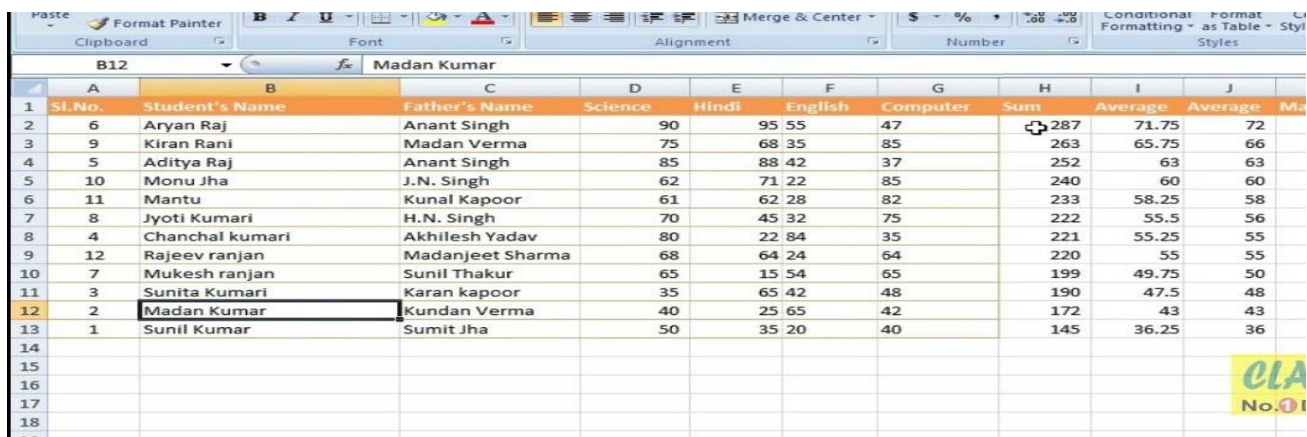
The purpose of storing data is to use and reuse it easily through proper organisation. When data is stored in Excel, one overcomes the limitations imposed by manual storage and retrieval, since Excel has special database features (sorting, filtering, and data retrieval) that allows the user to create and manage list. Though Excel is not a database package, it is equipped to handle and manipulate small databases.

While creating a small database in Excel, two points must be noted:

(i) The rows of data should be continuous to facilitate the manipulation of data. That is, no blank row exists between a column label and the first record in the database. (ii) The names of the columns should be entered in a single cell and must be unique.

Sorting:

When these data are stored in Excel with strict compliance to these rules, one can rearrange and reorder data in a list any number of times and in any order using SORT feature. You can sort a list to rearrange records in a specified sort order (e.g. alphabetically, numerically or chronological and in either ascending or descending) using any key filed as a frame of reference. Such field on which a sort is conducted is called the SORT KEY. See Fig 1.92(a)



Sl. No.	Student's Name	Father's Name	Science	Hindi	English	Computer	Sum	Average	Average	Marks
6	Aryan Raj	Anant Singh	90	95	55	47	287	71.75	72	
9	Kiran Rani	Madan Verma	75	68	35	85	263	65.75	66	
5	Aditya Raj	Anant Singh	85	88	42	37	252	63	63	
10	Monu Jha	J.N. Singh	62	71	22	85	240	60	60	
11	Mantu	Kunal Kapoor	61	62	28	82	233	58.25	58	
8	Jyoti Kumari	H.N. Singh	70	45	32	75	222	55.5	56	
4	Chanchal kumari	Akhilesh Yadav	80	22	84	35	221	55.25	55	
12	Rajeev ranjan	Madanjeet Sharma	68	64	24	64	220	55	55	
7	Mukesh ranjan	Sunil Thakur	65	15	54	65	199	49.75	50	
3	Sunita Kumari	Karan kapoor	35	65	42	48	190	47.5	48	
2	Madan Kumar	Kundan Verma	40	25	65	42	172	43	43	
1	Sunil Kumar	Sumit Jha	50	35	20	40	145	36.25	36	

Fig 1.92(a): Sorting in ascending order

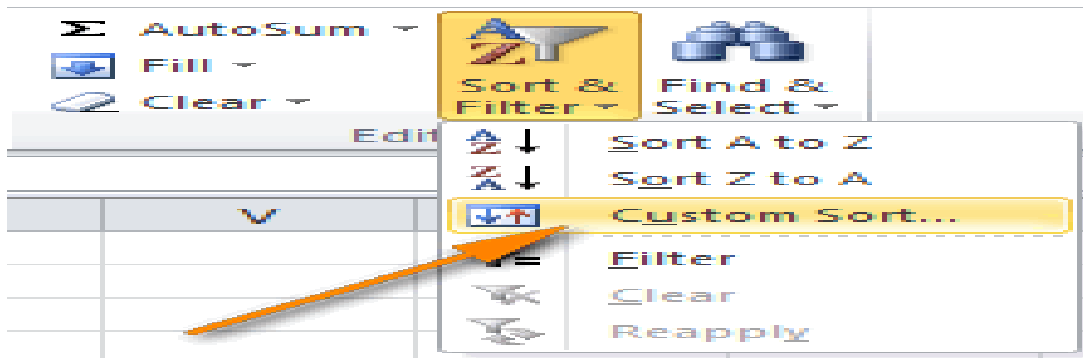


Fig 1.92(b): Custom Sort

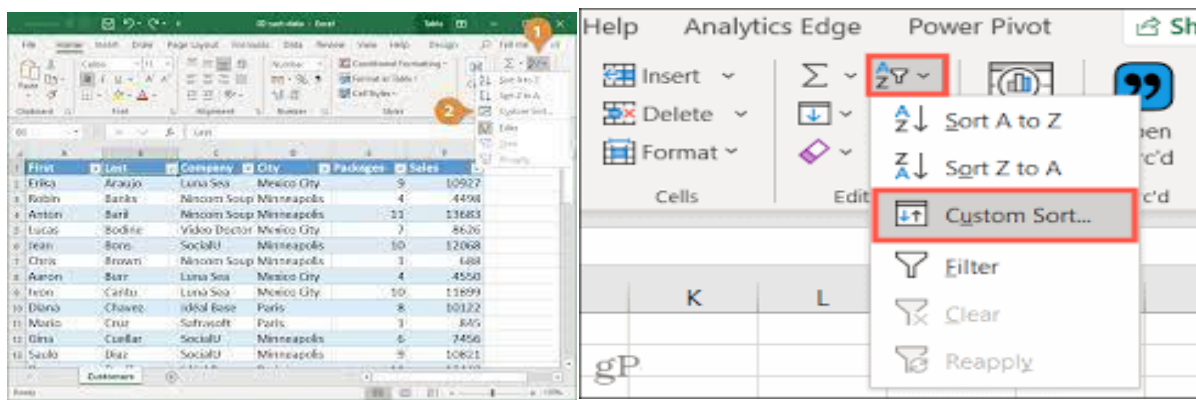


Fig 1.92 (c): Database sorted by Custom Sort.

Filtering:

Apart from sorting, Excel can assist in filtering our database (a process of finding or selecting information based on certain conditions). You can filter database on simple conditions in Excel using the Auto Filter or the advanced filter for complex conditions. To set the filter, the following steps, though similar to sorting, are performed:

Step 1: Select all the cell(s) you wish to filter

Step 2: GOTO “Editing” module on the Home Menu

Step 3: Click on “Sort & Filter”

Step 4: Click “Filter”

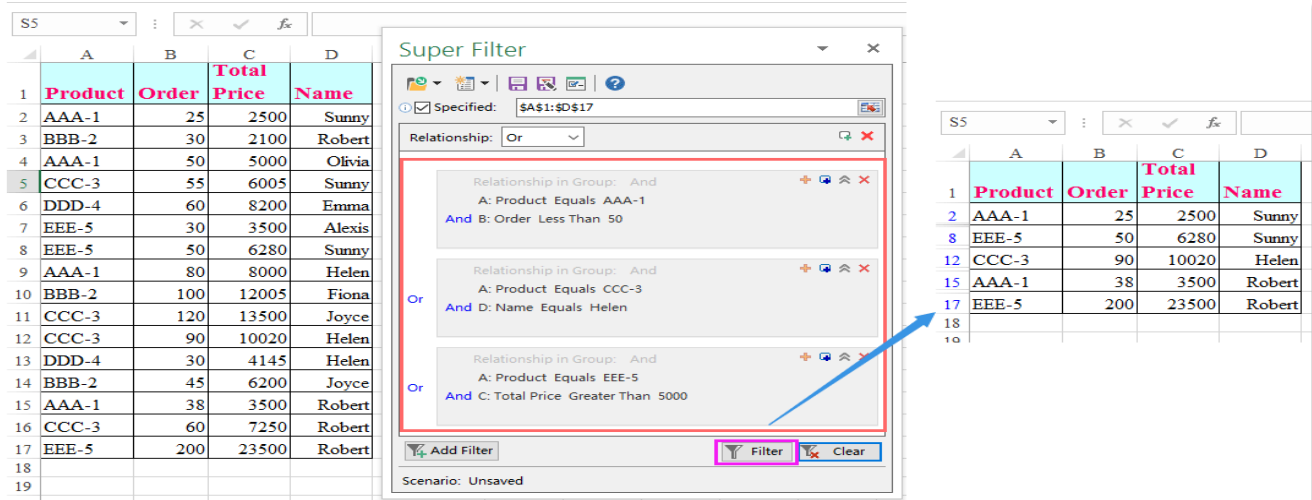


Fig 1.93(a): Invoking Filter

Excel automatically reads and places dropdown arrows for each column selected in the database, each of these arrows when clicked gives the dropdown list of all entries for each of the fields. After selecting the desired criterion from the list the Auto filter will then display only those records that satisfied the condition.

We can see that filtering SEX (column C) by Female (F), Excel gave a list of the seven (7) staff that are Male (M) in the database. Similarly, filtering RMK (column J) by NQ Excel gave the name of only staff of our organisation that qualified for the MD’s End of year” Award. See Fig 1.93(a).

Data Form

Sometimes one is faced with large database with several columns, which makes it difficult to view the details of a particular record easily or modify it or enter a new data, since one must embark on endless horizontal scroll. To make these activities easy, Excel provides the Data Form feature

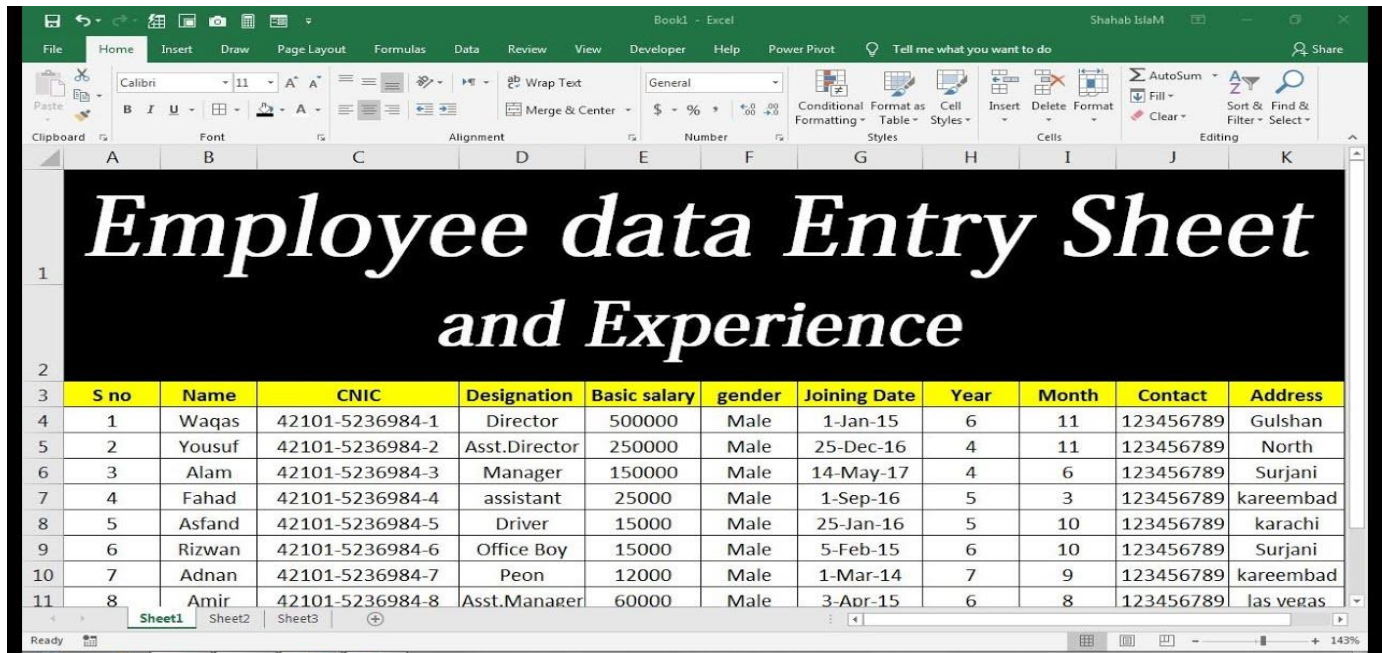


Fig 1.93(b) Data form features

www.ExcelDataPro.com

Company Name

Consolidated Salary Sheet for the month of December 2016

Sl No	Name of Employ	CTC	TOTAL GROSS SALARY							TOTAL DEDUCTIONS					TOTAL	NET PAYA	
			Basic Sa	DA	HRA	Conve	Medical	Special	Bonus	TA	TOTAL	Contribution	Professio	TDS			Salary A
1	Raj Sharma	60000	30000	6000	15000	1600	1250	6150	13100	0	73100	1800	0	7000	0	8800	64300
2	Sharad Gandhi	30000	15000	3000	7500	1600	1250	1650	2300	0	32300	1800	0	500	0	2300	30000
3	Danish D'Souza	20000	10000	2000	5000	1000	1250	750	0	0	20000	1440	0	0	0	1440	18560
4	Pawan Patil	25000	12500	2500	6250	1600	1250	900	0	0	25000	1800	0	0	0	1800	23200
5	Rijo Paul	22000	11000	2200	5500	1100	1250	950	2300	0	24300	1580	0	0	0	1580	22720
6	Joseph P	14000	7000	1400	3500	700	1250	150	2300	0	16300	1010	0	0	0	1010	15290
7	Aakash Patel	15000	7500	1500	3750	600	1200	450	0	0	15000	1080	0	0	0	1080	13920
8	Ganesh Rahu	14000	7000	1400	3500	600	1200	300	0	0	14000	1010	0	0	0	1010	12990
9	Vinudas K.S	14000	7000	1400	3500	700	1250	150	1500	0	15500	1010	0	0	0	1010	14490
10	Divya Kumar	8000	4000	800	2000	400	800	0	0	0	8000	580	0	0	0	580	7420
11	Shilpa R	8000	3740	750	1870	370	774	230	0	0	7734	540	0	0	0	540	7194
12	Sindhu J.P	8000	4000	800	2000	400	800	0	0	0	8000	580	0	0	0	580	7420

Fig 1.93 (c): creating database worksheet

Using this form, you can enter into all fields in the list with fewer errors, since the form has a portrait orientation and all fields in the database are visible at once without scrolling. The form has vertical scroll bar with which you can browse through the records in the database. It is pertinent to note that one can conduct a search for a specific record or easily deletes a record using form, but all data entry must be filled manually and that only one record can be viewed at a time. For example, we may design a Data form for our SALARY

database by highlighting the Header rows (i.e. S/N, SEX, AGE, BASIC SAL etc). When this is done, we can invoke the Data Form by remark.

2 Ways to Filter for a List of Items

	A	B	C	D
1	Date	Customer	Country	Qty
2	4/5/2017	Zontrax	Costa Rica	977
3	2/8/2017	Flexidy	Poland	186
4	4/13/2017	Fixflex	Venezuela	640
5	4/24/2017	Y-Solowarm	Brazil	480
7	8/9/2016	Voltsillam	Costa Rica	452
9	6/16/2016	Fixflex	Poland	653
12	9/10/2016	Lotstring	China	624
13	1/3/2017	Gembucket	China	445
14	1/25/2017	Ventosanzap	United States	508
15	7/20/2016	Home Ing	China	115
16	12/25/2016	Prodder	Poland	76
17	6/20/2016	Opela	Venezuela	516

Filter List

- Costa Rica
- Poland
- Venezuela
- China
- United States
- Philippines
- Brazil

ExcelCampus.com

Fig1.93 (d): Database filtering by remark/Field

	A	B	C	D	E	F	G	H
1	Employee Information							
2	Name	Date Hired	Age	Salary				
3	Michael	6/14/2001	47	\$122,000				
4	Joe	11/22/2008	44	\$150,000				
5	Mary	2/14/2012	31	\$88,000				
6	James	9/1/2014	33	\$70,000				
7	Tony	10/15/2014	29	\$68,000				
8	Lucy	5/4/2015	39	\$110,000				
9	Frank	12/8/2016	28	\$55,000				
10	Anna	3/20/2018	27	\$68,000				
11	Ralph	1/18/2019	25	\$41,000				
12	Sarah	5/1/2020	20	\$44,000				

Fig 1.93(e): Filtering a Database by field

Step 1: Pressing down ALT key and striking the pad for letter D.

Step 2: While the ALT is still pressed, strike the pad of letter M.

Step 3: The Data Form will be displaced immediately with all the SALARY database labels. See Fig1.93(e)

Note: This is Office 2016 access keys.

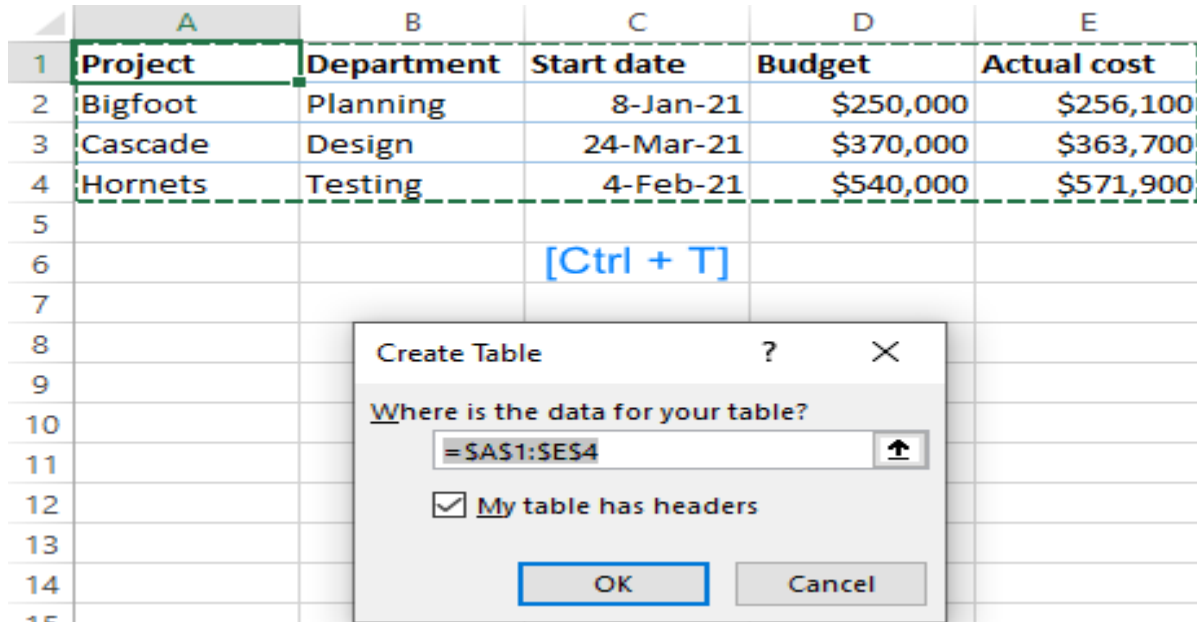


Fig 1.94(a): Data Form arrange by input field

Workbook Protection

It is possible to protect, or lock, an entire workbook, a worksheet, individual cells, or a range of cells from accidental changes or unauthorized use. Excel provides the protection feature, which locks the cells so that they cannot be changed.

All cells in a workbook are in a locked status at the defaulting setting. The locked status however is effective only when protection is put on the workbook. Therefore, if you wish to keep certain cells accessible in a protected worksheet, these cells must be unlocked before the worksheet is protected.

To protect the worksheet, the following steps must be accomplished:

Step 1: Select "REVIEW" on the menu

Step 2: Click on "Protect Sheet"

Step 3: Insert your desired Password

Step 4: Confirm your Password

When a worksheet is protected, Fig 1.35(d) will appear when you try to change the contents of its cells

Note: When the password used to protect the worksheet is forgotten, you will not be able to make changes to the worksheet.

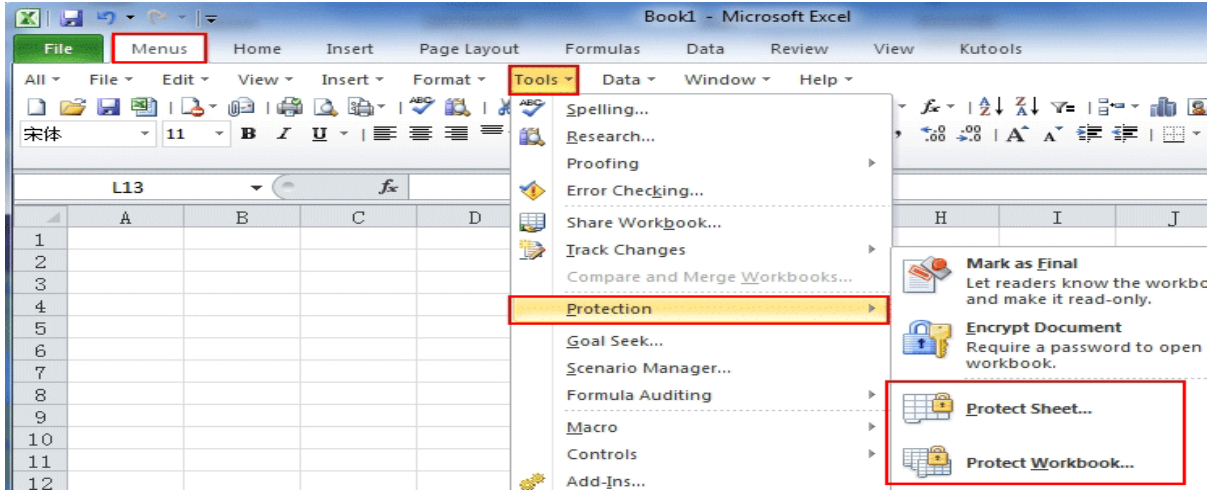


Fig 1.94 (b): worksheet with password

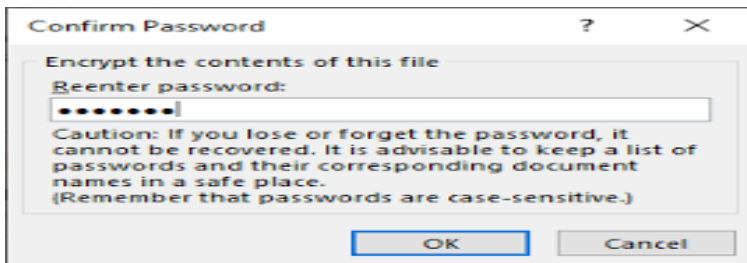


Fig 1.94 (c): confirming password used on the worksheet

Protecting a Worksheet

The process of protection can be reversed by clicking on “Unprotect Sheet” formerly “Protect Sheet”. When this is done, the computer system will prompt you for the Password used in protecting the worksheet. Supply this Password and your worksheet will be open for modification/changes.

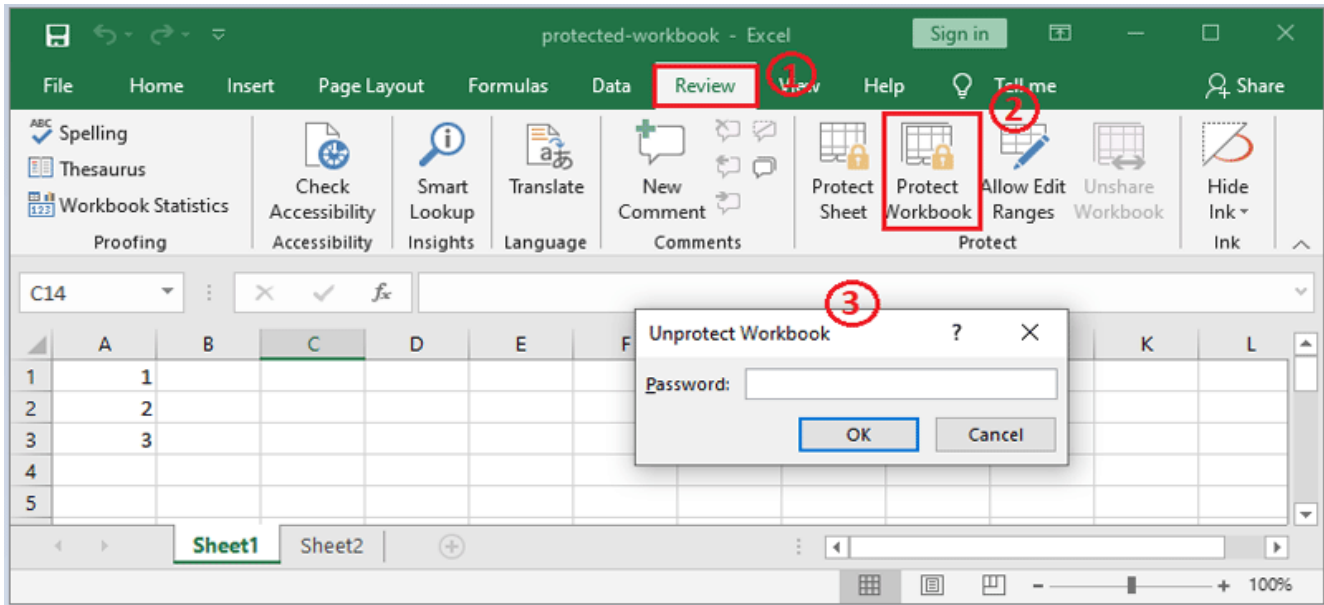


Fig 1.94 (d) : Unprotect Worksheet

Linking Worksheet

Although more than one worksheet can be opened at the same time, Excel allows links to be created between worksheets. By linking worksheet, a number of supporting files can be linked together in a consolidating file. Besides, different users' files can be integrated into a master worksheet, where the users can still update their respective individual file and the consolidating worksheet is always kept updated. To create a simple link, perform the following steps:

Step 1: Open the worksheets, which are to be linked

Step 2: Use Arrange/Windows commands to arrange the worksheets in the window

Step 3: In the worksheet, which is to contain the link (Dependent), click on the cell,

which is to be linked to the second worksheet (Source)

Step 4: Enter the formula needed e.g. sheet 1.x 1s!\$B\$8

Step 5: Click on the source worksheet to activate it

Step 6: Click on the cell that is to form the link

Step 7: Press Enter

Alternatively, we can have the following steps accomplished to effect what had been achieved above:

Step 1: Open the worksheets that are to be linked

Step 2: Click on the source worksheet to activate it

Step 3: Click on the cell which is to form the link

Step 4: From the HOME menu, click “Copy”

Step 5: Click on the Dependent worksheet to activate it

Step 6: Click on the cell which is being linked to

Step 7: From the HOME menu, click “Paste Link”.

If more than two worksheets are to be linked, it is quite likely that values from two worksheets need to be added together to form a total in a third worksheet. This is implemented easily by creating a complex link which will require the use of a complex formula of the type:

Sheet 1.xIs! \$B\$8 + Sheet 2.xIs!\$C\$5

Or

SUM (sheet 1.xIs! \$A\$3:\$A\$10) +SUM (sheet 2.Is! \$J\$1:\$J\$10)

It is a good practice to save supporting worksheets before dependent worksheets. This ensures that formulas in source worksheets with calculated and documented names in external references are current. Besides, source worksheets do not have to be opened for the dependent worksheet to display the latest linked information.

Creating Charts

When you are preparing a report (such as financial analysis and performance, sales forecast etc), you would use various tools to enhance the effect, since this numeric information cannot just be written about but must be expressed figuratively. We have seen how Excel-enhanced tools have been used to format our numbers in tabular form and give labels to Data columns since tables are very effective in comparing and analyzing figures. Similarly, charts are effective in graphically representing numerical data.

Charts are a way of presenting and comparing data in a graphical format. It creates a “picture” in the mind’s “eye” by giving a visual comparison, pattern and analysis of numbers. Charts therefore make data interesting and attractive to read and interpret.

You can create EMBEDDED Charts (chart objects placed on a worksheet and saved on the worksheets when the workbook is saved. This is, the chart exists on object in the worksheet or CHART Sheet (a sheet in a workbook that contains only a chart). Charts can be created from cells or ranges that are not next to one another. Also, it could be created from a Pivot Table.

A chart is created using Data Points otherwise known Data markers (are the individual numbers in a worksheet cell within a data table. They are represented by symbols such as a bar, line, area, dot, column etc) and Data Series (Data series are formed when a group of related data markers appearing either within a column or a row in a data table are plotted on a chart). There can be either one or more data series in a single chart. When a series is plotted, each series is distinguished by different color or pattern.

Using Excel, one can create different types of charts. There can be Pie Charts, Line and Area graphs, Column and Bar charts, Scatter charts, Stock charts, and Radar and surface charts. Depending on the purpose of the presentation, one can choose any of the types to create.

Using the Chart Wizard

The easiest way to create a chart in Excel is to use the Chart Wizard which takes you through the various stages systematically, offering you options at each stage. The basic steps to creating a chart are:

Step 1: Select the worksheet data to chart

Step 2: Click “Insert” Menu

Step 3: Select CHART Module (comprising of Column, Line, Pie, Bar, Area, Scatter and Other Chart)

Step 4: Check Chart Source Data

Step 5: Select Chart Type you desire

Step 6: Select Chart Options

Step 7: Select Chart Location

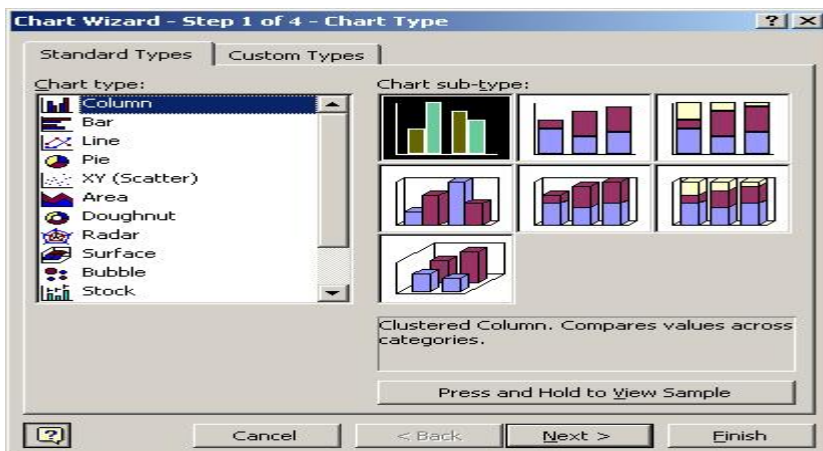


Fig 1.95(a): Using Char Wizard in Excel

To select the worksheet data to chart, the following are essential guidelines:

The selection should be rectangular

- (i) The selection should not contain blank columns or rows
- (ii) A non-adjacent selection is used to plot data separated by other data or blank columns or rows.
- (iii) You can hide columns you do not wish to chart
- (iv) The blank cell in the upper-left corner of selection tells the Excel that the data below and to the right of the blank cell contains labels for the values to plot.

- (v) The selection determines the orientation (in columns or rows) of the Data Series. However, orientation may be changed as desired.

Typically, the selection of worksheet data will include these parts of a chart:

Data Series = Values the Chart represents

Series Labels = labels identifying the charted values. These labels appear in the chart legend, which identifies each data series in the chart.

Category Labels = Labels identifying each data series shown on the horizontal axis.

Editing Charts

Even though you might create the chart with great thought and logic, when you finally place it on the worksheet, you may still find a few things wanting. Any aspect of a chart can be edited and modified to improve its appearance. To create any editing, the chart must be clicked once. When you click it handles (small squares) appear around its border. When selected in this way, a chart can be sized, moved, edited, copied or printed. Besides, you can change or enhance all chart items, such as the legend and data series, by clicking them and making the edit. When you right-click chart items, Excel displays a shortcut menu containing relevant commands.

To edit a chart, Excel provides the following features:

Menu bar options, which give options specific to the chart type and selected chart item.

Shortcut menu options, which display shortcut menus that are appropriate to the part of the chart you right clicked.

Name box, which displays the selected chart item

Chart Toolbar, which may be displayed to provide any of the following tools:

Chart Objects Displays the selected chart object and allows you to select chart objects.

Format Chart Area Displays to format areas (e.g. area or background colors).

Chart-type Displays a list of chart types from which you can select.

Legend Hides or displays Data table in the chart

By Rows Changes the orientation of data series to rows

By columns changed the orientation of data series to columns

Angle Text Downward angles selected text downward.

Angle Text Upward angles selected text upward.

Adding and Deleting Data Series

After creating a chart, one may find it necessary to improve on the analysis by adding extra series. In such circumstances, all you need do is to select the additional data series and then drop it on the chart. Just as you may want to add a data series to a chart, you might want to remove a series. All you need do is select the desired data series on the chart and remove a series has the handles and click delete. The data series is deleted immediately.

1.8 Conclusion:

It is expected that at the end of studying this chapter, candidates should be able to define computer system to its operations and the applications relatively. The candidates/students should be able to identify and differentiate between software, hardware and firmware, also recognize some of the fault symptoms, reason for the fault. The candidates/Students should be able to analyse data using spreadsheet and process documents using Microsoft word with all features there-in.

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1.10 Exercises

Theory

1. Define computer system.
2. Mention and discuss an application used for word processing and data analysis in office suite.
3. State the constituent elements of computer system with their functions.
4. Describe the architectural design of computer system.
5. Describe the process of creating chart using MS-excel.

MULTIPLE CHOICE QUESTIONS.

1. Computer can be defined as (a) Electronics device that process input data (b) common machine (c) An interpreter Machine (d) Coordinating instrument.
2. Digital and communication Technology cannot be used to ----- (a) build a traditional counting machine (b) create algorithms and flowcharts. (c) format a System (d) Read a compact disk.
3. The widely used word processor is ---- (a) AmiPro (b) Google Docs (c) MsWord (d) Libre office writer.
4. In a spreadsheet, the selected cell where data is to be entered is ---- (a) Active (b) Dormant (c) Task (d) Quick Access.
5. Letters and Memos are suitably typed using ----- (a) Corel Draw (b) Ms Access (c) Ms Word (d) Paint.
6. Translating the process of collecting raw data/facts into meaningful and information is ----- (a) Computerisation (b) Conversion (c) Data processing (d) Data storage.
7. A vast network that connects computers all over the world is ----- (a) ethernet (b) Spectranet (c) Internet.
8. Spreadsheet is an application program that is used ---- (a) To create and manipulate Images (b) for planning and production of payrolls (c) for Arithmetic/ Logical operations (d) for system Troubleshooting.
9. Types of database are ---- (a) Concentrated, conditional and Distributed (b) Conditional, Instructional and International (c) Distributed, Relational and Centralized (d) Ring, process and light.
10. Which of the following is not an Internet browser----(a) Mozillar Firefox (b) Google chrome (c) Messenger (d) Netscape.

CHAPTER TWO

COMPONENTS OF COMPUTER SYSTEM

(Computerisation of Operations - Issues and challenges)

The objectives of this chapter are for candidate to get familiar with computer operations, issues and challenges, some of which are stated below:

- a) Identify the names and distinguishing features of different kinds of input and output devices.
- b) Describe how the CPU processes data and instructions and controls the operation of all other devices.
- c) Identify the names, distinguishing features, and units for measuring different kinds of memory and storage devices.
- d) Recognizing and troubleshooting the system components.
- e) Search your personal computer for the various hardware components it contains.

2.0 Introduction:

2.1 Computer Hardware

Hardware refers to the physical components that constitute the computer configuration. These components can be touched, handled or seen. It is divided into three divisions: the Input units, Processing unit and the Output units. It is further classified into the Processing units and the Peripherals. This includes hardware ports and various parts of the motherboard. In essence, a computer is a machine designed to process, store, and retrieve data. Data may be represented as numbers in a spreadsheet, characters in the text document, dots of color in an image, waveforms of sound, or the state of some system, such as an air conditioner or a player.

A computer system is composed of many parts, both hardware and software. At the core of the computer is the processor, the hardware that executes the computer programs. The computer also has memory, often several different types in one system.

The memory is used to store programs while the processor is running them, as well as store the data that the programs are manipulating with. The computer also has devices for storing data, or exchanging data with the outside world. This includes input devices like keyboards, display devices for showing information on a screen, and mechanisms for transferring programs and data to or from a disk drive.

The processor is the most important part of a computer, the component around which everything else is centered. In essence, the processor is the computing part of the computer. The processor is an electronic device capable of manipulating data (information) in a way specified by a sequence of instructions.

The instructions are also known as opcodes or machine code. This sequence of instructions may be altered to suit the application, and, therefore, computers are programmable.



Fig 2.1: Different types of computer accessories, components units

2.2 Computer Software

Software refers to the instructions given to the machine to perform some specific tasks. Though, software are letters that can be seen but it is not possible to handle them like hardware and also it is possible to read them with physical eyes when written on magnetic materials. Materials with which software are stored are floppy disk, compact disc (CD) and fixed disk (normally installed in the system unit). Fixed disk is also called hard disk. Software can be divided into two parts, they are **System software** (Operating System) and Application software.

2.3 Computer Peripherals

The word peripherals refer to all the units that are attached to the system unit. Basically, a working computer consists of some major units. The system unit is like a hub to which other units are attached to. A complete computer consists of input, processing and output units.

The real performer of operations in a computer system is the processing unit, all other units are helpers to bring in data into the processing unit or bring out information (processed data) out of the processing unit. Every unit, either input or output unit which is a part of a working computer is referred to as peripheral unit. There are some peripherals that function as both input and output, they are storage units.

Input Devices

Card-Reader, punched paper tape reader, magnetic tape unit, optical character recognition (OCR), magnetic ink character recognition (MICR), console typewriter, keyboard, virtual display unit (with keyboard), mouse, scanner, light pen, joystick, trackball, touch sensitive display, digital camera and voice input (microphone).



Fig 2.2: common input devices of computer system

Output Devices:

Monitors, printers, plotters, computer output micro-film (COM) and voice output (speaker).



Fig 2.3: common output devices of computer system

Input/Output

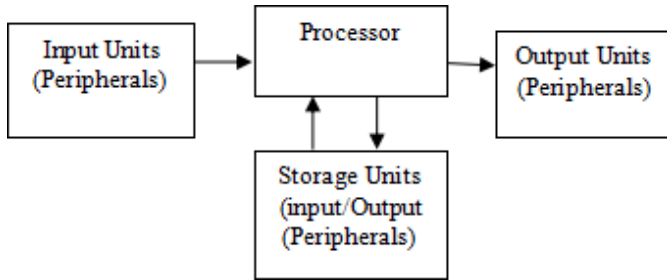


Fig 2.4: Schematic diagram of processing unit

Hard disks, diskette drive, compact disk, flash disk and different makes of removable memory cards.



Fig 2.5(a,b): Motherboard with processor Fig 2.6 computer Hard disk



Fig 2.6: computer Hard disk Fig 2.7: External disk storage Fig2.8: mobile disk storage

2.4 Disk Operating System (DOS)

All computer operations take place either in the hard disk or in the floppy disk. The Disk Operating System therefore controls all computer operations. Before a computer starts to work, the user has to plug on the computer and perform booting.

There are some DOS commands commonly used whenever a computer is put on. These are: Change directory (CD), Make directory (MD), Remove Directory (RD), DATE, TIME, VER COPY and CLS.

(i)**DATE:** At the command prompt (C:\> or A:\>) type “date” and press the <Enter> key, the following is displayed. Current date is Mon 05-07-1996. Enter new date (mm-dd-yy)

Note that the computer style of dating is not the same with normal dating. The month “mm” comes first, followed by the day “d” and then the year “yy”

(ii)**TIME:** This command is similar to the DATE command. At the prompt type “Time” and press the enter key. The computer being an electronic device will display time in digital form.

Current time is 01:35:40:15 am. Enter new time: If the displayed time is not correct, the user then enters the correct time at the cursor position.

(iii)**VER:** This command “Ver” is used to check the Version of DOS a Computer is using. At the DOS prompt type “Ver” and press the <enter> key. The following will be displayed: MS-DOS Version (4.00, 5.00, 5.22, etc).

Directory: This is a system of arranging files in an orderly manner. It makes it possible for the user to get the needed file easily. For instance, in libraries there are several books but it is grouped according to subjects so that the reader can easily locate a book and read. The computer files are grouped according to how they relate in directories.

(iv)**MD:** To make a directory, type “MD” Directory name at the prompt and press the <enter> key. To check whether the directory has been made type DIR and press <enter>

(v) **DIR:** This is a command used to view or display the directory of a computer. The command displays the existing directories and files in a computer. This is displayed in five columns, as file name or directory name, followed by file name extension, size of the file, date of creation and the time in that order. An example is shown below:

```

Volume in drive C is DISK1 VOL1
Volume Serial Number is ID47-15CD
Directory of C:\>

COMMAND  COM   54,645   05-31-94   6:22a
DMDRVR   BIN   22,431   04-20-92  12:00p
CONFIG   SYS    219     05-19-95   2:20p
DOS      <DIR>
AUTOEXEC BAT    131     02-15-97   9:10a
WP51     <DIR>
FORTRAN  <DIR>
CHKLIST  MS     162     05-29-96  11:10p
FILE001  CHK   2,048   06-09-96  10:00p

Press any key to continue...

```

Fig 2.9: hard disk directory console

(vi) **CD:** This changes the current directory. This command makes it possible to change from the current directory to a specified or new directory. To change a current directory type (CD..or CD\) and press the <enter> key. At the prompt (C:\> or A:\>) type CD directory name and press the <enter> key. Note that you do not change to file but only directories.

(vii) **RD:** This command removes directories that are no longer needed from a computer. At the command prompt type RD Directory name and press the <enter> key. Make sure the directory is empty if not the computer will display an error message. Invalid path, not a directory or directory not empty.

(viii) **CLS:** This command clears all listed or displayed information on the computer screen. To clear screen type “CLS” and press the <enter> key. The prompt will be displayed at the top left corner of the computer screen.

(ix) **COPY:** This is a command used to copy file(s). At the prompt, type “Copy filename drive”. The drive (A., B: or C) shows the target drive. It provides a duplicate copy of a file at the target drive.

2.5 Conclusion:

This chapter can be concluded after recognizing the components of computer system, integration of components, issues and troubleshooting the hardware such as input, processing and output unit with solutions provided from the link between hardware, software, system peripherals, and so on.

It also gives a better understanding of system integration, installations, creating directory and managing the system hard disk to optimal.

2.6 References

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2.7 Exercises

Theory

1. Define and illustrate with examples computer hardware.
2. What do you understand by the term “troubleshooting”?
3. Describe your knowledge of system integration.
4. What is the difference between hardware, software and firmware.
5. State and explain the syntax used in making file directory and changing directories.

Multiple Choice Questions

1. Components of computer system are --- (a) Hardware, software and firmware (b) Heat, Light and Sound (c) Input, Storage and device (d) Input unit, External disk and peripherals.
2. An example of input device in a computer system is --- (a) printer (b) Memory card (c) Visual display unit (VDU) (d) Keyboard.
3. The following are types of wireless communication except (a) Bluetooth (b) Fiber optic (c) Infrared (d) Satellite
4. The word “Troubleshooting” in computer system means --- (a) the act of replacing a computer system (b) the act of diagnosing computer system (c) the act of upgrading the computer system (d) the act of purchasing computer system.
5. Which of the following storage media is the fastest in speed --- (a) Floppy disk (b) Register (c) RAM (d) Hard disk.

6. The ----- is an access channel for computers to exchange information (a) Gateway (b) Port (c) Protocol (d)Socket.
7. In a computer system environment, operating system can be classified basically into --- (a) 4 (b) 3 (c) 5 (d)2.
8. Which of the following is the smallest unit of a worksheet --- (a) Front page (b) Range (c) Cell (d) worksheet.
9. What is the meaning of DOS in computer system? --- (a) Denial of Service (b) Disk operating system (c) Distributed operating system (d) Disjointed of structure.
10. Which of the following is not a multitasking operating system---- (a) DOS (b) UNIX (c) WINDOWS (d) MAC.

CHAPTER THREE

COMPUTER IN DATA ANALYSIS AND DECISION MAKING

The objectives of this chapter are for the candidate to be able to understand the involvement of computer in data analysis and decision making as stated below:

- (i) Candidates should be able to define data, Information and data analysis.
- (ii) What is Data Analysis?
- (iii) How do we involve computer in data analysis and its processes.
- (iv) How does data analysis transform to decision making.
- (v) Introducing Python and R language in data visualisation
- (vi) How to clean dataset and types of data Analytic.
- (vii) Application of data analytic in exploration, storytelling and visualisation.

3.0 Introduction:

3.1 The Role of Computer in Data Analysis and Decision Making

There are many ways computers can be used for decision-making. Some of common techniques must be able to espouse you to ingredients or variable that computer will process before decisions can be made, such as data, information before the analysis that will eventually generate a recommendation for decision making.

What is the role of computer in data analysis and decision making process?

Computers can process data/ information much faster than a human brain. One advantage to computers making decisions is that you will have decisions made faster and more accurately than a human brain, which may get hung up with different factors involving the decision, leading to slower overall results.

What is data?

In common usage and statistics, data is a collection of discrete or continuous values that convey information, describing the quantity, quality, fact, statistics, other basic units of meaning, or simply sequences of symbols that may be further interpreted.

What is Information?

It is knowledge shared or obtained through study, instruction, investigation or news and you share it through the act of communicating, whether verbally, non-verbally, visually, or through written word. Information has different names, including intelligence, message, data, signal or fact.

What is Data Analysis?

Data analysis is what occurs under the larger umbrella of data analytic. Analysis of qualitative data allows businesses to run data analytics on a larger scope and address company-wide issues such as productivity and performance. What data analysis involves is evaluating qualitative data in the hopes of establishing a reason for something that has happened. It can also identify patterns that then inform business decisions.

What is Qualitative Data?

In essence, qualitative data is non-numerical data. It might include customer behavior, such as how and when a consumer clicks on a link. It can also include customer feedback, transcripts, or recordings of sales calls.

The Different Categories of Data Analytics

There are four main categories of analytics: descriptive, diagnostic, predictive and prescriptive. Descriptive analytics documents what has happened over a certain period of time. Diagnostic analytics assess the why in an event: Did an election affect sales in November? Predictive analytics looks to the future and determines what will happen based on previous, similar events and models. Finally, prescriptive analytics assesses data then makes recommendations based on that data analysis.

Data analysis: By analyzing large amounts of data, computers can help identify patterns and trends that can inform decision-making. For example, a company might use data analysis to determine which products are most popular with customers.

Machine learning: Machine learning algorithms can be used to make predictions or identify patterns in data. For example, a bank might use machine learning to identify potential fraud.

Optimisation: Computers can be used to optimize complex systems by finding the best solution to a problem. For example, a transportation company might use optimisation algorithms to determine the most efficient routes for its trucks.

Simulation: Computers can be used to simulate different scenarios and predict the outcome of different decisions. For example, a city might use simulation to predict the impact of a new transportation system on traffic flow.

Expert systems: Expert systems use knowledge from experts in a particular field to make decisions. For example, a medical expert system might use knowledge from doctors to make a diagnosis. It's important to note that computers are just tools and the final decision should be made by a human. Additionally, it's important to evaluate the quality and accuracy of the data and models used in these techniques as well as the potential biases.

3.1.1 Data Analysis

Data analysis is the process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making.

In Data analysis, Computers can assist in identifying patterns and trends that can guide decision-making by analyzing vast amounts of data. Data analysis may be used by a business, for instance, to identify the most well-liked products among consumers.

Algorithms for machine learning can be used to anticipate the future or spot patterns in data. A bank, for instance, might employ machine learning to spot possible fraud.

By identifying the ideal response to a problem, computers may be used to optimize complicated systems. For instance, to find the best routes for its vehicles, a transportation business might utilize optimisation algorithms. Computers may be used to simulate a variety of situations.

Data analysis also examines enormous volumes of data; computers can help in detecting patterns and trends that can inform decision-making. A company might utilize data analysis, for instance, to determine which products are most popular with customers.

Machine learning algorithms can be used to predict the future or identify patterns in data. For example, a bank might use machine learning to identify potential fraud.

Computers can optimize complex systems by determining the best solution to a problem. For instance, a transportation company might use optimisation algorithms to determine the optimal routes for its cars. A multitude of circumstances can be simulated using computers in various circumstances.

Data Analysis Process

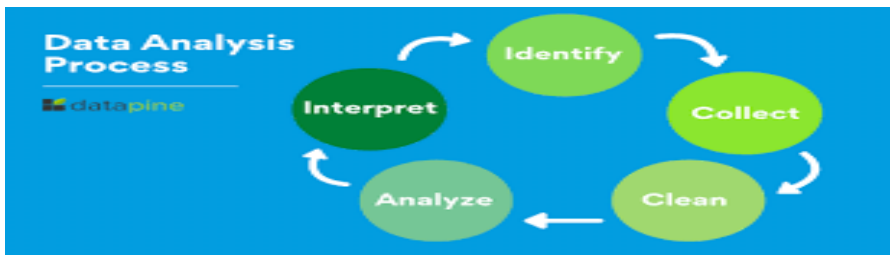


Fig 3.1: The schematic diagram of data analysis process.

It is better we explore the main steps in the data analysis process. This will cover how to define your goal, collect data, and carry out an analysis. Where applicable, it uses examples and highlights a few tools to make the journey easier. This will help you tweak the process to fit your own needs. Here are the steps involved in the process:

1. **Defining the question**
2. **Collecting the data**
3. **Cleaning the data**
4. **Analyzing the data**
5. **Sharing your results**
6. **Embracing failure**
7. **Summary**

THE DATA ANALYSIS PROCESS



Fig 3.2: stages of Data analysis

1. Step One: Defining the Question

The first step in any data analysis process is to define your objective. In data analytics jargon, this is sometimes called the ‘problem statement’.

Defining your objective means coming up with a hypothesis and figuring how to test it. Start by asking: What business problem am I trying to solve? While this might sound straightforward, it can be trickier than it seems. For instance, your organisation’s senior management might pose an issue, such as: “Why are we losing customers?” It’s possible, though, that this doesn’t get to the core of the problem. A data analyst’s job is to understand the business and its goals in enough depth that they can frame the problem the right way.

Analysing Your Data

The first step in any data analysis is segmenting the data optimally. You want to look at the metrics that most directly affect your hypothesis. Segment your data by category, looking at factors such as time or location. You can also code data to make it easier to analyse. Next, look over the data to spot trends and spikes. Finally, assess the impact of any trends that you spotted in your assessment of the data.

Let's say you work for a fictional company called TopNotch Learning. TopNotch creates custom training software for its clients. While it is excellent at securing new clients, it has much lower repeat business. As such, your question might not be, "Why are we losing customers?" but, "Which factors are negatively impacting the customer experience?" or better yet: "How can we boost customer retention while minimizing costs?"

Now you have defined a problem, you need to determine which sources of data will best help you solve it. This is where your business acumen comes in again. For instance, perhaps you've noticed that the sales process for new clients is very slick, but that the production team is inefficient. Knowing this, you could hypothesize that the sales process attracts lots of new clients, but the subsequent customer experience is lacking. Could this be why customers don't come back? Which sources of data will help you answer this question?

Tools to Help Define Your Objectives

Defining your objective is mostly about soft skills, business knowledge, and lateral thinking. But you'll also need to keep track of business metrics and key performance indicators (KPIs). Monthly reports can allow you to track problem points in the business. Some KPI dashboards come with a fee, like Databox and DashThis. However, you'll also find open-source software like Grafana, Freeboard, and Dashbuilder. These are great for producing simple dashboards, both at the beginning and the end of the data analysis process.

2. Step Two: Collecting the Data

Once you've established your objective, you'll need to create a strategy for collecting and aggregating the appropriate data. A key part of this is determining which data you need. This might be quantitative (numeric)

data, e.g. sales figures, or qualitative (descriptive) data, such as customer reviews. All data fit into one of three categories: first-party, second-party, and third-party data. Let's explore each one.

What is First-Party Data?

First-party data are data that you, or your company, have directly collected from customers. It might come in the form of transactional tracking data or information from your company's customer relationship management (CRM) system. Whatever its source, first-party data is usually structured and organized in a clear, defined way. Other sources of first-party data might include customer satisfaction surveys, focus groups, interviews, or direct observation.

What is Second-Party Data?

To enrich your analysis, you might want to secure a secondary data source. Second-party data is the first-party data of other organisations. This might be available directly from the company or through a private marketplace. The main benefit of second-party data is that they are usually structured, and although they will be less relevant than first-party data, they also tend to be quite reliable. Examples of second-party data include website, app or social media activity, like online purchase histories, or shipping data.

What is Third-Party Data?

Third-party data is data that has been collected and aggregated from numerous sources by a third-party organisation. Often (though not always) third-party data contains a vast amount of unstructured data points (big data). Many organisations collect big data to create industry reports or to conduct market research. The research and advisory firm Gartner is a good real-world example of an organisation that collects big data and sells it on to other companies. Open data repositories and government portals are also sources of third-party data.

Tools to Help You Collect Data

Once you've devised a data strategy (i.e. you've identified which data you need, and how best to go about collecting them) there are many tools you can use to help you. One thing you'll need, regardless of industry or area of expertise, is a data management platform (DMP).

A DMP is a piece of software that allows you to identify and aggregate data from numerous sources, before manipulating them, segmenting them, and so on. There are many DMPs available. Some well-known enterprise DMPs includes Salesforce DMP, SAS, and the data integration platform, Xplenty.

3. Step Three: Cleaning the Data

Once you've collected your data, the next step is to get it ready for analysis. This means cleaning, or 'scrubbing' it, and is crucial in making sure that you're working with high-quality data. Key data cleaning tasks include:

- i. **Removing major errors, duplicates, and outliers**—all of which are inevitable problems when aggregating data from numerous sources.
- ii. **Removing unwanted data points**—extracting irrelevant observations that have no bearing on your intended analysis.
- iii. **Bringing structure to your data**—general 'housekeeping', i.e. fixing typos or layout issues, which will help you map and manipulate your data more easily.
- iv. **Filling in major gaps**—as you're tidying up, you might notice that important data are missing. Once you've identified gaps, you can go about filling them.

A good data analyst will spend around 70-90% of their time cleaning their data. This might sound excessive. But focusing on the wrong data points (or analyzing erroneous data) will severely impact your results.

Data Cleaning

Data cleaning is correcting errors or inconsistencies, or restructuring data to make it easier to use. This includes things like standardizing dates and addresses, making sure field values (e.g., "Closed won" and "Closed Won") match, parsing area codes out of phone numbers, and flattening nested data structures.

#	Id	Name	Birthday	Gender	IsTeacher?	#Students	Country	City
1	111	John	31/12/1990	M	0	0	Ireland	Dublin
2	222	Mery	15/10/1978	F	1	15	Iceland	
3	333	Alice	19/04/2000	F	0	0	Spain	Madrid
4	444	Mark	01/11/1997	M	0	0	France	Paris
5	555	Alex	15/03/2000	A	1	23	Germany	Berlin
6	555	Peter	1983-12-01	M	1	10	Italy	Rome
7	777	Calvin	05/05/1995	M	0	0	Italy	Italy
8	888	Roxane	03/08/1948	F	0	0	Portugal	Lisbon
9	999	Anne	05/09/1992	F	0	5	Switzerland	Geneva
10	101010	Paul	14/11/1992	M	1	26	Ytali	Rome

Uniqueness Formats Attribute dependencies Misspellings

Fig3.3: Data cleaning process(filtering duplicated elements and unwanted variables)

Tools to Help You Clean Your Data

Cleaning datasets manually—especially large ones—can be daunting. Luckily, there are many tools available to streamline the process. Open-source tools, such as OpenRefine, are excellent for basic data cleaning, as well as high-level exploration. However, free tools offer limited functionality for very large datasets. Python libraries (e.g. Pandas) and some R packages are better suited for heavy data scrubbing. You will, of course, need to be familiar with the languages. Alternatively, enterprise tools are also available. For example, Data Ladder, which is one of the highest-rated data-matching tools in the industry.

Carrying Out an Exploratory Analysis

Another thing many data analysts do (alongside cleaning data) is to carry out an exploratory analysis. This helps identify initial trends and characteristics, and can even refine your hypothesis. Let’s use our fictional learning company as an example again.

Carrying out an exploratory analysis, perhaps you notice a correlation between how much TopNotch Learning’s clients pay and how quickly they move on to new suppliers. This might suggest that a low-quality customer experience (the assumption in your initial hypothesis) is actually less of an issue than cost. You might, therefore, take this into account.

4. Step Four: Analysing the Data

Finally, you've cleaned your data. Now comes the fun bit—analysing it! The type of data analysis you carry out largely depends on what your goal is. But there are many techniques available. Univariate or bivariate analysis, time-series analysis, and regression analysis are just a few of you might have heard of. More important than the different types, though, is how you apply them. This depends on what insights you're hoping to gain. Broadly speaking, all types of data analysis fit into one of the following four categories.

Descriptive Analysis

Descriptive analysis identifies what has already happened. It is a common first step that companies carry out before proceeding with deeper explorations. As an example, let's refer back to our fictional learning provider once more. TopNotch Learning might use descriptive analytics to analyse course completion rates for their customers. Or they might identify how many users access their products during a particular period.

Perhaps they'll use it to measure sales figures over the last five years. While the company might not draw firm conclusions from any of these insights, summarizing and describing the data will help them to determine how to proceed.

Diagnostic Analysis

Diagnostic analytics focuses on understanding why something has happened. It is literally the diagnosis of a problem, just as a doctor uses a patient's symptoms to diagnose a disease. Remember TopNotch Learning's business problem? 'Which factors are negatively impacting the customer experience?' A diagnostic analysis would help answer this. For instance, it could help the company draw correlations between the issue (struggling to gain repeat business) and factors that might be causing it (e.g. project costs, speed of delivery, customer sector, etc.) Let's imagine that, using diagnostic analytics, TopNotch realizes its clients in the retail sector are departing at a faster rate than other clients. This might suggest that they're losing customers because they lack expertise in this sector. And that's a useful insight!

Predictive Analysis

Predictive analysis allows you to identify future trends based on historical data. In business, predictive analysis is commonly used to forecast future growth, for example. But it doesn't stop there. Predictive analysis has grown increasingly sophisticated in recent years.

The speedy evolution of machine learning allows organisations to make surprisingly accurate forecasts. Take the insurance industry. Insurance providers commonly use past data to predict which customer groups are more likely to get into accidents. As a result, they'll hike up customer insurance premiums for those groups. Likewise, the retail industry often uses transaction data to predict where future trends lie, or to determine seasonal buying habits to inform their strategies.

Prescriptive Analysis

Prescriptive analysis allows you to make recommendations for the future. This is the final step in the analytics part of the process. It's also the most complex. This is because it incorporates aspects of all the other analyses we've described. A great example of prescriptive analytics is the algorithms that guide Google's self-driving cars.

Every second, these algorithms make countless decisions based on past and present data, ensuring a smooth, safe ride. Prescriptive analytics also helps companies decide on new products or areas of investment.

5. Step Five: Sharing Your Results

You have finished carrying out your analyses accompanied with your insights, the final step of the data analytic process is to share these insights with the wider world (or at least with your organisation's stakeholders!). This is more complex than simply sharing the raw results of your work—it involves interpreting the outcomes, and presenting them in a manner that's digestible for all types of audiences.

Since you'll often present information to decision-makers, it's very important that the insights you present are 100% clear and unambiguous. For this reason, data analysts commonly use reports, dashboards, and interactive visualisations to support their findings.

How you interpret and present results will often influence the direction of a business. Depending on what you share, your organisation might decide to restructure, to launch a high-risk product, or even to close an entire division. That's why it's very important to provide all the evidence that you have gathered, and not to cherry-pick data. Ensuring that you cover everything in a clear, concise way will prove that your conclusions are scientifically sound and based on the facts. On the flip side, it's important to highlight any gaps in the data or to flag any insights that might be open to interpretation. Honest communication is the most important part of the process. It will help the business, while also helping you to excel at your job

Tools for Interpreting and Sharing Your Findings

There are tons of data visualisation tools available, suited to different experience levels. Popular tools requiring little or no coding skills include Google Charts, Tableau, Datawrapper, and Infogram. If you're familiar with Python and R, there are also many data visualisation libraries and packages available.

For instance, check out the Python libraries Plotly, Seaborn, and Matplotlib. Whichever data visualisation tools you use, make sure you polish up your presentation skills, too.

Remember: Visualisation is great, but communication is key. This is an excellent insight into what it's really like to work as a data analyst.

6. Step Six: Embrace Your Failures

The last 'step' in the data analytics process is to embrace your failures. The path we've described above is more of an iterative process than a one-way street. Data analytics is inherently messy, and the process you follow will be different for every project. For instance, while cleaning data, you might spot patterns that spark

a whole new set of questions. This could send you back to step one (to redefine your objective). Equally, an exploratory analysis might highlight a set of data points you'd never considered using before. Or maybe you find that the results of your core analyses are misleading or erroneous. This might be caused by mistakes in the data, or human error earlier in the process.

While these pitfalls can feel like failures, don't be disheartened if they happen. Data analysis is inherently chaotic, and mistakes occur. What's important is to hone your ability to spot and rectify errors. If data analytics was straightforward, it might be easier, but it certainly wouldn't be as interesting. Use the steps we've outlined as a framework, stay open-minded, and be creative. If you lose your way, you can refer back to the process to keep yourself on track.

7. Summary

In the above discussion, we've covered the main steps of the data analytics process. These core steps can be amended, re-ordered and re-used as you deem fit, but they underpin every data analyst's work:

- **Define the question**—What business problem are you trying to solve? Frame it as a question to help you focus on finding a clear answer.
- **Collect data**—Create a strategy for collecting data. Which data sources are most likely to help you solve your business problem?
- **Clean the data**—Explore, scrub, tidy, de-dupe, and structure your data as needed by removing duplicate or irrelevant observations from your dataset, filter unwanted outliers, handling missing data and validating the questions and answer that arises.

However, data cleaning simply means the act of correcting errors or inconsistencies or restructuring data to make it easier to use.

- **Analyse the data**—Carry out various analyses to obtain insights. Focus on the four types of data analysis: descriptive, diagnostic, predictive, and prescriptive.
- **Share your results**—How best can you share your insights and recommendations? A combination of visualisation tools and communication is key.

- **Embrace your mistakes**—Mistakes happen. Learn from them. This is what transforms a good data analyst into a great one.

3.2 The Use of Python in Data Visualisation

Python is a new language that has gain popularity especially in the field of Data Science, Machine Learning (ML), and Artificial Intelligence (AI) applications. It has a large and active community of developers, many libraries and frameworks are available to make Python development faster and easier.

Python is widely used for data analysis and visualisation, leading to Data Analyst roles that help organisations make data-driven decisions, it also allow you to work as a Machine Learning Engineer, developing and implementing Machine Learning(ML) algorithms.

How to start Python Command in Window Environment?

Run Python Code from the Command Prompt:

The first way to work with Python in Windows is through an interactive session.

To get an interactive session started, just open the Command Prompt.

Search for cmd on the toolbar, then hit Enter.

Once the command prompt is open, simply type python and hit Enter again.

OR

To start a Python interactive session, just open a command-line or terminal and then type in python, or python3 depending on your Python installation, and then hit Enter.

How do I start Python after Installation?

After installation, Python may be launched by finding it in Start.

Alternatively, it will be available from any Command Prompt or PowerShell session by typing python. Further, pip and IDLE may be used by typing pip or idle.

IDLE can also be found in Start.

How to Check if Python is Installed?

To check if Python is installed on your Windows machine using the Start Menu, follow these steps: Press the Windows key or click on the Start button to open the Start Menu and type “ython”. If Python is installed, it should show up as the best match.

Execute Python Scripts

Execute Python scripts in the terminal or an IDE. Python files have the **.py** extension. Whenever you make a Python script, save it as name.py

A simple program (hello.py) is shown below. The first line indicates that we want to use the Python interpreter. The 3rd line outputs a line of text “hello wrld” to the screen.

The text below can be copied into a text editor and save as **hello.py**. Python works with files that end in **.py**.

```
#!/usr/bin/env python3
print('hello world')
```

You can use any text editor to create a Python program. I recommend using a text editor that supports syntax highlighting (text colouring) and line numbers.

Run Python

Run from Terminal

You can start a Python program with the terminal or command line. This works on all platforms (Mac OS, Windows, Linux).

To open a terminal on Windows: press the windows key + r key (run program), type cmd or command and press enter.

On Mac OS use finder to start a terminal. You can hit command+space and type terminal, then hit enter.

Start Program

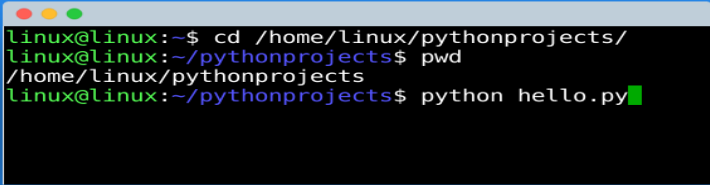
To **start** the program, we have to open the command line and type:

```
python hello.py
```

For this to work you need to be in the correct directory. That means the directory where your python program is located.

On Mac OS and Linux you can see the current directory with the command *pwd*. If you use Windows the directory is shown in the command line title bra.

To change directory use the command 'cd' like this 'cd /home/user/pythonprojects' or 'cd C: \Projects\'.



```
linux@linux:~$ cd /home/linux/pythonprojects/  
linux@linux:~/pythonprojects$ pwd  
/home/linux/pythonprojects  
linux@linux:~/pythonprojects$ python hello.py
```

Fig 3.4: A command .py for python coding environment

Run from IDE

To run a Python script from an IDE, start a project first. Once the project is created add your .py files (or create them in the IDE) and press run.

In the PyCharm IDE:

1. Start project
 - o Welcome screen opens, click Create New Project.
 - o On the main menu, choose File | New Project.
2. Select Python interpreter
 - o Choose Python version from the list. Use 3.x
3. Click create
4. Add new Python file (File new) and add hello.py
5. Click the green triangle to start the program. Another option is to click right mouse button on your Python file and selecting run.

Other IDEs have a similar process to run a Python program (start project, add file, run button).

Output

You should see a line of text showing “hello world”.


```

C:\WINDOWS\system32\cmd.exe
2/24/2015 10:39 PM      384,270 NEWS.txt
2/24/2015 10:42 PM      102,400 py.exe
2/24/2015 10:44 PM       40,960 python.exe
2/24/2015 10:44 PM    4,057,600 python34.dll
12/12/2015  3:31 PM    545,280 pythoncom34.dll
2/24/2015 10:44 PM      41,472 pythonw.exe
2/24/2015 10:42 PM     102,912 pyw.exe
12/12/2015  3:31 PM     130,560 pywintypes34.dll
12/12/2015  3:17 PM         81 qt.conf
2/24/2015 10:39 PM      6,954 README.txt
2/1/2016 12:23 AM <DIR> Scripts
2/1/2016 12:23 AM <DIR> share
2/1/2016 12:23 AM <DIR> tcl
2/1/2016 12:23 AM <DIR> Tools
12/12/2015  3:15 PM      57,168 vcomp100.dll
15 files              6,938,125 bytes
13 directories       16,080,556,032 bytes free

E:\home\frank\Downloads\WinPython-64bit-3.4.3.7\python-3.4.3.amd64>python hello.py
fixme:heap:HeapSetInformation 0x3b4000 0 0x32fcd0 4
hello world

E:\home\frank\Downloads\WinPython-64bit-3.4.3.7\python-3.4.3.amd64>

```

Fig 3.5: winPython execute pathway and directory showing installed python.dll.

Seven (7) Steps In Data Visualisation

These are inevitable steps in the process of data visualisation, they are:

1. Develop your research questions
2. Get or create your dataset
3. Clean your data
4. Make a choice of the appropriate chart to convey your message
5. Choose your tool
6. Prepare your data
7. Create a chart that depicts your inference
8. Interpret your inference for correct decision making.

Introduction to R Language in Data Visualisation

It is pertinent to know that R and Python languages are both important in data analytic that can be used in data visualisation and exploratory data analytics. The R package comprises of R studio, a comprehensive R

Archive Network (CRAN), a collection of functions, and R codes. It involves the installation of R and R studio environments.

What's The R Programming Language?

R is a programming language created for statistical computing and information science. It's a preferred language amongst statisticians, information scientists, and researchers on account of its big selection of statistical and graphical instruments. It's generally utilized in scientific analysis, bioinformatics, and the healthcare trade.

The first assignment is to download R and R studio free version and install the two software to start working. R studio is an R language or code where you execute your R codes or syntax.

RStudio by default displays four panes: Console, Source Code, Environment/History, and Files. You can rearrange them by going to View -> Panes -> Pane Layout. You can add and remove tabs from panes by going to View and selecting/deselecting tab options listed at the bottom

In R, the environment () function returns the environment associated with a given function or formula. An environment is a collection of objects such as functions, variables, and so on. Whenever we hit up the R interpreter, an environment is created.

The "Environment" tab in the top right window lists the variables and functions present in the current R session. It does not include the function/data in loaded packages however (unless you select a package from the drop down menu that says "Global Environment").you will notice three major menus like Console, Terminal and Rmarkdown.

You must have a set of dataset to work with, for instance, download woman dataset and type inside your script portion of the working environment.

Steps:

1. Open R studio to start working, the working environment that comprises of script and command prompt portion will be displayed; you can now start typing your statements.

For example:

2. Type `women read.csv ('C: /dataset.csv')`: this statement load woman dataset you want to work on.

3. Summary(women)

Max (women, height)

Attach (women)

Height

Plot(height, weight)

`##You want to check if there is a linear relationship between height and weight, such as $y=mx+c$.`

`Model<- lm(height,weight,data=women)`

`Plot (height,weight,main='height and weight'`

`Plot`type =`l`, `subtitle`,xlab='weight(kg)` ,ylab='height(m)`;`

We can also use more syntax like `ggplot()`, `geom()`,`Mapping()`, `aes()` etc. to visualize your dataset.

Then execute the codes by pressing (Run) icon for result to be displayed on the right hand side of the working environment, and you can save your work by clicking on save icon, a box showing to name the file and click save in the directory where you can easily recall it later.

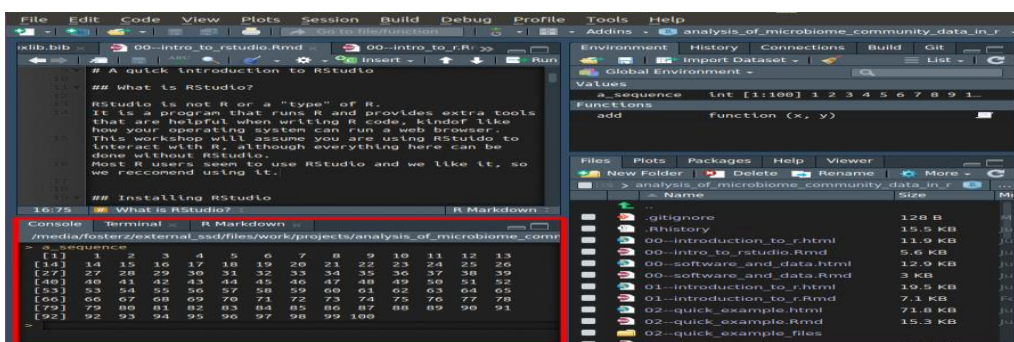


Fig 3.6: Global working environment of Rstudio to run R statements.

3.3 Conclusion:

We can actually conclude that at the end of studying this chapter, the reader can achieve all the stated objectives of the study such as the meaning of data and information, the process of data analysis, the involvement of computer in data processing and decision making, how to use python ,R language in data visualisation, some of the insight deduction that could be achieved using some appropriate computer software and languages deployed to achieve the aim and objectives of the study and finally how applicable it is in the real life situations.

3.4 References:

1. An introduction to data visualisation using R programming by Gareth James, Daniela Witten Trevor Hastie, Robert Tibshirani.
2. An Introduction to python programming Language by Yue Zhang (Singapore University of Technology & Design, Singapore).
3. Fundamentals of Data visualisation by Claus Wilke(2019).
4. Better Data visualisation - A guide for Scholars, Researchers and Works (2021) - by Jonathan Schwabish.

3.5 Exercises

Theory

1. What do you understand by data visualisation?
2. Differentiate between data and information.
3. Mention and discuss stages of data visualisation
4. Expatriate on the needs to visualize data and state those tools useful in data visualisation.
5. Briefly describe two common languages used in Data visualisation with an inclusion of its features.

Multiple Choice Questions

1. Data is referred to as ----- (a) organized facts (b) Raw facts (c) Scheduled numbers (d) diluted information.
2. Data visualisation involve the following stages except ----- (a) Define research question (b) collect data (b) Data cleaning (c) Data duplication.

3. The following are the reason for data visualisation except----- (a) Generate more insight information (b) Replicate data analysis processes (c) create unstable decision (d) Establish facts in decision making process.
4. The two common languages used in Data visualisation are...(a) OO Visual Basic and OOFortran (c) BASIC and Assembly Language (c) Python and R Language (d) OOjava and OO Pascal.
5. The Global working Environment for R Language statement execution is ----- (a) R Studio (b) VB.Net (c.) R-cmd (d) Ms-DOS.
6. Data visualisation is necessary because ----- (a) It gives more insight for decision making (b) Used to hide vital information (c) Telling fictional stories. (d) used to defragment information.
7. ggplot syntax in Rcode is been used to do ----- (a) draw graph (b) To choose the graphic visual of insight information about subject of interest (c.) To sketch graph axis (d) Plan the variables of interest.
8. Interpret this code: Plot (height,weight,main='height and weight' (a) compare height to weight (b) Assigning portion to height with corresponding value of weight on the graph (c.) plot weight versus height (d) All of the above.
9. Using python program, interpret this statement python hello.py (a) word hello is written .py(file.ext) (b) Greeting Hello!!! (c) Echo the word "hello" (d) All of the above.
10. You can RUN Python code from two mode (a) IDE only and (b) IDE and command line (c.) None of the above (d) All of the Above.

CHAPTER FOUR

CLOUD COMPUTING

At the end of this chapter, the students should be able to:

- (i) Define cloud computing.
- (ii) Understand and differentiate types of cloud computing.
- (iii) Understand the concept of cloud computing.
- (iv) Explain the circumstances and applications of cloud computing in business world.
- (v) Describe vulnerability of data and information as a reason for cloud computing.

4.0 Introduction:

In the present era of information technology, some of the emerging issues are in the area of Cloud Computing and Forensic Computing which are important to deal or discuss in this learning pack.

4.1 Definition: Cloud computing is the delivery of different services through the Internet, including data storage, servers, databases, networking, and software. Cloud storage has grown increasingly popular among individuals who need larger storage space and for businesses seeking an efficient off-site data back-up solution.

Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software.

Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it. It is a popular option for people and businesses for a number of reasons including cost savings, increased productivity, speed and efficiency, performance, and security.

Cloud computing is named as such because the information being accessed is found remotely in the cloud or a virtual space. Companies that provide cloud services enable users to store files and applications on remote servers and then access all the data via the Internet. This means the user is not required to be in a specific

place to gain access to it, allowing the user to work remotely. It takes all the heavy lifting involved in crunching and processing data away from the device you carry around or sit and work at. It also moves all of that work to huge computer clusters far away in cyberspace. The Internet becomes the cloud and voilà—your data, work, and applications are available from any device with which you can connect to the Internet, anywhere in the world.

Cloud computing can be both public and private. Public cloud services provide their services over the Internet for a fee. Private cloud services, on the other hand, only provide services to a certain number of people. These services are a system of networks that supply hosted services. There is also a hybrid option, which combines elements of both the public and private services.

Types of Cloud Services

Regardless of the kind of service, cloud computing services provide users with a series of functions including:

- a) Email
- b) Storage, backup, and data retrieval
- c) Creating and testing apps
- d) Analyzing data
- e) Audio and video streaming
- f) Delivering software on demand

Cloud computing is still a fairly new service but is being used by a number of different organisations from big corporations to small businesses, nonprofits to government agencies, and even individual consumers.

Deployment Models

There are various types of clouds, each of which is different from the other. Public clouds provide their services on servers and storage on the Internet. These are operated by third-party companies, who handle and control all the hardware, software, and the general infrastructure. Clients access services through accounts that can be accessed by just about anyone.

Private clouds are reserved for specific clientele, usually one business or organisation. The firm's data service center may host the cloud computing service. Many private cloud computing services are provided on a private network.

Hybrid clouds are, as the name implies, a combination of both public and private services. This type of model allows the user more flexibility and helps optimize the user's infrastructure and security.

Newer forms of cloud computing services include the community cloud, the big data cloud, and the multi-cloud.

Types of Cloud Computing

Cloud computing is not a single piece of technology like a microchip or a cellphone. Rather, it's a system primarily comprised of three services: software-as-a-service (SaaS), infrastructure-as-a-service (IaaS), and platform-as-a-service (PaaS).

1. **Software-as-a-service (SaaS)** involves the licensure of a software application to customers. Licenses are typically provided through a pay-as-you-go model or on-demand. This type of system can be found in Microsoft Office's 365.
2. **Infrastructure-as-a-service (IaaS)** involves a method for delivering everything from operating systems to servers and storage through IP-based connectivity as part of an on-demand service. Clients can avoid the need to purchase software or servers, and instead procure these resources in an outsourced, on-demand service. Popular examples of the IaaS system include IBM Cloud and Microsoft Azure.
3. **Platform-as-a-service (PaaS)** is considered the most complex of the three layers of cloud-based computing. PaaS shares some similarities with SaaS, the primary difference being that instead of delivering software online; it is actually a platform for creating software that is delivered via the Internet. This model includes platforms like Salesforce.com and Heroku.

Advantages of Cloud Computing

Cloud-based software offers companies from all sectors a number of benefits, including the ability to use software from any device either via a native app or a browser. As a result, users can carry their files and settings over to other devices in a completely seamless manner.

Cloud computing is far more than just accessing files on multiple devices. Thanks to cloud computing services, users can check their email on any computer and even store files using services such as Dropbox and Google Drive. Cloud computing services also make it possible for users to back up their music, files, and photos, ensuring those files are immediately available in the event of a hard drive crash.

It also offers big businesses huge cost-saving potential. Before the cloud became a viable alternative, companies were required to purchase, construct, and maintain costly information management technology and infrastructure. Companies can swap costly server centers and IT departments for fast Internet connections, where employees interact with the cloud online to complete their tasks.

The cloud structure allows individuals to save storage space on their desktops or laptops. It also lets users upgrade software more quickly because software companies can offer their products via the web rather than through more traditional, tangible methods involving discs or flash drives. For example, Adobe customers can access applications in its Creative Cloud through an Internet-based subscription. This allows users to download new versions and fixes to their programs easily.

Disadvantages of the Cloud Computing

With all of the speed, efficiencies, and innovations that come with cloud computing, there are, naturally, risks. Security has always been a big concern with the cloud especially when it comes to sensitive medical records and financial information. While regulations force cloud computing services to shore up their security and compliance measures, it remains an ongoing issue. Encryption protects vital information, but if that encryption key is lost, the data disappears.

Servers maintained by cloud computing companies may fall victim to natural disasters, internal bugs, and power outages, too. The geographical reach of cloud computing cuts both ways: A blackout in California

could paralyze users in New York, and a firm in Texas could lose its data if something causes its Maine-based provider to crash.

As with any technology, there is a learning curve for both employees and managers. But with many individuals accessing and manipulating information through a single portal, inadvertent mistake can transfer across an entire system.

The World of Business

Businesses can employ cloud computing in different ways. Some users maintain all apps and data on the cloud, while others use a hybrid model, keeping certain apps and data on private servers and others on the cloud.

When it comes to providing services, the big players in the corporate computing sphere include:

- a) Google Cloud
- b) Amazon Web Services (AWS)
- c) Microsoft Azure
- d) IBM Cloud
- e) Alibaba Cloud

Amazon Web Services is 100% public and includes a pay-as-you-go, outsourced model. Once you are on the platform you can sign up for apps and additional services. Microsoft Azure allows clients to keep some data at their own sites. Meanwhile, Alibaba Cloud is a subsidiary of the Alibaba Group.

An Example of Cloud Computing is a cloud service on streaming platforms for audio or video, where the actual media files are stored remotely. Another would be data storage platforms like Google Drive, Dropbox, OneDrive, or Box.

Is Cloud Computing Safe?

Cloud computing is deemed safe because software and data are stored remotely in cloud computing. Data security and platform security are a big concern, but it's a better environment with double authentication security protection. Cloud security refers to the measures undertaken to protect digital assets and data stored

on cloud-based services. Measures to protect this data include two-factor authorisation (2FA), the use of VPNs, security tokens, data encryption, and firewall services, among others.

What Is Cloud Security?

Cloud security is the protection of data stored online via cloud computing platforms from theft, leakage, and deletion. Methods of providing cloud security include firewalls, penetration testing, obfuscation, tokenisation, virtual private networks (VPN), and avoiding public internet connections. Cloud security is a form of cybersecurity.

- a) Cloud security refers broadly to measures undertaken to protect digital assets and data stored online via cloud services providers.
- b) Cloud computing is the delivery of different services through the Internet, including data storage, servers, databases, networking, and software.
- c) Measures to protect this data include two-factor authorisation (2FA), the use of VPNs, security tokens, data encryption, and firewall services, among others.

Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software. Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it. Cloud computing is a popular option for people and businesses for a number of reasons including cost savings, increased productivity, speed and efficiency, performance, and security.

Cloud security is essential for the many users who are concerned about the safety of the data they store in the cloud. They believe their data is safer on their own local servers where they feel they have more control over the data. But data stored in the cloud may be more secure because cloud service providers have superior security measures, and their employees are security experts. On-premise data can be more vulnerable to security breaches, depending on the type of attack. Social engineering and malware can make any data storage system vulnerable, but on-site data may be more vulnerable since its guardians are less experienced in detecting security threats.

4.2 WHAT IS A DENIAL-OF-SERVICE (DOS) ATTACK?

A denial-of-service (DoS) attack is a cyberattack on devices, information systems, or other network resources that prevents legitimate users from accessing expected services and resources.

This is usually accomplished by flooding the targeted host or network with traffic until the target can't respond or crashes. DoS attacks can last from a few hours to many months, costing companies and consumer's time and money while their resources and services are unavailable.

KEY TAKEAWAYS

- 1) A denial-of-service (DoS) is a form of cyberattack that prevents legitimate users from accessing a computer or network.
- 2) In a DoS attack, rapid and continuous online requests are sent to a target server to overload the server's bandwidth.
- 3) Distributed denial-of-service (DDoS) attacks leverage a wide web of computers or devices infected with malware to launch a coordinated barrage of meaningless online requests, blocking legitimate access.

How Denial-Of-Service Attacks Work

DoS attacks are on the rise as businesses and consumers use more digital platforms to communicate and transact with each other.

Cyberattacks are often launched to steal personally identifiable information (PII), causing considerable damage to companies' financial pockets and reputations. Data breaches can target a specific company or a host of companies at the same time. For example, a company with high-security protocols in place may be attacked through a member of its supply chain that has inadequate security measures. When multiple companies have been selected for an attack, the perpetrators can use a DoS approach.

Cyber attacks typically fall into one of three main categories: criminal, personal, or political. Criminally motivated attacks seek financial gain. Personal attacks may occur when a disgruntled current or former employee seeks retribution, steals money or data, or simply wants to disrupt a company's systems. Sociopolitical attackers—aka "hacktivists"—seek attention for their causes.

In a DoS attack, the cyber attackers typically use one internet connection and one device to send rapid and continuous requests to a target server to overload the server's bandwidth. DoS attackers exploit software vulnerability in the system and proceed to exhaust the RAM or CPU of the server.

The damage in loss of service a DoS attack does can be fixed in a short time by implementing a firewall with allow/deny rules. Because a DoS attack only has one IP address, the IP address can be easily fished out and denied further access using a firewall. However, there is a type of DoS attack that is not so easy to detect—a distributed denial-of-service (DDoS) attack.

Distributed Denial-of-Service (DDoS) Attack

A common type of DoS attack is the distributed denial-of-service (DDoS) attack. The attacker floods its target with unwanted internet traffic so that normal traffic is unable to reach its intended destination. Hordes of infected, connected devices (e.g., smartphones, PCs, network servers, and Internet of Things devices) from around the world go after a targeted website, network, web application, application programming interface, or data center infrastructure simultaneously to block traffic.

For example, the cyber vigilante group Anonymous uses DoS and DDoS attacks to take down government and corporate websites they disagree with. A denial of service attack is any attack that aims to prevent access to a service for legitimate users. That service might be a website, an email account, a network, or a device.

DoS and DDoS attacks can slow or completely stop various online services, including email, websites, ecommerce sites, and other online resources.

The various sources of attack traffic may operate in the form of a botnet. A botnet is a network of personal devices that have been compromised by cyber criminals without the knowledge of the devices' owners.

The hackers infect the computers with malicious software to gain control of the system to send spam and fake requests to other devices and servers. A target server that falls victim to a DDoS attack will experience an overload due to the hundreds or thousands of phony traffic requests that come into it. The server is attacked from multiple sources, detecting all the addresses may prove difficult. Furthermore, separating legitimate

traffic from fake traffic may also prove impossible, hence another reason it is hard for a server to withstand a DDoS attack.

Are DDoS Attacks Launched?

Unlike most cyberattacks initiated to steal sensitive information, initial DDoS attacks are launched to make websites inaccessible to their users. However, some DDoS attacks serve as a facade for other malicious acts. For example, when servers have been successfully knocked down, the culprits may go behind the scenes to dismantle the websites' firewalls or weaken their security codes for future attack plans.

A DDoS attack can also function as a digital supply chain attack. If the cyber attackers cannot penetrate the security systems of their multiple target websites, they can find a weak link connected to all the targets and attack the link instead. When the link is compromised, the primary targets would automatically be indirectly affected as well.

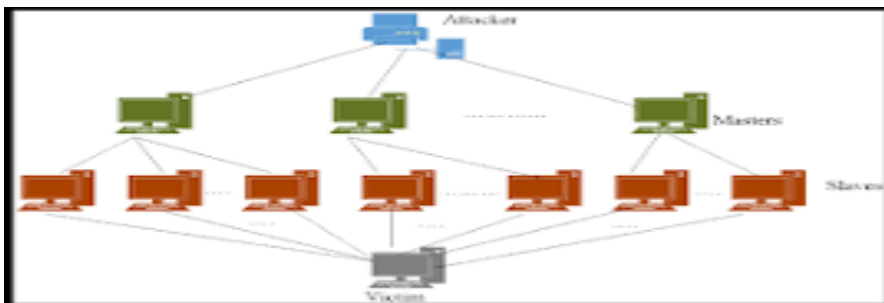


Fig 4.1: Diagram of DDOS attack in cyber crime

Cyber vandals keep creating new ways to commit cybercrimes for fun or profit. It is imperative that every device that has access to the internet has security protocols in place to restrict access.

DDoS Attack Examples

One of the more recent examples of a DDoS Attack occurred in February 2020, impacting Amazon Web Services (AWS), a cloud computing service used by over a million companies, individuals, and government entities.

The hackers used directories on Connection-less Lightweight Directory Access Protocol (CLDAP) servers to send huge amounts of information to AWS's servers—as many as 2.3 terabits per second (Tbps). However, Amazon was able to stop the attack before it became a big security risk for its customers.

In October 2016, a DDoS attack was carried out on a domain name system (DNS) provider, Dyn, which hosts and manages the domain names of select companies in this directory on its server. When Dyn's server was compromised, it also affected the websites of the companies it hosts. The attack on Dyn flooded its servers with overwhelming traffic, creating a massive web outage and shutting down over 80 websites, including major sites like Twitter, Amazon, Spotify, Airbnb, PayPal, and Netflix.

Some traffic was detected as coming from a botnet created with malicious software known as Mirai, which seemed to have affected more than 500,000 devices connected to the internet. Unlike other botnets that capture private computers, this botnet gained control over easily accessible Internet of Things (IoT) devices such as internet-connected cameras and recording devices. These weakly secured devices were then used to make a DDoS attack designed to take down the Sony Playstation Network's gaming platform by sending an insurmountable number of requests to Dyn's server.

What Is a DoS Attack?

A DoS (denial-of-service) attack is a cyberattack that makes a computer or other device unavailable to its intended users. This is usually accomplished by overwhelming the targeted machine with requests until normal traffic can no longer be processed. With a DoS attack, a single computer launches the attack. This differs from a DDoS (distributed denial-of-service) attack, in which multiple systems simultaneously overwhelm a targeted system.

What Is a DDoS Attack?

A DDoS (distributed denial-of-service) attack happens when multiple systems overwhelm the bandwidth or resources of a targeted system. A DDoS attack uses various sources of attack traffic, often in the form of a botnet.

What Do Cyber attackers Target?

Cyber attackers are motivated by different goals. For example, they may seek:

- i. Financial data (business and customer)
- ii. Sensitive personal data
- iii. Customer databases, including personally identifiable information (PII)
- iv. Email address and login credentials
- v. Intellectual property, such as trade secrets and product designs
- vi. IT infrastructure access
- vii. U.S. government departments and agencies

The Bottom Line

Denial of service attacks are methods used by hackers to shut down internet service for a specific purpose. Extortion, theft, political statements, or just doing it for fun are reasons these attacks take place and because of denial of service and distributed denial of service attacks—and many other security issues—it's important to ensure you use the latest, updated hardware in your personal and professional life. Likewise, businesses should also have the latest technology to secure their data. If you can afford it as a business owner, it's best to hire the services of a cybersecurity firm to ensure you and your customers have the latest security. Therefore, the introduction of cyber security is an inevitable field to be studied in order secure cloud storage information by the experts.

What is Cyber Security?

Cyber security refers to measures taken to protect Internet-connected devices, networks, and data from unauthorized access and criminal use. Additionally, cyber security ensures the confidentiality, integrity, and availability of data over its entire life cycle.

Cyber security applies to software and hardware, as well as information on the Internet. It can protect everything from personal information to complex government systems.

Key Takeaways

- 1) Cyber security refers to the measures taken to protect devices, networks, and data from unauthorized access and criminal use.
- 2) Cyber security can span various protection measures, such as preventing cyber criminals from hacking into computers and other connected devices and stealing sensitive information.
- 3) Password protection and encryption are types of cyber security measures.
- 4) Common types of cyber attacks include phishing, malware, eavesdropping attacks, and denial-of-service (DoS) attacks.

Understanding Cybersecurity

Cyber security measures include preventing, detecting, and responding to cyberattacks. Any information stored on an Internet-connected device, computer system, or network can be hacked. With the proper measures in place, this can be prevented. Given that the world is more reliant on computers than ever before, cyber security has become essential.

Cyber security ranges from simple to complex. As a basic preventative measure, most devices come equipped with password protection to prevent hacking. Updating software is another straightforward way to prevent cyber-attacks.

If a system is attacked or at risk of an attack, specific measures might be taken depending on the type of attack. Encryption, for example, is one way to prevent attacks, and certain antivirus software can detect suspicious activity online and block most software attacks.

In order to ensure that a system is secure, it's essential to understand the risks and vulnerabilities inherent to that specific device or network and whether or not hackers can exploit those vulnerabilities.

Cybersecurity measures must constantly adjust to new technologies and developments to stay one step ahead, as hackers adapt their methods to new forms of cybersecurity and render previous measures ineffective.

Types of Cyber Attacks

Cyber-attacks can have wide-ranging effects on individuals, businesses, and government organisations, including monetary loss, identity theft, and reputational damage. They are classified by the method of attack. Though there are many types of cyber-attacks, some of the most common include:

Phishing

Phishing occurs when an email or text appears to be sent from a reputable source. The goal of phishing is to trick the recipient into sharing sensitive information like credit card details and login credentials or to install malware on the victim's machine. Phishing is one of the most common attacks on consumers.

Malware

Malware is malicious software intended to cause damage to a computer or network. Types of malware include viruses, worms, spyware, and ransomware. Malware can find its way into computers when a user clicks a link or email attachment that installs malicious software.

When inside the system, malware can block access to key components of the network (ransomware), covertly obtain information by transmitting data from the hard drive (spyware), disrupt components, and render the system inoperable.

Eavesdropping Attacks

An eavesdropping attack (aka a man-in-the-middle attack) is when a hacker intercepts, deletes, or modifies data as it is transmitted over a network by a computer, smartphone, or another connected device. Cyber criminals take advantage of unsecured network communications to access data as a user sends or receives it.

Eavesdropping often occurs when a user connects to a network that is not secured or encrypted and sends sensitive business data to a colleague. Eavesdropping attacks can be hard to spot because, unlike some other cyber-attacks, the presence of a listening device may not affect the device or network's performance.

Denial-of-Service Attacks

Denial-of-service (DoS) attacks target devices, information systems, and other network resources to prevent legitimate users from accessing services and resources. This is typically accomplished by flooding the server and host with traffic to the point that it becomes inoperable or crashes. DoS attacks are system-on-system attacks, meaning they originate from a single location and target a single system.

Distributed Denial-of-Service Attacks

Distributed denial-of-service (DDoS) attacks are similar, but the attack comes from multiple remote machines (zombies or bots). These attacks can be deployed much faster—and with more traffic—than DoS attacks, so they are typically harder to detect than DoS attacks.

The number of people who fell victim to phishing scams in 2021, according to the FBI. This is up from 241,342 in 2020, for a 34% year-over-year increase. The Internet Crime Complaint Center, or IC3, received an average of 552,000 complaints per year over the last 5 years, representing losses of \$6.9 billion in 2021 alone.

Common Targets of Cyber attacks

Though any individual system is at some level of cyber-attack risk, larger entities such as businesses and government systems are often the targets of these attacks because they store a lot of valuable information.

The Department of Homeland Security, for example, uses high-tech cyber security measures to protect sensitive government information from other countries, nation-states, and individual hackers.

Cybercrime is on the rise as criminals try to benefit from vulnerable business systems. Many attackers are looking for ransom. The average ransomware payment climbed to a record \$570,000 in the first half of 2021, according to a report from cybersecurity firm Palo Alto Networks.

Any financial system that stores credit card information from its users is at high risk because hackers can directly steal money from people by accessing these accounts. Large businesses are often attacked because they store personal information about their extensive network of employees.

The industries with the most cyber-attacks between November 2020 and October 2021 by basic web application attacks are finance (226 incidents), healthcare (173 incidents), professional (164 incidents), public administration (158 incidents), and information (144 incidents).

What is the Difference Between DOS and DDOS?

Both types of attacks overload a server or web application to interrupt services for legitimate users. A DoS (denial-of-service) attack comes from a single location, so it's easier to detect its origin and sever the connection. DDoS (distributed denial-of-service) attacks originate from multiple locations. They are faster to deploy and can send much larger amounts of traffic simultaneously, so they are harder to detect and shut down.

Is Cyber Security a Good Career?

Due to ongoing and increasing cyber security threats, the industry has a very promising career outlook. There are not enough skilled people to fill cyber security jobs, so professionals are likely to find jobs easily. On Oct. 28, 2021, Microsoft announced plans to cut the cyber security workforce shortage in half by 2025 by partnering with community colleges across the U.S. and providing free resources to help end the shortage.

What Is Spoofing?

Spoofing is a type of scam in which a criminal disguises an email address, display name, phone number, text message, or website URL to convince a target that they are interacting with a known, trusted source. Spoofing often involves changing just one letter, number, or symbol of the communication so that it looks valid at a quick glance. For example, you could receive an email that appears to be from Netflix using the fake domain name “netffix.com.”

Key Takeaways

- a. Spoofing to trick you into divulging personal information can be done through email, text messages, caller ID, and even GPS receivers.
- b. Be skeptical of any request for personal information, download files only from trusted sources, and install reputable antivirus and antimalware software.

- c. If you think you've been spoofed, file a complaint at the Consumer Complaint Center of the Federal Communications Commission (FCC). If you have lost money, contact the local police.

How Spoofing Works

Spoofing criminals try to gain your trust, and they count on making you believe that the spoofed communications are legitimate. Often, using the name of a big, trusted company—such as Amazon or PayPal—is enough to get targets to take some kind of action or reveal information.

For instance, a fake email from Amazon might indicate a problem with a recent purchase which could motivate you to click on the link to learn more (hint: Don't click on the link). From that link, you could download malware or be directed to a fake login page, where you unknowingly enter your username and password.

Spoofing can lead you to disclose personal and financial information, send money, and download malware, which can lead to infected computers, financial fraud, and identity theft. Spoofing can be used to spread malware via links and attachments, bypass network access controls, and restrict access through denial-of-service (DoS) attacks. At the corporate level, spoofing can cause infected computer systems and networks, data breaches, and loss of income.

There are several kinds of spoofing, including email spoofing, text message spoofing, caller ID spoofing, and URL and GPS spoofing. Essentially, if there's a form of online communication, spoofers are trying to scam their way into it—and into your identity and your assets.

How to Protect Yourself from Spoofing

There are several ways to protect yourself from would-be spoofing scammers:

- a. Turn on your email's spam filter. This will prevent many spoofed emails from ever landing in your inbox.
- b. Don't click on links or open attachments in emails from unknown senders. If there's a chance that the email is legitimate, reach out directly to the sender to confirm that it's real.

- c. If you get a **suspicious email** or text asking you to log into your account for some reason, don't click on the provided link. Instead, open a new tab or window (or the dedicated app on your phone) and log in directly to your account.
- d. Display file extensions in Windows. Windows does not display file extensions by default, but you can change the setting. To do so, click the "View" tab in File Explorer and check the box to show file extensions. While this doesn't prevent scammers from spoofing file extensions, you'll be able to view any spoofed extensions and avoid opening any malicious files.
- e. Invest in reputable cyber security software. Good software will alert you about potential threats, stop downloads, and prevent malware from taking over. Keep in mind that the software only works if you keep it updated and use it regularly.
- f. If you get an inquiry seeking personal information, don't provide it. Hang up (or log off) and then look up the phone number or customer service email address from the entity purportedly contacting you for your personal information.

If you think you've been spoofed, you can file a complaint at the Consumer Complaint Center of the **Federal Communications Commission (FCC)**. The FCC doesn't act on individual complaints but will add that information to its database. If you've lost money because of spoofing, the FCC recommends contacting your local police department.

Types of Spoofing

Email Spoofing

Email spoofing is the act of sending emails with false sender addresses, typically as part of a **phishing** attack intended to steal your data, ask for money, or infect your computer with malware. This tactic is used by both dishonest advertisers and outright thieves. The spoofer sends emails with a falsified "From:" line to trick victims into believing that the message is from a friend, their bank, or some other legitimate source. Any email that asks for your password, Social Security number, or any other personal information could be a trick.

These emails typically include a combination of deceptive features, including:

- i. False sender addresses that look like someone who you know and trust
- ii. A missing sender address, or at least one that is hard for the average user to find

- iii. Familiar corporate branding, such as logos, colors, call-to-action buttons, and the like
- iv. Typos, bad grammar, and unusual syntax (e.g., “Good day sir, please made certain this data is well and good”).

Text Message Spoofing

Sometimes referred to as smishing, text message (SMS) spoofing is similar to email spoofing. The text message appears to come from a legitimate source, such as your bank or a doctor’s office. It may request that you call a specific phone number or click on a link within the message to get you to divulge personal information.

Caller ID Spoofing

Here, the spoofer falsifies the phone number from which they are calling in the hope of getting you to take their call. On your caller ID, it might appear that the call is coming from a legitimate business or government agency, such as the Internal Revenue Service (IRS). Note that the IRS says it doesn’t call taxpayers to tell them they owe taxes without first sending them a bill in the mail.

Spoofing comes in many forms, but the goal is usually to trick people into divulging personal information that criminals can use.

Neighbor Spoofing

This is a type of caller ID spoofing in which the call appears to be from someone you know or a person who lives near you. The FCC says that the Truth in Caller ID Act prohibits “anyone from transmitting misleading or inaccurate caller ID information with the intent to defraud, cause harm or wrongly obtain anything of value.” If they’re caught (and that’s a big “if”), the spoofer can face penalties of up to \$10,000 for each violation.

URL or Website Spoofing

URL spoofing happens when scammers set up a fraudulent website to obtain information from victims or install malware on their computers. For instance, victims might be directed to a site that looks like it belongs to their bank or Credit Card Company and be asked to log in using their user ID and password. If the person falls for it and logs in, the scammer could then use the information that the victim typed in to log into the real site and access their accounts.

GPS Spoofing

GPS spoofing has a somewhat different purpose. It attempts to trick a GPS receiver into believing it is in a different location or headed in a different direction by broadcasting bogus GPS signals or other means.

At this point, GPS spoofing is more likely to be used in warfare or by gamers (e.g., Pokémon GO players) than to target individual consumers, although the technology exists to make anyone vulnerable.

Man-in-the-Middle (MitM) Attacks

These spoofing attacks involve three players: the victim, the entity that the victim is trying to communicate with, and the “man in the middle” who intercepts the communications. The spoofer attempts to eavesdrop on the exchange or impersonate one of the parties. The goal is to intercept information that is useful, sensitive, or potentially profitable (e.g., login credentials and credit card information). Stolen information can be used to approve financial transactions, for identity theft, or it may be sold to a third party.

IP Spoofing

This type of scam happens when someone wants to disguise or hide the location from where they’re sending or requesting data, so they replace the source Internet protocol (IP) address with a fake one. The spoofed IP address looks like it’s from a trusted source (the original IP address) while masking its true identity: an unknown third party. Virtual private network (VPN) services allow users to mask their IP and location, which can also be used for legitimate reasons such as privacy or streaming content went traveling overseas.

Facial Spoofing

This is the latest form of spoofing. With facial spoofing, a criminal uses a person’s face and simulates their facial biometrics by using a photo or video to replace their identity. Facial spoofing is most commonly used to commit bank identity fraud. However, it is also used in money laundering.

Spoofing vs. Phishing

Spoofing involves faking one's identity, and can be used for various attacks such as identity theft.

Phishing is one such use of spoofing that attempts to steal somebody's personal information or credentials by having them volunteer that information from a nefarious source that looks legit. For instance, a phishing email may appear to come from your bank, but the link inside would direct you to a phony

version of the bank's website. If you enter your credentials, they are subsequently turned over to the attacker.

How to Detect Spoofing

Spoofing can be sophisticated, so the key is to pay close attention to the details and trust your instincts. Be wary of websites with no lock symbols or green bars, or URLs that begin with HTTP instead of HTTPS, the encrypted version of HTTP. Another way to tell a fake website is if your password manager doesn't auto fill your login—a sign that it doesn't recognize the website.

With emails, take a close look at the sender's address, keeping in mind that scammers will use fake domains that are very similar to legitimate ones. Of course, typos, bad grammar, and unusual syntax in the email are also red flags. If you're still unsure, copy and paste the contents of the email into Google, where a quick search can reveal if a known scam is circulating. Finally, always hover over an embedded link to reveal the URL before you click on it. If the URL looks suspicious, it is likely a scam. Expand the details of the sender to see if the email address is correct and not just the name. Also pay attention for alternations in small details like a capital "i" (I) for a small "L" (l).

With phones, caller ID is easily spoofed. Scammers often use neighbor spoofing, so it appears that calls are coming from a local number. They may also spoof a number from a government agency or business that you know and trust. The FCC advises people not to answer calls from unknown numbers—and to hang up immediately if you do answer such a call.

To hover on a link that's on your smartphone, hold your finger on the link for a few seconds. A window will pop up that shows the full URL of the link. This can help you determine if the link is reliable or suspicious.

Is Spoofing Illegal?

Spoofing can be illegal depending on the type of spoof, the intent, and the jurisdiction involved. If you mask your phone number and there is no harm, spoofing is legal. But in the U.S., the FCC prohibits anyone from transmitting misleading or inaccurate caller ID information with the intent to defraud, with fines up to \$10,000 per instance. An example of spoofing is a common spoofing scenario happens when an email is sent from a fake sender address, asking the recipient to provide sensitive data.

Typically, the recipient is prompted to click on a link to log into their account and update personal and financial details. Links in spoofing emails also infect the recipient's computer with malware.

What is the Difference between Spoofing and Phishing?

The terms “spoofing” and “phishing” are often used interchangeably, but they mean different things. Spoofing uses a fake email address, display name, phone number, or web address to trick people into believing that they are interacting with a known, trusted source. Phishing tricks you into providing personal data that can be used for identity theft. Many phishers use spoofing tactics to trick their victims into believing they are providing personal information to a legitimate, trusted source.

The Bottom Line:

People have pretended to be other people or the representatives of other organisations since time immemorial. However, with the advent of the internet and online communications, "spoofing" has become much easier and more widespread. Websites, emails, geolocations, and phone numbers today can all be spoofed by bad actors to commit crimes, steal identities, or perpetuate scams.

Knowing how to spot and protect against spoofing is important in the digital age. At the same time, spoofing can provide anonymity for internet users for legitimate purposes of privacy. The use of VPNs, for instance, can mask your location and identity when surfing the web.

4.3 Forensic Computing

Definition: Computer forensics is a field of technology that employs investigative techniques to identify and store evidence from a computer device. Often, computer forensics is used to uncover evidence that could be used in a court of law.

Computer forensics is the application of investigation and analysis techniques to gather and preserve evidence from a particular computing device in a way that is suitable for presentation in a court of law.

Forensic computing (also known as the computer forensics or **cyber forensics**) refers to the practice of investigation and analysis in order to gain knowledge from a specific computing device regarding a legal case. Forensic computing aims to gather necessary information through a well-structured, proper investigation and find out what exactly took place on a specific computing device and who was before the device.

As a prominent branch of the **digital forensic sciences**, forensic computing looks for evidence stored in computers, smartphones, tablets and other digital storage media. The evidence unveiled by the **forensic computing professionals** can be referred to in court settings and provide necessary information to steer a case.

Even though forensic computing is often mentioned with the investigation of serious computer crimes, it can also be a strong and useful ally in civil life as well.

How Forensic Computation Techniques are being Used

Forensic computation: is the process of identifying, preserving, analysing and presenting digital evidence in a manner that is legally acceptable.

Forensic computation can be applied to a wide array of areas. In fact, we can name only few areas where forensic computation techniques cannot be useful. As a result, forensic computation practices have been a dependable ally for many, including the law enforcement officers. As a matter of fact, law enforcement forces and agencies were one of the earliest adapters of **forensic computation**. That is why forensic computation is closely tied with law enforcement and its development is often both supported and encouraged by them.

In some instances, computers can offer very important information regarding the legal cases. And in other instances, computers are the actual crime scenes where illegal action took place.

Denial of service attacks, hacking, cracking and such cybercrimes take place in the virtual realm and when we need to find out who carried out these heinous actions, we often need to take a closer look at the suspects' computers and internet history.

There we can find valuable information like chats, e-mails, browser history, pictures and various other files that offer relevant information regarding serious crimes like fraud, drug trafficking, murder and such.

In addition to the files themselves, investigators can also gain access to the metadata of these files. A user's actions are recorded and kept in various places within a computer, including but not limited to the note taking software, logs, photo editing software, internet browsers and such with a thorough forensic examination, experts can find out when a specific file appeared on the device, where it came from, when was the last time it was viewed, edited, saved or printed.

Moreover, the experts can also pin down which user happened to carry out these actions.

In addition to solving serious and heinous crimes, forensic computing can be referred to solve or offer valuable information regarding the following cases:

- i. Forgeries, spurious bills, counterfeit documents
- ii. Regulatory compliances
- iii. Intellectual property theft
- iv. Fraud

Phishing

Disputes regarding employment inappropriate use of email and internet in the workplace.

What are the Stages of a Forensic Computing Examination?

There are six different stages of a forensic computing examination. You can find these stages below.

1. Readiness
2. Evaluation
3. Collection
4. Analysis
5. Presentation
6. Review

ENCRYPTION

Encryption is a technique employed for keeping sensitive and private information safe, such as passwords, identity information, and credit card details. In this article, we will explain what encryption is in detail. As a member of the society in the 21st century, you must have accounts on some online platforms or done online shopping at least once in your life. Have you ever wondered how your sensitive information like credit card details, passwords and such are kept safe in such platforms? The answer is short and quite straightforward: encryption! In this article, we will take a closer look at what encryption is and how it can be very crucial for your organisation's **cyber security operations**.

What is encryption?

Simply put, encryption refers to the practices that aim creating ciphertexts from plaintexts. Plaintexts are the texts that can be read and understood by the third parties. On the other hand, ciphertexts are scrambled texts that cannot be understood by the third parties if they somehow managed to get their hands on this piece of information. In order to decipher a text, you need to use a cipher or an encryption algorithm that will sort out the ciphertext and recreate the plaintext. To the plain eye, encrypted data may seem very random or even chaotic. In fact, it is ‘scrambled’ in a very rule governed, predictable way.

How is Encrypted Data Deciphered?

The intended receiver of the encrypted data can decipher it with the help of a key, an algorithm, a decoder or something similar. If the data and the encryption technique are on the digital realm, the intended receiver can use the corresponding **decryption tool** and acquire the information they need.

The thing used for decryption purposes can be called as the key, cipher or algorithm. Below you can find detailed information on each.

Cipher: The term cipher refers to the algorithm that is specifically used for the encryption purposes. A cipher consists of a set of successive steps at the end of which the **encrypted information** is decrypted. There are two main kinds of ciphers: stream ciphers and block ciphers.

Algorithm: Algorithms are the procedures that are followed by the **encryption processes**. There are numerous types of algorithms that are specifically used to decipher encrypted files and information: blowfish, triple DES and RSA are some of these types. In addition to the algorithms and ciphers, brute force can be used to decrypt an encrypted text.

What are the Different Kinds of Encryption?

There are various techniques employed for encryption. As a result, one can opt for various types of encryption. Below you can find detailed information on these different kinds.

Symmetric encryption: In this kind of encryption, all the communicating parties have the same key for encryption and decryption purposes.

Asymmetric encryption: In this kind of encryption, two different keys are used. One is for the encryption purposes and the other is for decryption purposes. One of these keys are shared publicly while the other one is kept private. That is why **asymmetrical encryption** is also known as the public key encryption. This specific kind of encryption is also of pivotal importance for SSL (TLS).

Hacking

Hacking and hackers are popular topics that are known and uttered by almost everyone, yet ethical hacking is rather a mystery to most. What it is and how it can be beneficial to your organisation?

What is Ethical Hacking?

Ethical hacking (also known as pen testing or penetration testing) is a term that covers the intruding practices aiming to discover any threats and significant cyber security vulnerabilities that can be found and exploited by an ill-intended attacker. Such vulnerabilities can cost organisations their valuable data, hard earned image or even billions of dollars. That is why ethical hackers exist.

They try to find weak spots and issues of an organisation's security system before ill intended hackers do. An ethical hacker seeks the answers of the following questions in order to help security teams improve an organisation's security posture.

To find answers to the questions above, ethical hackers attack an organisation and test their security measures.

Why is Ethical Hacking Important?

There is no doubt that information is the most valuable asset in today's business environment. From government agencies to private companies, all kinds and sizes of organisations deal with massive amounts of sensitive and valuable data on a daily basis.

As a result, they are often targeted by terrorist groups, hacker teams, and cyber criminals. In order to be safe and protected, organisations of all sizes take numerous security measures but simply locking your doors and shutting your windows can't ensure your safety. In today's world, organisations need to take proactive measures and update their security on a regular basis. Every day, hackers find new methods to penetrate through the barriers of firewalls, antivirus software and such, so your organisation needs to keep up.

Ethical hackers, or white hat hackers, offer a new approach to safety. In order to test your security measures, they perform '**pen tests**' on your organisation. In other words, they 'hack' your systems for you and provide you with insight and valuable information regarding your organisation's security posture. As a result, you seize the opportunity to see your organisation from the perspective of a hacker without facing actual threats like sensitive data theft.

When you know how hackers see and approach your organisation, you can update your security measures accordingly. Thus, you can make sure that the walls around your organisation are thick and protective enough.

What are the Types of Ethical Hacking?

There are different kinds of ethical hacking practices since almost every component of a system can be hacked and these ‘hacking’ performances require deep knowledge regarding that component. Below you can find a list of different **ethical hacking practices**.

- i. Web application hacking
- ii. Social engineering
- iii. System hacking
- iv. Hacking wireless networks
- v. Web server hacking
- vi. smurf attack is a type of DDoS attack that aims to create high traffic on your network and harm your organisation. Read more to learn how you can avoid such attacks.

What is a Smurf Attack?

A smurf attack is a type of DDoS attack that consumes the essential resources of your network through the utilisation of ICMP Echo mechanism. In other words, an attacker tries to flood a server with ICMP packets in order to render it inaccessible.

When successful, a smurf attack can overwhelm an entire computer network and make it inoperable.

Dating back to the second half of the 1990s, smurf attacks are relatively old but they manage to remain as a relevant threat because of their sheer popularity amongst hackers and cyber criminals. That is why you must be informed about smurf attacks and how you can prevent your organisation against them.

What are the Types of Smurf Attacks?

There are two main types of smurf attacks: basic and advanced.

Basic Smurf Attack: When the targeted network is flooded with a seemingly endless array of **ICMP request packets**, a basic smurf attack is successful. The ICMP request packages include a source address that is set to the broadcast address of the target’s network. If the packets succeed to disperse

properly, every single device within the target network replies the ICMP request with an echo. As a result, an **immense** traffic which will bring the whole systems down is created.

1. **Advanced Smurf Attack:** Advanced smurf attacks start off just like the basic smurf attacks. ICMP request packages that feature the source address directed at the broadcast address of the target network are created and dispersed swiftly. Then the devices within the network replies ICMP requests with echoes, yet this time these echo requests have the ability to configure their sources so that the sources can respond to third party victims. As a result, attackers can reach various targets at once and slow down a larger part of the web.
2. Advanced smurf attacks allow attackers to widen their scope and target bigger groups.

History of Smurf Attacks

The very first smurf attack was conducted by Dan Moschuk, also known as TFreak in hacker circles. The name of this type of **DDoS attack** is inspired by the cartoon and comic strip characters called Smurfs.

Smurf attacks aims to overwhelm and take down a large and strong entity by performing considerably small but plentiful attacks. Hence this technique is named after Smurfs –the small, blue creatures that are able to overpower their much bigger enemies when they work together.

During the second half of the 1990s, smurf attacks were very popular and threatening, yet today almost all organisations are immune to such cyber-attacks.

What is a Fraggle Attack? A **Fraggle attack** is a specific type of smurf attack where the hacker sends massive amounts of **DUP traffic** to Echo and CHARGEN ports. The basic principle behind a fraggle attack is very similar to the one behind smurf attacks: creating an overwhelming traffic to render networks inoperable.

The very first fraggle attack was conducted by **TFreak** as well. You might also want to learn about Top Cyber threats.

What is Data Breach?

A data breach is a security violation, in which sensitive, protected or confidential data is copied, transmitted, viewed, stolen, altered or used by an individual unauthorized to do so. Other terms are unintentional information disclosure, data leak, information leakage and data spill.

What Types of Data or Information Can Leak in a Data Breach? There are several types of data or information that can be leaked during a data breach. These include:

- 1) The Personally Identifiable Information (PII) such as name, username, password, social security number, address, and so forth.
- 2) Financial data such as financial statements, invoices, tax forms, bank details, debit or credit card numbers.
- 3) The Personal Health Information (PHI), which is created by a health care provider and is related to an individual's past, present, or future mental or physical health, as defined by the HIPAA standard.
- 4) Intellectual Property such as contracts, customer lists, blueprints, trade secrets, and patents.
- 5) State secrets such as information related to national security or military secrets.
or any other data or information that is valuable and can pose financial and reputational damage.

How Can Data Breach be Prevented?

Though hackers are fast and sophisticated in their operations, nevertheless, some best practices and efficient security tools can help organisations and individuals contain this problem. Here is some help.

- a) **SIEM** - The Security Information and Event Management (SIEM) is the first line of defense against data breaches. Even compliant regulations require this essential tool to be implemented. SIEM effectively detect security events and raise alerts to notify the security teams. Moreover, SIEM integration allows security professionals to integrate other tools such as threat intelligence feeds, IDS or IPS.
- b) **SOAR** – Security Orchestration, Automation, and Response (SOAR) is also an effective tool that assists enterprises to prevent data breaches and counter cyber-attacks. Like SIEM, SOAR also integrates incredibly well with the diverse security tools to provide multiplayer security. More importantly, its automation feature is extremely important to address the cybersecurity skills gap.

- c) **Patch Management** – Patching is also a critical factor that cannot be disregarded. All systems and applications should be patched and updated. The process should be repeated in a timely fashion.
- d) **Segmentation** – This is also a good practice in which the compromised area of the network can be segmented or limited in order to avoid further escalation.
- e) **Principle of Least Privilege (PLP)** – The PLP provides only the level of access or privilege to the user (s) that is necessary to perform a specific task.
- f) **Encryption** – Encrypt critical data whether it is stored on a hard drive or on a cloud.
- g) **Multi-Factor Authentication** – Use multi-factor authentication to contain the loss of login credentials.
- h) **Backup** – Use backup of all critical data so that such data can be recovered in the event of the data breach.
- i) **Education and Awareness** – Launch an education and security awareness program regularly to educate your corporate employees with regard to data breaches.

The primary goal of any web application or service is to **render high-quality performance** and meet the expectations of its customers.

It is possible that a web application may receive millions of requests per second and hence, it is not practically possible for a single system to respond to each of these incoming requests.

This is precisely where cluster **architecture** plays a vital role. Put simply; it is a system of interconnected nodes that cooperate with each other in sharing their workload. For example, there is a web application, and it is supported by a group of servers to handle the incoming requests.

This group of servers not only helps a web application in efficiently balancing the overall load but also increases redundancy in case if one of the servers in the group fails or breaks down. Especially for **e-commerce web applications** that require **high performance with minimal downtime**, **server clustering** ensures that the supporting infrastructure is working as needed even if one or more servers in the cluster are down.

Common Types of Clusters

Some of the most common types of clusters include **failover (high availability) clusters**, **load balancing** clusters, and high-performance clusters.

a) **Failover (High Availability) Clusters**

A failover cluster replicates existing servers and redundant hardware and software reconfiguration to increase service availability. Every constituent system is continuously monitoring the other so that if one node fails, the request is dealt with by other nodes. Such clusters are generally used by users with a high dependency on computer systems such as news websites, e-commerce businesses, etc.

b. **High-Performance Clusters**

Specifically used in complex scientific applications, high-performance clusters run parallel programs for time-exhaustive calculations. By intelligently sharing the workload among the connected nodes, high-performance clusters are able to increase performance significantly.

Other industries relying on **high-performance clusters** include graphics and video processing industry, augmented and virtual reality, etc.

c. **Load Balancing Clusters**

As the name clearly suggests, load balancing clusters distribute loads among the constituent servers for providing increased network capacity. Since the nodes are integrated, the incoming requests are evenly distributed across the connected nodes.

However, it must not be interpreted that the entire system is working together; instead, the incoming requests are evenly distributed as they arrive. Load balancing clusters are preferred by e-commerce businesses and internet service providers for managing a large number of user requests, while at the same time, maintaining a satisfactory level of performance.

Benefits of Logsign's Cluster Architecture

In order to provide our clients with state of the art **SIEM** and SOAR services, Log sign is supported by a mixed cluster architecture at the backend to support easier scalability, extended availability, efficient load balancing, effective self-healing, and necessary redundancy.

Massive Scalability

Depending upon the network size, Logsign can be either installed on a single cloud and a physical server or on multiple servers at once. Logsign's constituent services are operated as an active-active cluster. These

services are delivered through various servers for meeting performance expectations and optimized conditions. Logsign's cluster architecture allows horizontal as well as vertical stability.

High Availability

By utilizing **Logsign's cluster architecture**, the received data clones are available on multiple servers. If one or more than one servers are damaged, the rest of the servers keep operating efficiently as if nothing has happened.

Further, we block direct access from untrusted/unverified users in order to protect our clustered architecture from unexpected user behavior. With clustered architecture in place, security measures like **demilitarized zone (DMZ)** and firewalls are also implemented.

The feature set for our scalable cluster infrastructure consists of:

- a. Distributed Online Data Backup (2x, 3x, 5x)
- b. Hadoop Distributed File System (HDFS)
- c. **Multi-machine Distributed Service Balancing**
- d. Distributed Service Backup
- e. Distributed Process & Service Clustering and Balancing
- f. Data Clustering
- g. Hot/Cold Data Management
- h. Horizontally/Vertically Scalable Architecture
- i. Virtual and Physical Appliance Installment
- j. Health Monitoring and Alerting
- k. Offline Data Backup
- l. Self-Healing & Data Recovery

After a thorough analysis, it has been realized that **data breach** is a worldwide cybersecurity issue and is unstoppable. The companies have suffered a loss of billions of dollars due to ever-growing data breaches. The main causes of data breaches are poor cybersecurity defense, untrained employees, and negligent or disgruntled employees.

Though today's data breaches are very sophisticated and fast, organisations can take proactive measures to avoid these menaces. Security awareness and training should be given to employees, disgruntled employees

should be addressed, and more importantly, effective security tools such as **SIEM** and **SOAR** should be deployed.

4.4 Conclusion

We can conclude this chapter with the understanding of the objectives that actually dwelt on cloud computing, forensics computing and different type of cyber threats, attacks and the security measures to be put in place to secure every digital computation.

The reason for studying cloud and forensic computing, digital forensics investigations, the security architecture of a system and its vulnerability and how to control or curtail the menace with different types of solutions in place have been provided for practice purposes.

4.5 References

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4. Guide to computer Forensics & investigations (2014), 5th Edition- by Bill Nelson, Amelia Phillips, Christopher Steuart.
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6. An Introduction to Digital Forensics (2017) - by Andre Ames.

4.6 Exercise

1. Define Cyber security and expatiate on the needs for studying the discipline.
2. What is cyber-attack? Mention forms of cyber-attacks.
3. What information or part of the system is most attractive to a hacker and How to access?
4. What can a hacker do with the information they gain from the organisation?
5. What do you understand by DDoS? And how do you avoid it.
6. Differentiate between Spoofing and Phishing with examples.

Multiple Choice Questions

1. What is cloud computing? (a) delivery of service through internet (b) storage of processed data
(c.) Eliminating Malwares and virus (d) Denial of service.
2. Hacker does what ----- (a) Obstruct the accessibility of the right owner to its file or system
(b) block file directories (c.) Unauthorized accessibility to system files. (d) block operating system.
3. DDOS simply means ----- (a) Data denial service (b) Debunk Data of Service (c.) Distributed Denial of Service (d) Dislodged Distribution of Service.
4. During DOS attack, IP address can be fished out using -- (a) Firewall (b) Virus (c.) Firmware (d) Worms.
5. Types of cloud computing are except..... (a) Email (b) Creating & Testing Apps (c.) Deleting Audio and Video Steaming (d) Analysing Data.
6. Cyber security refers to the measures taken to protect ----- (a) Digital device (b) Networks (c.) e-money from unauthorized access (d) Criminal use.
7. Cyber-attack falls into one of this except ----- (a) Criminal (b) Personal (c.) Political motivated (d) Emotion.
8. Spoofing is a method used by hackers to steal information except ----- (a) E mail & Test Message (c) Caller ID (c.) Biometrics (d) Gps receiver.
9. Cyber-attack techniques include the following except ----- (a) Phishing (b) Malware (c.) Money Laundry (d) Eaves dropping.
10. What is Data breach? (a) Data security violation (b) Decryption of data (c.) Stealing caller ID (d) Network distortion

CHAPTER FIVE

TELECOMMUNICATION

Objectives: The students/candidates will be able to recognise the importance of communication with the introduction of digital devices such as telecommunication equipment with perfect integration of computer components for ease of information dissemination to enhance efficiency in personnel management operations and real-life situations.

The following could be achieved after the study of this material:

- (i) Understanding the meaning of telecommunication and its origin.
- (ii) Discover the differences between communication and telecommunication.
- (iii) Generations of telecommunication devices and connectivity.
- (iv) Importance of telecommunication in personnel management and real life situation.
- (v) Evolution of cellular Phone as a wireless communication device.

5.0 Introduction:

5.1 What is Telecommunication?

Telecommunications also known as telecom is the exchange of information over significant distances by electronic means and refers to all types of voice, data and video transmission.

The purpose of a telecommunication system is to exchange information among users of the system. This information exchange can take place in a variety of ways, for example, multiparty voice communications, television, electronic mail, and electronic message exchange.

We have four (4) Main Types of Telecom Services and Its Uses for Businesses

- a. **Voice Services.** Voice services are an essential part of modern telecom services for small businesses in the telecommunications industry.

- b. Data Services.
- c. Internet-Based Services.
- d. Cloud-Based Telecoms.

Telecommunications engineers design, construct, install and service telecommunications equipment and systems. They may work in telecommunication areas such as telephone and internet networks, radio and television broadcasting and satellite communications.

Some of the advantages of telecommunication are:

- a. Improve efficiency.
- b. Inspire collaboration.
- c. Bring flexibility to the workplace.
- d. Save time.
- e. Eliminate Face-To-Face contact.

5.2 Computer Networking

Computer networking refers to *interconnected computing devices that can exchange data and share resources with each other.*

Types of Computer Network

LAN: Local Area Network

MAN: Metropolitan Area Network

WAN: Wide Area Network

PAN: Personal Area Network

CAN: Campus Area Network



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Fig 5.1: Different types of computer/communication Networks

Basic Technology Network

The foundations of networking: switches, routers, and wireless access points. Switches, routers, and wireless access points are the essential networking basics. Through them, devices connected to your network can communicate with one another and with other networks, like the Internet.

Network Topology

Types of Network Topology: Physical topology is the geometric representation of all the nodes in a network. There are six types of network topology which are Bus Topology, Ring Topology, Tree Topology, Star Topology, Mesh Topology, and Hybrid Topology.

The two major telecommunication networks can be analog or digital, depending on the type of signals they transmit. Analog networks transmit information using continuous waves, while digital networks transmit information using discrete signals, such as ones and zeros and the typical examples of telecommunication networks are the telephone landline network, the mobile network, cable TV networks or the internet.



Fig 5.2: Types of Network Topology

What is the Difference between Communications and Telecommunications?

COMMUNICATIONS: A site for the transmission, transfer, or distribution of telephone service and related activities. While TELECOMMUNICATIONS: A structure built exclusively to support one or more antennae for receiving or transmitting electronic data or telephone communications.

There are common means of communication that can be refer to as WIFI and WIMAX which are germane in telecommunication (telecom) method that involves the exchange of information, such as voice, video and

data, using electronic devices. It's a wide term that encompasses many technologies like wireless and wired phones, fiber optics, radio, TV, the internet and other means of transmitted communication.

Telecommunication is very important in today's business to enhance Team Collaboration, provide access to services and communication capabilities needed to bring employees together, and make progress on any joint ventures.

What is WIFI?

Wi-Fi is a wireless networking technology that uses radio waves to provide wireless high-speed Internet access. A common misconception is that the term Wi-Fi is short for "wireless fidelity," however Wi-Fi is a trademarked phrase that refers to IEEE 802.11x standards.

Wi-Fi is a family of wireless network protocols based on the IEEE 802.11 family of standards, which are commonly used for local area networking of devices and Internet access, allowing nearby digital devices to exchange data by radio waves.

What is INTERNET?

The Internet is a vast network that connects computers all over the world. Through the Internet, people can share information and communicate from anywhere with an Internet connection.

The Internet, sometimes called simply "the Net," is **a worldwide system of computer networks** -- a network of networks in which users at any one computer can, if they have permission, get information from any other computer (and sometimes talk directly to users at other computers).

What is the Difference between WIFI and INTERNET?

WiFi is a wireless technology that establishes a wireless network to allow computers and devices with the required wireless capacity to communicate via radio waves. The Internet, on the other hand, is a global network of networks where computers communicate with each other via Internet Protocol.

What is WIMAX?

WiMAX is been describe as *a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL.*

WiMAX, the Worldwide Interoperability for Microwave Access, is a telecommunications technology aimed at providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access.

WiMax operates over radio waves on a tower-receiver model. A single WiMax tower can provide coverage over about 8,000 square km (3,000 square miles) and also connect to other towers via a line-of-sight microwave link to broaden coverage further.

What is the Difference between WiFi and WiMAX?

WiFi and WiMax are used to create wireless network connections. WiFi is used to create small networks and used to connect printers, computers, gaming consoles, whereas WiMax uses spectrum to deliver connection to network. WiMax is used to provide Internet services such as Mobile Data and hotspots.

The working method of WiMAX is little different from Wi-Fi network, because Wi-Fi computer can be connected via LAN card, router, or hotspot, while the connectivity of WiMAX network constitutes of two parts in which one is WiMAX Tower or booster also known as WiMAX base station and second is WiMAX receiver (WiMAX CPE).

5.3 Evolution of Cellular Technology

First Generation (1G)

Although not called 1G at the time, first generation mobile networks emerged in Japan in 1979, before rolling out to other countries such as the USA (1980), and the UK, (1985). Based on an analogue technology known as Advanced Mobile Phone System (AMPS), which used Frequency Division Multiple Access (FDMA) modulation, 1G networks offered a channel capacity of 30 KHz and a speed of 2.4kbps. 1G networks only allowed voice calls to be made, suffered from reliability and signal interference issues and had limited protection against hackers.

Second Generation (2G)

Despite its flaws the 1G network wasn't superseded until 1991, when 2G networks were introduced. Based on digital signaling technology, Global System for Mobile Communication (GSM) ,which increased security and

capacity, and 2G networks offered bandwidths of 30KHz to 200KHz allowing users send SMS and MMS messages, although at low speeds, up to 64kbps. Continuous improvement of GSM technology led to the introduction of so-called 2.5G, which incorporated packet switching in the form of GPRS and also EDGE technology. 2.5G enabled data-rates up to 144kbps, enabling users to send and receive e-mail messages and browse the web.

Third Generation (3G)

The arrival in the year 2000 of 3G, known as UMTS in Europe and CDMA2000 in the USA, heralded a change in the way mobile phones were used and viewed by the end user, becoming less about voice calls, more about social connectivity. Also based on GSM, the main aim of 3G was to support high-speed data and the original 3G technology allowed data-rates up to 14Mbps. With its ability to transmit greater amounts of data at higher speeds, 3G enabled users to make video calls, surf the web, share files, play online games and even watch TV online. Whereas 2G networks would enable a 3-minute MP3 song to be downloaded in around 6-9 minutes, the same file would take anywhere between 11 and 90 seconds to download on a 3G network. Today the most common use for 3G networks is as a backup for 4G.

Fourth Generation (4G)

The introduction of 4G really ushered in the era of the smartphone and hand-held mobile device. 4G is the first generation to use Long-Term Evolution (LTE) technology to deliver theoretical download speeds of between 10Mbps and 1Gbps, offering end users better latency (less buffering), improved voice quality, instant messaging services and social media, quality streaming and faster download speeds.

4G is also the first IP-based mobile network, handling voice as just another service and the technology is being developed to accommodate the Quality of Service (QoS) and rate requirements required by applications including wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content, Digital Video Broadcasting (DVB).

In the relatively short time since their introduction however, 4G networks are already struggling to cope with the demands placed upon them. Driven by emerging technologies such as Augmented Reality (AR), autonomous vehicles and the exponential growth of the Internet of Things (IoT), global demand for mobile bandwidth is growing at an explosive rate.

Technology giant Ericsson predicts a Compound Annual Growth Rate (CAGR) of 39 per cent in global mobile data traffic between now and 2023, equating to a total of 107 Exabyte's (EB) per month. As well as

being bandwidth hungry, emerging applications need higher speeds and lower latencies and the growing number of IoT devices is fuelling demand for ever higher numbers of connections – to over 29 billion by 2022, according to Ericsson.

Realizing that 4G/LTE networks will ultimately reach capacity, the International Telecommunications Union, (ITU), in 2015, defined the requirements specification for 5G.

The 5G Revolution

The ITU specification for 5G, contained in the document, ITU-R IMT-2020 (5G), is summarised in Figure 3. The ambitious specification represents a step-change in performance over 4G and aims to address the requirements of the emerging applications, described above. Throughputs up to 10Gbps (100 times faster than 4G networks) aim to satisfy the growing hunger for bandwidth; latencies of 1mSec (cf. 30 - 50mSec for 4G) will enable near-real time response rates; and connection densities of 1000 devices per square kilometer (100 times more than 4G) will support the growing numbers of IoT devices and sensors.

The first public cellular telephone system (first-generation, 1G), called Advanced Mobile Phone System (AMPS) [8, 21], was introduced in 1979 in the United States. During the early 1980s, several incompatible cellular systems (TACS, NMT, C450, etc.) were introduced in Western Europe. The cellular communications networks are known by their numeric generation: 1G, 2G, 3G, 4G and 5G.

5.4 Importance of Telecommunications

Telecommunications is an important tool for businesses. It enables companies to communicate effectively with customers and deliver high standards of customer service. It is a key element in allowing employees to collaborate easily from wherever they are located, remote or local.

Telecommunication gives an environment for employees to perform flexible work, with the help of video conferencing and video calling, employees can join corporate meetings from their homes and the employees can access corporate video calling from any PC or mobile phone.

Vast amounts of information are available to employees; telecommunications allows more employees to access and use the information and make decisions upon it. This helps to free up valuable time to allow for more productivity.

The Importance of Using Telecommunication: When businesses use telecommunication technology, they can communicate directly with customers, access the information they need anywhere and anytime, keep up with

their market, and create resources and relationships that help them to stay competitive. It is always imperative to highlight the most basic functions of a telecommunication system is transmission of information. Using this technology people can transmit information through instant messaging, email and more. These modes of communication can allow users to gather, analyse, share and synthesize information in a variety of ways.

Telecommunications in HR or Personnel Management

Telecom HR professionals are responsible for the management of employees in the telecommunications industry. They have a wide range of responsibilities that include employee recruitment, training, performance evaluations and compensation. These HR staff are responsible for recruiting qualified candidates to fill vacancies in their organisation, conducting performance evaluations and providing feedback to employees on how they can improve their skills (while providing them with the professional development programs to do so). Telecom HR professionals may also be involved in developing company wide diversity initiatives to ensure that all groups are represented at all levels of the company.

The telecommunications industry is faced with a variety of challenges, including:

- 1) Retention of qualified employees can be difficult when advancements in technology create so many evolving opportunities outside of the industry.
- 2) The fast pace of the industry itself can make it a challenge for HR to keep up with an ever-changing environment.
- 3) High turnover rates mean HR must develop compelling recruitment processes and focus on strong employee engagement.
- 4) In sometimes high-stress telecom environments, employees may develop “bore out syndrome” due to prolonged boredom in their work. This greatly affects productivity. This also becomes an issue in underemployed settings where employees feel overworked due to staffing shortages.
- 5) Despite being in a technology-based workplace, many telecom organisations use outdated and decentralized management systems to organize their employees and store important data.
- 6) The lack of a formalized career path in many sectors makes it difficult for employees to find their place in the company and know what they should be doing next.

- 7) An absence of clear standards or guidelines on how to deal with problems or disputes among employees complicates discipline.
- 8) The need for formal inclusion plans to help promote more diversity within the industry is clearer than ever.

Telecom companies will often use a combination of open source and proprietary software in their tech stack. When it comes to HR software, many still lack the tools they need to effectively automate many of the tasks that can streamline the entire HR process. This will not only save time but also reduce human errors in the process. Additionally, the software helps with performance management reviews and training programs for employees, leading to increased productivity.

HR in telecommunications sometimes involves dealing with a huge number of employees. A large employee pool can also lead to an increased risk of issues among staff. Hiring, onboarding and managing talent can therefore be a challenging task — one that HR Acuity is one of the computer software integrated into telecommunication devices in a digital twin format to take care every needs of personnel activities that provides centralized issue management and risk management software that can help in managing issues, identifying and prioritizing risks and generating formal and informal reports on various subjects. It provides a centralized repository where all the information related to the issue can be stored. Through effective and valuable insight provided by our employee relations management software, your organisation can monitor, track and even investigate issues. Through HR Acuity's unique human resource management system, you can work to prevent issues from impacting the productivity of your employees. The right HR technology can support and mitigate.

Applications of Telecommunications in human/personnel management cannot be underestimated because, it comes with huge amount of data or information to be managed effectively and accurately towards a better decision making by the organisation and this leads us to dwell on the components of telecommunication as applicable to the management of human resources. Therefore, Telecommunication systems have been made important by digital technology since it is now part of our daily life. Key components of telecommunication systems include: signals, communication channel and communication network.

Signaling is one of the most important basic principles in telecommunications because it has to convey information about the call through the telephone system in order to control, route, and maintain the call. In telecommunications, a channel refers to a “logical” transmission path.

How to Measure the Effectiveness of Telecommunications in Personnel Management?

A major concern and responsibility of corporate human resources management (HRM) is the systematic description of workers’ job-relevant strengths and weaknesses. Applications of telecommunication tools can be deployed through appraising employee performance as a function of human resource planning (HRP), which combines subjective (qualitative) measures with the objective (quantitative). Accurate evaluation of each employee’s performance can be used to assess:

- Workplace satisfaction/motivation: The employee’s desire to improve execution of job-related responsibilities
- Need for training: Identifying weaknesses in worker’s performance can pinpoint areas where further training is needed.
- Pay, bonus, reward decisions: Basing corporate financial rewards on job performance can be an incentive encouraging employees to work harder to meet corporate objectives.
- Personnel decisions: Performance appraisal data is also very useful to HRM in making decisions regarding worker promotions, demotions, discipline, training, layoffs and the like.

At the same time, the very act of monitoring and measuring employee performance can generate side-effects that interfere with the overall performance of the typical personnel management of a company. Thus, assessing employee performance in the personnel management requires implementation of appropriate appraisal procedures.

Some of the variables that could be subject of interest to a personnel expert which could be communicated to every employee due for appraisal at a point in time via telecommunication medium either within the locality or remotely are listed below:

Work Satisfaction

Measuring employee recognition of quality of worklife (QWL) provides ratings of worker job satisfaction, which relate to their commitment to and enthusiasm for completing job tasks. To what extent does enhanced QWL contribute to greater productivity? Are better satisfied employees more motivated?

Employee Motivation

Assessment can determine if each worker's measured motivation adds value to the company productivity and performance. At what point does employee motivation depend on such HRP-determinants as recruitment, training and incentives?

Technological Skill

Virtually every aspect of telecom work requires technological proficiency, from basic repair and job scheduling, to higher-level tasks involving new system development. Does the employee have sufficient technical skill to capably handle assigned job tasks, adding value to corporate functions?

Job-specific Performance Efficiency

Each job has a range of performance-levels that must be met to ensure satisfactory completion of work responsibilities, measures tied to cost-of-work and production. Will this employee benefit from further training?

Worker Compensation and Promotion

Performance appraisal generates data appropriate to HR decisions regarding employee pay, benefits and bonuses. It also provides reliable parameters for promotion/demotion decisions, as well as guidelines for disciplining poor performance, tardiness, absence, etc. Should salaries increase by based on an incremental system for worker service and seniority, or should they be based essentially on good performance? Similarly, should promotions be based on seniority or performance?

5. 5 Conclusion

It was deduced that the study of this pack as concern the digital and management information system relative to personnel management throws more intuitive and insights concerning the digital transformation of every

area of personnel management with the integration interaction process, and at the same time, the introduction of telecommunication tools will benefit not only from better analysis of worker performance, but also from the increased employee participation/productivity and job satisfaction resulting from putting the right worker in the right job.

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5.7 Exercises

1. What do you understand by the word “communications”?
2. State the importance of Telecommunications to personnel management practice.
3. Define and explain the concept of Telecommunications.
4. What is the difference between communications and Telecommunications?
5. State and highlight the significant improvements in the generation or evolution of Cellular Technology.
6. Differentiate between WiFi, WiMAX, Hotspot and Internet.

Multiple Choice Questions

1. Communication involves the following medium of passing messages except ----- (a) mechanical device (b) Electrical device (c.) Abstract device (d) Electromechanical device.
2. Information & Technology cannot be used to ----- (a) build a traditional counting device (b) create algorithms & flowcharts. (c.) Format a system (d) read a compact disk.
3. The widely used word processor is ----- (a) Liber office Writer (b) Google .Docs (c.) AmiPro
(d) Ms Word.

4. ICT can be used to develop the society through ----- (a) breaking internet security protocols
(b) creating more advanced virus (c.) the creation of models to increase efficiency in workers (d) the elimination of competitive markets.
5. Which of the following is a rule and regulation in computer laboratory? ----- (a) Arrange the computer and peripherals in an orderly manner. (b) Format the computers in the laboratory (c.) Hibernate the computers (d) unplug the computer when in use.
6. The organisation that regulates telecommunication in Nigeria is ----- (a) National communication commission (NCC) (B) Nigeria computer society (NCS) (c.) Nigeria Internet Group (NIG)
(d) Chartered Institute of Personnel Management (CIPM).
7. The following are the variables used to measure the effectiveness of communication in personnel management except ----- (a) performance appraisal (b) Added professional skills (c.) Arbitration
(d) Value added quality.
8. The key components of Telecommunications are as follows except ----- (a) Signals (b) Communication channels (c.) Employee Gateway (d) communication Network.
9. Telecommunication industries faces some challenges listed except ----- (a) Retention of qualified employees (b) Environmental & Societal challenges (c.) Profit making deficiency (d) Absence of clear standard.
10. What is the meaning of QWL? ----- (a) Quality worklife (b) Qualitative working liability (c.) Quality working Label (d) Qualified Work labour.

CHAPTER SIX

COMPUTER MAINTENANCE

Objectives: The students should be able to identify some of the problems associated to computer system at a time and proffer solutions to them as stated below:

- (i) Understand computer system configuration and specifications.
- (ii) Detect issues early, before they become problems (system troubleshooting).
- (iii) Prevent against viruses and malware (prevention on security threats).
- (iv) Speed up Your Computer (system upgrading).
- (v) Keep Antivirus Software Up-to-date (Intrusion prevention).
- (vi) Maximize Software Efficiency to enhance system performance.

6.0 Introduction

Computer maintenance keeps your computer running smoothly by performing regular tasks such as deleting temporary files, defragmenting your hard drive, and running virus scans. On the other hand, computer repair is fixing problems that have already occurred on your computer.

6.1 Computer maintenance

Computer maintenance refers to the maintenance of computer equipment to ensure its proper functioning. This mission is generally carried out by IT service companies, the ESN, or Digital Service Companies.

The two main components of system maintenance are preventive and corrective maintenance. Preventive maintenance involves taking measures to help keep the system functioning, whereas corrective maintenance involves the replacement or repair of a system or its components after they have already failed.

Setting up hardware and installing and configure software and drivers. Maintaining and repairing technological equipment (e.g. routers) or peripheral devices. Installing well-functioning LAN/WAN and other networks and manage components (servers, IPs etc.)

There are 5 types of maintenance to know about which are practicably as listed below:

- 1) Corrective maintenance.
- 2) Preventive maintenance.
- 3) Predictive maintenance.
- 4) Systematic preventive maintenance.
- 5) Conditional preventive maintenance.



Fig 6.1: Motherboard troubleshooting

You can easily locate your cooling system (cooling fan) positioned on top of the processor on the mother board and its function is to reduce the effect of heat on the processor when the system is working. Therefore, there is a need for frequent cleaning of the component from clusters of dusty particles.

Every computer system comes with an operating system (os), like windows, linux, Unix, MacOs etc. Depending on the manufacturers and the end-user.

The *computer system* is divided into three separate units for its operation. They are 1) *arithmetic logical unit*, 2) control unit, and 3) central processing unit. *ARITHMETIC LOGICAL UNIT (ALU)* *Arithmetic logic unit* is that part of the processor that deal with all arithmetic and logical operations and other calculated related assigned statement field into the computer system through the input device.

The second portion is the CONTROL UNIT that controls the flow of commands statement. It exists within the programmable unit of a processor inside the central processing unit, and the third one is the CPU itself (registry) that account for the numbers of operations and logs of file system registered on the processor.

In the process of carrying out computer system maintenance or upgrading, there may be a need for hard disk defragmentation. The user must also ensure a backup of every file/documents created in case the ROM, PROM and EPROM misbehave or there is a sudden power failure.

6.2 What is System Defragmentation?

System Defragmentation is a process of running a disk defragment or disk clean up on certain interval of time. Defragmentation simply means an act of dividing the whole system hard disk into sub-units through fragmentation process in order to give room for better performance of the disk, when it is not being occupied by unwanted files that can reside in the back up facilities.

There is an internal component of a computer system refer to as central processing unit (CPU), it comprises Arithmetic Logical unit, Control Unit and Register.

Processor:

What is a processor in a computer definition?

The processor is a circuit that performs all of the calculations needed to run the computer. Modern computers often have more than one processor. For example, a gaming computer typically has both a central processing unit (CPU) and a graphics processing unit (GPU).

Processor speed measures (in megahertz or gigahertz; MHz or GHz) the number of instructions per second the computer executes. The need for speed is most evident for schools that offer advanced computing classes including web design, animation and graphic design and the two common brands could be in the range of Intel icore series and the AMD relatively.

What Does Processor Mean?

A processor is an integrated electronic circuit that performs the calculations that run a computer. A processor performs arithmetical, logical, input/output (I/O) and other basic instructions that are passed from an operating system (OS). Most other processes are dependent on the operations of a processor.

The terms processor, central processing unit (CPU) and microprocessor are commonly linked as synonyms. Most people use the word “processor” interchangeably with the term “CPU” nowadays, it is technically not correct since the CPU is just one of the processors inside a personal computer (PC).

The Graphics Processing Unit (GPU) is another processor, and even some hard drives are technically capable of performing some processing.

Techopedia Explains Processor

Processors are found in many modern electronic devices, including PCs, smartphones, tablets, and other handheld devices. Their purpose is to receive input in the form of program instructions and execute trillions of calculations to provide the output that the user will interface with.

A processor includes an arithmetical logic and control unit (CU), which measures capability in terms of the following:

- 1) Ability to process instructions at a given time.
- 2) Maximum number of bits/instructions.
- 3) Relative clock speed.

Every time that an operation is performed on a computer, such as when a file is changed or an application is open, the processor must interpret the operating system or software’s instructions. Depending on its capabilities, the processing operations can be quicker or slower, and have a big impact on what is called the “processing speed” of the CPU.

Each processor is constituted of one or more individual processing units called “cores”. Each core processes instructions from a single computing task at a certain speed, defined as “clock speed” and measured in gigahertz (GHz). Since increasing clock speed beyond a certain point became technically too difficult, modern computers now have several processor cores (dual-core, quad-core, etc.). They work together to process instructions and complete multiple tasks at the same time.

Modern desktop and laptop computers now have a separate processor to handle graphic rendering and send output to the display monitor device. Since this processor, the GPU, is specifically designed for this task,

computers can handle all applications that are especially graphic-intensive such as video games more efficiently.

A processor is made of four basic elements: the arithmetic logic unit (ALU), the floating point unit (FPU), registers, and the cache memories. The ALU and FPU carry basic and advanced arithmetic and logic operations on numbers and then results are sent to the registers, which also store instructions. Caches are small and fast memories that store copies of data for frequent use, and act similarly to a random access memory (RAM).

The CPU carries out his operations through the three main steps of the instruction cycle: fetch, decode, and execute.

Fetch: the CPU retrieves instructions, usually from a RAM.

Decode: a decoder converts the instruction into signals to the other components of the computer.

Execute: now, the decoded instructions are sent to each component so that the desired operation can be performed.

INTEL OR AMD CPUS DUAL CORE, QUAD Core Processors to Choose from for Your System

Every PC has a Central Processing Unit (CPU) this acts as the brain of your system. It connects to the Motherboard and works alongside the other components processing many instructions at the same time between the different hardware and memory systems.

Advancements in CPU technology now mean systems typically come at least Dual Core, Quad Core or more processors (on one single chip) instead of the traditional one core per chip. Now the total number of Cores can slot into a socket as before and a single heat sink and fan can keep everything to the right temperature.



Intel Pentium Dual Core Processors

The Intel Pentium processors with Intel dual-core technology deliver great desktop performance, low power enhancements, and multitasking for everyday computing.



AMD Processor: Don't get too hung-up on reviews, you can view a number of benchmarks comparing the Intel and AMD equivalents head to head, sometimes AMD will be ahead sometimes Intel will be out in front. But unless you are crunching specific tasks you will not notice the odd fraction of a second or couple of seconds here and there.

If you are looking to upgrade just the CPU of your system, then you need to check what type of socket your Motherboard uses and then check what the current speed CPU is against the fastest speed version which can be used in your existing Motherboard.

Arithmetic Logical Unit (ALU):

An arithmetic-logic unit is the part of a central processing unit that carries out arithmetic and logic operations on the operands in computer instruction words.

In some processors, the ALU is divided into two units: an arithmetic unit (AU) and a logic unit (LU). Some processors contain more than one AU -- for example, one for fixed-point operations and another for floating-point operations.

In computer systems, floating-point computations are sometimes done by a floating-point unit (FPU) on a separate chip called a numeric coprocessor.

How Does an Arithmetic-logic Unit Work?

Typically, the ALU has direct input and output access to the processor controller, main memory (random access memory (RAM)) in a personal computer and input/output devices. Inputs and outputs flow along an electronic path that is called a bus.

The input consists of an instruction word, sometimes called a machine instruction word, which contains an operation code or "opcode," one or more operands and sometimes a format code. The operation code tells the ALU what operation to perform and the operands are used in the operation.

For example, two operands might be added together or compared logically. The format may be combined with the opcode and tells, for example, whether this is a fixed-point or a floating-point instruction. The output consists of a result that is placed in a storage register and settings that indicate whether the operation was performed successfully. If it isn't, some sort of status will be stored in a permanent place that is sometimes called the machine status word.

In general, the ALU includes storage places for input operands, operands that are being added, the accumulated result (stored in an accumulator) and shifted results. The flow of bits and the operations performed on them in the subunits of the ALU are controlled by gated circuits.

The gates in these circuits are controlled by a sequence logic unit that uses a particular algorithm or sequence for each operation code. In the arithmetic unit, multiplication and division are done by a series of adding or subtracting and shifting operations.

There are several ways to represent negative numbers. In the logic unit, one of 16 possible logic operations can be performed -- such as comparing two operands and identifying where bits don't match. The design of the ALU is a critical part of the processor and new approaches to speeding up instruction handling are continually being developed.

What Type of Functions do ALUs Support?

In computer science, ALUs serve as a combinational digital circuit that performs arithmetic and bitwise operations on binary numbers. This is a foundational building block of arithmetic logic circuits for numerous types of control units and computing circuits including central processing units (CPUs), FPUs and graphics processing units.

The following are a few examples of bitwise logical operations and basic arithmetic operations supported by ALUs:

- 1) **Addition.** Adds A and B with carry-in or carry-out sum at Y.

- 2) **Subtraction.** Subtracts B from A or vice versa with the difference at Y and carry-in or carry-out.
- 3) **Increment.** Where A or B is increased by one and Y represents the new value.
- 4) **Decrement.** Where A or B is decreased by one and Y represents the new value.
- 5) **AND.** The bitwise logic AND of A and B is represented by Y.
- 6) **OR.** The bitwise logic OR of A and B is represented by Y.
- 7) **Exclusive-OR.** The bitwise logic XOR of A and B is represented by Y.

ALU shift functions cause A or B operands to shift, either right or left, with the new operand represented by Y. Complex ALUs utilize barrel shifters to shift A or B operands by any number of bits in a single operation.

Registry

This is a portion in the hearth of the central processing unit of a computer system accommodate the registers of the system operation and the logs of files executed within a point in time when the system is been put to use, it also account for the keeping of job schedules on the processor.

System and file recovery cannot be done in isolation of registry in the central processing unit of a computer system, it also works with the volatile portion of the processor keeping the records of any commands, statement or operation that takes place during execution process.

Central Processing Unit (CPU)

The CPU interprets processes and executes instructions, most often from the hardware and software programs running on the device. The CPU performs arithmetic, logic, and other operations to transform data input into more usable information output. The computer's central processing unit (CPU) is the portion of a computer that retrieves and executes instructions. The CPU is essentially the brain of a CAD system. It consists of an arithmetic and logic unit (ALU), a control unit, and various registers.

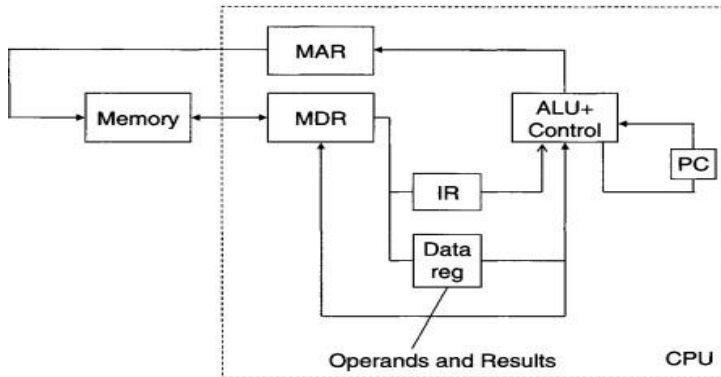


Fig 6.1: Architectural structure of a processor

Cache:

A CPU cache is a hardware cache used by the central processing unit (CPU) of a computer to reduce the average cost (time or energy) to access data from the main memory. A cache is a smaller, faster memory, located closer to a processor core, which stores copies of the data from frequently used main memory locations. Most CPUs have a hierarchy of multiple cache levels (L1, L2, often L3, and rarely even L4), with different instruction-specific and data-specific caches at level 1. The cache memory is typically implemented with static random-access memory (SRAM).

When trying to read from or write to a location in the main memory, the processor checks whether the data from that location is already in the cache. If so, the processor will read from or write to the cache instead of the much slower main memory.

Many modern desktop, server, and industrial CPUs have at least three independent caches:

Instruction cache

Used to speed up executable instruction fetch

Data cache

Used to speed up data fetch and store; the data cache is usually organized as a hierarchy of more cache levels (L1, L2, etc.; see also multi-level caches below).

Translation lookaside buffer (TLB)

Used to speed up virtual-to-physical address translation for both executable instructions and data. A single TLB can be provided for access to both instructions and data, or a separate Instruction TLB (ITLB) and data

TLB (DTLB) can be provided. However, the TLB cache is part of the memory management unit (MMU) and not directly related to the CPU caches.

6.3 What is Computer Backups?

Backup is the process of creating a copy of the data on your system that you use for recovery in case your original data is lost or corrupted. You can also use backup to recover copies of older files if you have deleted them from your system.

The most common examples for a home user would be an additional local hard drive, an external hard drive, optical discs (CDs, DVDs, or Blue-ray discs), or flash drives.

What Happens When You Back Up Your Computer?

Computer backup is a process that copies all your files, data and information to effectively create two versions – one on your original devices and one backup. It is designed to protect all of your important files and pictures, even the ones you save to an external hard drive.

How to Set Computer Back Up

Select Start > Settings > Update & Security > Backup > Add a drive, and then choose an external drive or network location for your backups.

There are three most common types of backup; full backup, incremental backup and differential backup. Other backup types include synthetic full backups and mirroring.

What Files Should I Back Up?

- 1) Personal Directories: Having a backup of your data is the most crucial thing to do.
- 2) Projects: Keep a copy of any creative work, such as projects, you're currently working on in case anything happens to your computer or you lose it.
- 3) Mails.
- 4) Important Files.

Where Can I Back Up Data?

You can use cloud storage providers such as Google Drive, iCloud, Dropbox, Backblaze, iDrive, and Microsoft OneDrive. Cloud storage offers several key advantages over other data backup methods, including:
Easy and convenient: Backing your data to the cloud is quick and easy

Effective Strategies to Safely Back Up Your Data

One of the best backup strategies to have is the 3-2-1 rule. This means creating 3 different copies of your data to put on 2 different storage types and keeping 1 copy offsite. By doing so, you'll be able to create a failsafe system that keeps your data safe. You can even maintain more than one offsite copy to be even safer.

There are more than a few ways to achieve the 3-2-1 backup rule. Using a combination of the following strategies, you can start to create a safe and secure way to prevent data loss.

1. Use an External Hard Drive

There are two types of external drives you can buy: HDDs (hard disk drives) or SSDs (solid-state drives). HDDs are considered a legacy technology, meaning they are much older and cheaper than SSDs. SSDs have much faster copy speeds and are typically more portable, making them the better option, but at a much higher cost.

There are a few ways to back up your important data with an external drive. You can do this by:

- i. **Using your computer's built-in backup software** - Most computers come with software that will automatically back up your files to an external storage device. All you have to do is connect the external drive to your computer, and the software will do the rest. For example, Apple computers use the Time Machine to create automatic backups.
- ii. **Using a third-party backup program** - You can also use a third-party backup program if you don't want to use your computer's built-in backup software. These programs can sometimes be faster and more efficient because it utilizes cloud software.
- iii. **Manually copying files** - Manual data transfer can be more time-consuming, but it's a good option if you don't want to use backup software.

When shopping for an external hard disk, make sure the drive is compatible with your computer and has sufficient storage space to do a full operating system backup. You also want to choose a drive strictly for data backups and a separate drive for daily use.

2. Use a USB Flash Drive

USB flash drives are great portable storage solutions to store the most important files from your computer. Since USB drives are typically much smaller than external hard drives, it might be more efficient to store only the most important files or documents, rather than an entire system backup.

To back up your data using a USB flash drive:

- i. Connect the drive to your computer.
- ii. Open Windows Explorer (or Finder on Mac) and locate the drive in the left-hand column.
- iii. Drag and drop the files and folders you want back onto the drive.
- iv. When you're done, eject the drive by clicking on the Safely Remove Hardware icon in your system tray (PC) or menu bar (Mac).

3. Use Optical Media

Optical media solutions like CDs or DVDs can be used to make a copy of your data. There are various burner solutions that allow you to copy and create an image of your files and important documents.

Optical media is effective because it provides a physical backup of your data that you can keep in a safe place. However, it is important to note that this method is not foolproof and there can still be data loss if the disk is damaged or scratched.

Another way to back up sensitive with an optical disk is to use a service like Mozy or Carbonite. These services allow you to store your data in the cloud and download it onto an optical disk. Optical media is a great option if you don't have a lot of space to store a physical backup.

4. Use Cloud Storage

Cloud storage is a great way to create backups as an online media type. This service can store files, photos, or any other type of data. Cloud storage can be used as a primary backup or as a secondary backup. A cloud storage service will offer you a certain amount of space on their servers for a monthly fee. You can then use this space to store your backups. Most providers offer encryption services so that your data is secure while it is stored in the cloud.

You can access your cloud backup from any computer or mobile device with an internet connection. Cloud storage makes it easy to restore your data if something happens to your computer or phone. You can use cloud storage providers such as Google Drive, iCloud, Dropbox, Backblaze, iDrive, and Microsoft OneDrive.

Cloud storage offers several key advantages over other data backup methods, including:

- a) **Easy and convenient:** Backing your data to the cloud is quick and easy. You can do it from anywhere, and you don't need any special equipment or software.
- b) **Safe and secure:** Cloud storage is a safe way to store your data. Your data is stored on servers protected from physical and logical threats and encrypted while in transit.
- c) **Affordable:** Cloud storage is very affordable, especially if you compare it to the cost of buying and maintaining your storage infrastructure.
- d) **Scalable:** As your data needs grow, you can easily scale up your cloud storage to meet those needs.

5. Use an Online Backup Service

You can back up your data with an online backup service by encrypting your files, scheduling regular backups, and storing the backup files in a safe location. Online backup services are a great way to protect your data in case of a computer crash or theft.

They offer security features like file encryption and password protection, allowing you to schedule regular backups (full and incremental backups), so you don't have to worry about losing your data.

Most online backup services also allow you to store your backup files in a secure location to rest assured that your data is safe and protected.

6. Invest in a Network Attached Storage (NAS) Device

If you are serious about protecting your data, invest in a Network Attached Storage (NAS) device. NAS is a dedicated server that provides file-level storage and sharing for your home or small business network. Unlike an external hard drive plugged into your router, a NAS is designed to be always on and connected so that you can access your data any time, from anywhere.

There are many benefits to using a NAS, but the two most important are reliability and security. With a NAS, your data is stored on its dedicated server, which means it's not susceptible to the same risks as a PC or laptop. For example, if your computer crashes or is infected with malware your data will still be safe on the NAS. NAS devices also come with a host of security features, such as password protection and encryption that help to keep your data safe from prying eyes.

Why You Should Back Up Your Data

- a) **Backups Protect You From Data Loss** - If your computer crashes or your hard drive fails, you could lose all of your data. Backing up your data protects you from this type of data loss and allows you to restore previous versions of your files.
- b) **Backups Guard You Against Malware and Ransomware** - If your computer becomes infected with malware or ransomware, your data could be encrypted and made inaccessible. Backing up your data protects you from this type of data loss.
- c) **Recover from Data Loss More Quickly** - If you lose data, it can take a long time to recover. If you have a backup, you can quickly restore your data and get back to work.
- d) **Data Gives You Peace of Mind** - Knowing that your data is backed up can give you peace of mind. If something happens to your data, you know you have a backup and can rest assured that you can recover it.
- e) **Remote Access** - If you have a backup of your data, you can access it from anywhere in the world. This is extremely useful if you work remotely or travel frequently. All you need is an internet connection, and you can get to your files.

Tips for Creating a Successful Data Backup Plan

Here are some tips for creating a successful data backup or disaster recovery plan:

- i. **Identify what data needs to be backed up.** Not all data is equally important, so it's important to prioritize which data needs to be backed up first. Make a list of your company's most critical data and make sure that this data is included in your backup plan.
- ii. **Choose the right backup method.** There are many ways to back up data, so choosing the method best suits your needs are important. If you have large amounts of data to backup, you may want to consider using an online backup service.

- iii. **Store backups in a safe location.** Once you have made your backups, storing them in a safe and secure location is crucial. If you are using an external hard drive, make sure that it is stored in a fire-proof and water-proof safe.
- iv. **Test your backups regularly.** It's important to test your backups regularly to ensure that they are working properly. Restore your backups to a test environment and check that all of your data can be accessed as expected.
- v. **Keep your backup plan up to date.** As your business grows and changes, so too should your backup plan. Review your backup plan regularly and ensure it is still meeting your needs.

6.4 System Restoration

What is System Restore?

System Restore is a feature in Microsoft Windows that allows the user to revert their computer's state to that of a previous point in time, which can be used to recover from system malfunctions or other problems.

System Restore attempts to correct issues with system stability after a particular event occurs that affects the performance of a computer. For example, System Restore could fix a problematic Windows update by bringing the machine to an earlier restore point.

When an install failure or data corruption occurs, System Restore can return a system to working condition without you having to reinstall the operating system. It repairs the Windows environment by reverting back to the files and settings that were saved in the restore point.

What are the Steps of System Restore with Windows (Os)

Follow these steps to restore Windows back to the previous day's version.

1. Click System Restore from the System Protection tab.
2. Click Next.
3. Select a restore point.
4. Click Next.
5. Confirm the restore point and system restoration, and then click Finish.
6. Once your computer restores the files and data, click Restart.

However, it is important to back up a restore system and here are steps to follow;

How do I Back Up my System Restore?

Restore files with File History. In the search box on the taskbar, type Control Panel, then select it from the list of results. In the search box in Control Panel, type File History and select Save backup copies of your files with File History from the list of results. Follow the instructions to restore your files.

6.4 Conclusion

This chapter is hereby concluded after achieving its set of objectives, impacted on candidates/students in the area of computer system maintenance, upgrading, configuration, back-up including several strategical ways to carry-out a backup processes and system restore. Some of the internal processing operation was also dealt with, such as the composition of central processing units, functions of ALU, CONTROL UNIT, REGISTER and CACHE. Different types of processor were examined such as intel icores and AMD to ascertain users choice during system configuration.

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6.6 Exercise:

1. Define and expatiate on the term "computer Maintenance"
2. State and illustrate the four (4) main components of central processing unit.
3. What do you understand system configuration and restore?
4. Define computer backup and state the reasons for it.
5. Explain the stages in computer system backup.

Multi Choice Questions

1. When do we need computer system maintenance ----- (a) needed at its optimal performance (b) Error signal time (c.) During invasion of virus (d) During system redundancy.
2. What is system error? ----- (a) Signs of system failure (b) Corrective attention messages (c.) Below optimal performance (d) Unexpected breakdown.
3. Why computer backup is much important in system maintenance? ----- (a) System recovery (b) low speed of operations (c.) Enable loss of information (d) Allow redundancy.
4. The components of Central Processing Unit (CPU) are except ----- (a) Arithmetic Logical Unit (b) Registry (c.) Control Unit (d) Random Access Memory (RAM).
5. What is the essence of System Restore ----- (a) Keep system up to standard performance (b) Defragmented system components (c.) To allow system intrusion (d) To make more money.
6. The reason for cloud storage is ----- (a) To have a more secure storage facility (b) To congest the storage facility (c.) To restrict accessibility (d) For efficient recovery.
7. Which file(s) must be compulsorily backup ----- (a) Personal Directories (b) Projects (c.) Mails (e) Money exchange folder.
8. Computer system configurations requirement involves ----- (a) system specification (b) Personal Directories (c.) system warranty (d) system routine maintenance.
9. System maintenance is at its best with ----- (a) Corrective maintenance (b) Preventive maintenance (c.) Predictive maintenance (d) Abstract maintenance.
10. System upgrade is necessary at ----- level (a) System Optimal performance (b) Low booting performance (c.) Fast processor (d) RAM effective performance

CHAPTER SEVEN

TECHNOLOGY TRENDS IN ACCELERATING HUMAN RESOURCES

7.0 Objectives: The candidates/students should be able to identify specific technology applicable to human resources enhancement especially in the era of digital life. This chapter will study some of the hardware and software that are needed and their trends in the management of human resources. It intended to mention artificial intelligence and machine learning, Digital learning, training & development, block-chain integration and mobile optimisation.

7.1 Introduction

The world of HR technology is rapidly evolving, and the future looks exciting. With advances in AI, machine learning, and data analytics, HR technology is poised to transform the way we work and manage our workforce. As technology continues to transform every aspect of our lives, it is no surprise that it is also having a significant impact on the field of human resources (HR).

From AI-powered recruiting tools to cloud-based HR management systems, technology is enabling HR professionals to work smarter, faster, and more efficiently than ever before. But what does the future of AI in HR hold? What new trends and developments can we expect to see in the coming years, and what implications will they have on automation in HR and the organisations they serve?

In this article, we will explore some of the most exciting trends in HR technology and their potential implications. We will examine how technology is enabling HR professionals to improve recruitment, engagement, and retention, as well as how it is helping them to manage a distributed and increasingly diverse workforce. We will also discuss some of the challenges and risks associated with it, such as the potential for bias and its effects on data privacy in HR.

7.2 Navigating the Trends of Automation in HR

As we explore the future of workplace technology, it is important to keep in mind that the field of HR is evolving rapidly and the trends and developments we discuss in this article may be just the tip of the iceberg.

They include:

AI and Machine Learning

AI and machine learning are transforming technology in the workplace by enabling more efficient and accurate recruitment, performance management, and employee engagement. With AI in HR, professionals can analyse large amounts of data and identify patterns and trends, allowing them to make more informed decisions about hiring, promotions, and employee development. AI in HR can also be used to automate repetitive tasks, freeing up professionals to focus on more strategic initiatives.

Predictive Analytics

Predictive analytics is another trend that is impacting the HR industry. By analyzing data on employee performance, engagement, and turnover, HR professionals can predict which employees are at risk of leaving and take proactive steps to retain them. Predictive analytics can also help identify high-performing employees who are ready for promotions or leadership roles, allowing HR to develop and retain top talent.

Employee Self-Service

Employee self-service is also becoming increasingly popular as a way to improve employee engagement and streamline HR processes. With self-service portals, employees can access information about their benefits, payroll, and time off, as well as update their personal information and submit requests for time off or other benefits. Self-service portals can reduce the workload on HR professionals and empower employees to manage their own HR needs.

How is Computer Used in Human Resource Management?

The main roles of computer in human resource management are decreasing time complexity, flexibility, record keeping problem etc. HRM system process lots of data everyday with the help of computer. This data processed easily without any fear of data loss so computer a vital role in human resource management system.

How Is Technology Used in Human Resource Management?

HR managers use technology to make their jobs easier and make better judgments. There's an application for that these days. This is especially true when it comes to managing employees in a company.

Aside from employee management, automation tools help in reducing paper use and organising data entry. Employees, for example, do not need to fill out paper forms that must then be entered by HR staff. All of this can be done through a centralized system like membership management software.

Here are some examples of how technology is used in human resource management.

1. Employee Management

Employee management deals with helping employees in achieving their full potential. Additionally, it also helps the company achieve its objectives. It's a comprehensive process that encompasses all aspects of human resources.

This includes recruitment, payroll management, and management. An automated employee management system improves all these processes. It allows companies to have a more standardized, systematic, and formal evaluation process.

More specifically, it provides: Greater employee-manager accessibility; improved training programs; and Effective performance reviews. For example, membership management software helps simplify administrative tasks. This includes handling dues payments and accounts receivable. Such tasks can be completed within minutes with the right tools. By using such software, a company can meet its goals without sacrificing employee satisfaction.

HR technologies that boost management and improve efficiency, such as taking the hassle out of payroll using a gross-up calculator, resulting in the overall success of the company. Regardless of their size or industry, organisations are striving to improve organisational performance.

Managers should make sure that all departments are improving their procedures and controls. They should also have their operations focused on enhancing the company's competitiveness. All of these can happen with tools like association management software.

2. Employee Engagement

Employee engagement applications are increasingly being used in performance management. These platforms and apps employ a range of strategies to keep employees engaged in their work.

Association management software includes features that increase employee engagement. Applications with posting and commenting features allow businesses to share information. On top of that, it also allows employees to express their thoughts about it.

Additionally, gamification strategies also help engage employees by making apps enjoyable.

3. Performance Management

Employers have also started to automate processes for monitoring employees' job performance. Most performance management modules usually have interactive features. This allows for employee feedback in a process known as continuous performance management. Such performance management can significantly improve employee retention and productivity.

Businesses can start with technology-assisted appraisals. These appraisals keep track of important information about employees. You can easily and quickly monitor their strengths and weaknesses. Additionally, it also stores employees' areas for improvement.

Individual performance management and skills data are used in workforce analytics. Based on the appraisal results, applications use this data to create tailored learning programs for employees. These assist employees in planning their career paths and developing their skill sets effectively.

4. Training and Development

A lot of training nowadays is done digitally and tailored to individual needs. It enables HR teams to keep track of progress and evaluate the effectiveness of established objectives. HR departments use online training sessions and webinars for employee development. They're also great for teams that are spread out across the country.

5. Recruitment

One of the most important functions of HR professionals is to hire people. Different technological solutions help them in maintaining a seamless recruitment procedure. Today, the majority of job positions are advertised online. Additionally, applications are processed through a single platform.

This makes reviewing application forms easier and faster. Recruiters use resume screening applications to remove submissions that aren't a good fit for the job. Using HR software for the recruitment process offers numerous benefits. It improves the recruitment team's overall productivity by automating monotonous and

time-consuming tasks. The software enables HR teams to engage with potential candidates on social media platforms, generating leads, and streamlining the recruitment procedure. Additionally, it allows for the collection and analysis of data from job candidates to further simplify the process. HR software also provides tools to tailor searches, helping staff find the best candidates for each position.

6. Employee Scheduling and Tracking

Simple things like overlapping leave requests can wreak havoc on a company's efficiency. The right HR software ensures that professionals can monitor employee availability. It also helps manage schedules properly. This enables the company to operate at maximum productivity throughout the year.

Moreover, there are several reasons why a company invests in employee scheduling and tracking software. This HR system enables the HR department to implement automated time off request and approval processes. As a result, it simplifies finding replacements and prevents under staffing caused by short-notice absences or time offs. Also, employee scheduling and tracking software can help reduce lateness and absenteeism by ensuring that all work schedules are released and distributed ahead of time.

7. Documentation

The HR department is tasked to ensure that employees have timely access to important information. This increases transparency within the company and fosters a culture of trust. Both of these are essential for employee productivity.

Additionally, HR technology makes use of a cloud-based system to store important employee data. This ensures that the data is available throughout the day. Additionally, it makes sure that it is safeguarded even in the case of a physical disaster.

Since all of the data is stored on cloud-based servers, paperwork is kept to a minimum. With a few clicks, you can access documents, handbooks, and training manuals.

HR technology can be used to disseminate information in a timely and useful manner. Some examples include Talent Management Software and AI-powered chatbots.

An HR information system (HRIS) has become a popular tool for managing employee data and information. These include work schedules, training, performance appraisals, payroll, and benefits. It can help generate reports necessary for compliance with specific labor laws and regulations and better decision-making.

If you want to streamline HR documentation/information, try out HRIS and book a demo today with one of the reliable software providers.

8. Integrated Management System

HR is now needed to collaborate with other departments inside the organisation. They've traditionally shared responsibilities with payroll. Today, they are required to share information and resources with other departments. These include the legal department, executives, and team leaders.

The best management systems make sharing easier. They ensure that all departments have the information they require to complete their tasks. This type of technological integration is important. It helps firms develop a corporate community, track employee behavior, and boost engagement and productivity.

7.2.1 Benefits:

Technology has brought about the beneficial transformation that is required in the HR department. Technology that centralizes administrative tasks helps put HR professionals' priorities into more important tasks. A list of association management companies can help you choose the best management software.

You can also look for association management software reviews online to help you decide. Remember that these applications and software should cater to your company's needs. So it's best to look for software that meets your needs.

However, you should keep in mind that technological breakthroughs can't compete with humans. Some roles and tasks are better off done by humans. While this is true, technology is still important to businesses.

What are the technologies used in HRM?

HR tech solutions include software, digital platforms, tools, and cloud-based technologies that securely store data, automate day-to-day processes, and provide analytical tools to make more strategic decisions.

7.2.2 Computer Application and Human Resource Management

The computer application in human resource management is the managerial applications of computer use which is usually known as management information system. In case of Human Resource Management, it is known as Human Resource Information System (HRIS). Computer converts the data into meaningful information needed by the manager to make decisions, planning and control.

Today HRIS is computer based information system. Manager as a decision maker is a processor of information. He must possess the ability to obtain the information, store the information, process and retrieve the information and use it for the right decision. Today knowledge is increasing with the tremendous speed. There is an explosion of knowledge. Current information is very essential for right decision.

Speed and accuracy is the special feature of computer. The machine does not get bored or fatigued. It can handle any quantity of data. The speed and accuracy of computer has led to speedy transactions and other business operations. The information is made available to management more quickly Computer provides large and sophisticated database to the manager that can be used at appropriate time for making decisions.

In recent times, computer languages are user friendly that allow manager to learn enough skills in a short time ranging from a day or two to have an access to the most of their demand for immediate and ad hoc information provided data are properly collected, organized and stored in a computer.

Management must insist on economic quality the quality which is cost effective. It should establish quality standards that reflect needs of the organisation. It can be easily done through “Quality Circles”. They should focus their attention on programming techniques, documentations, new technology use etc. Computer is a time saver device.

Data and Information:

There is a distinction between data and information. Data are facts and figures in the form of historical records that are not used in making decisions. Information on the other hand consists of data which are retrieved and processed and used for making decisions, forecasting and argument. Processed data is information.

Decisions Support System:

Decision support system aids the manager in decision making. According to R. H. Sprague and E. D. Karlson, decision support system is, “an interactive computer based system that helps decision makers utilizes data and models to solve unstructured problems.”

A decision support system can be created in which senior and experienced manager’s procedures and methods of decision making can be replicated. It will help the managers immensely to arrive quickly at a decision on any problem related to human resources of the organisation.

DSS facilitates the present executive to have experts' advice at his finger tips. The system is user friendly. It provides a readymade advice to the executive. DSS for several human resources problems can be developed and kept ready. DSS helps an executive to plan for future.

Database Management System:

It is a collection of software for processing interrelated data. In large organisations there is an expansion in succession at the bottom structure. They face with a problem of integrating the organisations human resources information.

Their activities should be integrated. The information about their activities should be integrated. There are several software packages that are developed to integrate the data contained in a data base. Such software packages are known as database management systems.

The data base management systems are special computer programmes enabling user to create, manipulate, retrieve and maintain file data. The database management system facilitates creation, addition, deletion and modification and sorting of records.

It also helps in preparing printed reports as per required specifications. It helps in arranging the data in desired sequence. It acts as an interface between applications programme and the office files.

The figure given below is an illustration:

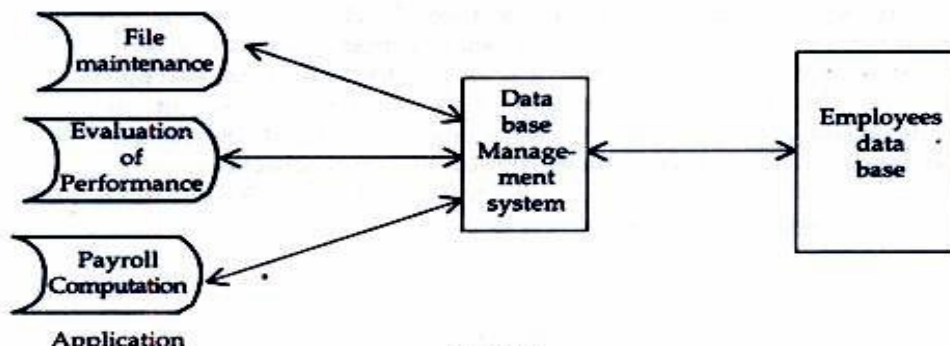


Fig 7.0: Database query Schema

Data base management system provides access to file inquiries and information, other details regarding employees, updates records, creates reports etc. It makes efficient use of computerised storage space.

Management Information System

Management information system or MIS is the old concept. The computerised MIS is new. Executives used MIS for planning and control. Computerised MIS added new dimensions by way of increased speed and accuracy. The use of computer has made the management information system feasible. It is not necessary that management information system should be computerised. There are host of tasks that are performed perfectly by employees and executives but there are certain tasks that can be speedily and accurately performed by this electronic machine” computer.

According to Gordon B. Davis and Margrethe H. Olson management information system (2020) “an integrated, user machine system for providing information to support operations, management and decision making functions in an organisation. The system utilizes computer hardware and software; manual procedures; models for analysis, planning, control and decision making; and a data base.”

MIS helps in integrating organisational information. In respect of human resources management, it helps in having the integrated information in respect of human resources of the organisation. The information can be utilized by anyone needing it for which the knowledge of computer is not essential. Simply knowledge of using it will do. MIS is a support system for various functions of management.

Organisation is a techno-economic and social system. MIS draws upon the organisation, organisation theory and management. It helps in understanding organisational structure and design, organisational change processes, motivation, decision making, organisational behaviour pattern etc.

Organisation is a system made up of several subsystems based on functional activities such as Production, Marketing, Personnel, Finance, Sales, Accounting, and Materials etc. MIS tries to bring about their integration for smooth working. Human resources are used in each system manning respective positions.

MIS helps in providing integrated information in respect of all human resources of the organisation. The information system should match managerial needs of the organisation. Computer Applications in Human Resource Management programme and the office files. The figure given below is an illustration.

Management’s Needs and Information Systems:

The information systems come to the rescue of employees and executives while performing their jobs at their workplace. The system helps them to improve their performance leading to complete job satisfaction. The

information needed by the executives differ in quantity and quality according to their position and level in the organisational hierarchy.

Traditionally the management of organisation has a pyramidal shape, i.e. narrower at the top having flattened base. This organisational pyramid can be divided into three levels; top, middle and lower. Top management consists of top level managers such as managing directors, chief executive officer etc., the middle level management consists of middle level management i.e., the departmental heads and lower level of management consists of the front line supervisors, superintendents and other operational staff. For performing the works they require different types of information.

The information for performance can also be divided, according to these levels because the decisions to be made differ according to the managerial hierarchy.

It is shown in the diagram given below



Fig 7.1: Management organogram in personnel/HR Management

The top level management requires Decision Support System or DSS to frame organisational strategy in respect of various aspects of organisation. They may frame the strategy in respect of human resources of the organisation. They have to take strategic decisions requiring an interactive computer based system which is known as decision support system.

The middle level management has to make tactical decisions for which they need the data base system known as management information system or MIS. Lower level management has to make operational decisions for actual work performance, the system they require for the purpose is known as the electronic data processing system or EDP system.

The information needed by the executive depends on the technical background, decision making ability and managerial leadership style adopted nature of the corporate body structure of organisation and executive's perception of requirements of information.

Human Resource System

Human resource is actually a subsystem of a system, the organisation. Human resource system includes acquisition of human resources, their training and development, compensation, other benefits, health and safety, job analysis, job description, job specification, performance evaluation, job evaluation, other information relating to human resources such as skill, competence, experience, their yearly increments, bonus, cost of acquiring human resources, cost of training, composing skill inventory, strategy in respect of acquisition, retention of human resources etc. The complete information in all these respects is to be kept ready at hand. Computers aid in keeping all the information, and make them available at the fingertips of a human resource manager. Human resources are the part of the whole system. They are working in all functional areas of the organisation manufacturing, marketing, sales, finance, logistics, research and development, advertising, etc.

Complete information is to be stored, compiled, processed, retrieved along with the external agencies like government, dealers, wholesalers, financiers, suppliers etc. A system oriented human resource function integrates and interrelates with other functions of the organisation. The computerised human resource system is known as human resource information system or HRIS. It is dealt with in the chapter Human Resource Planning earlier.

HRIS maintains the up to date information relating to all aspects of human resources of the organisation and works as decision support system. Its input is raw data and output is information. It is a system that acquires, manipulates, analyses, stores, retrieves and makes available the instant information in respect of human resources of the organisation.

The information is finished and structured one. Some personnel are required to work with the system. They include Systems Manager who is responsible for planning, monitoring and controlling the activities relating to computerisation.

System Analyst is another personnel required in the system to study and analyse the problems and prepare solutions and programme specifications. The third personnel in the system and in the hierarchy are the

Programmer. More programmers are required to prepare computer programmes based on specifications prepared by system analyst.

The fourth personnel in the system who works at the lowest level in the hierarchy is the Data Entry Operator. More such operators are required who are responsible for entering the data into computer system. This man machine interface is known as human ware or live wire. These people prepare several software's and databases and pass on the information on line by making these systems accessible. In this way eliminating waste and achieve significant improvements in data quality, thus helping the line managers to solve their human resource problems.

The computerised systems have added value to the human resource development and management giving an opportunity to emerge as power base in the organisation. Now the electronic mail, computer to computer links and videoconferencing have brought about transformation of human resource function. It has also brought down the overhead costs incurred.

The human resource management system consists of several inputs and outputs and other activities and processes working through information media. The system possesses a computerised data base management system, programme for cross checks for accuracy, modules for performing specific functions and a facility for special information to be provided on query.

Computer use in HRM:

The modern technology has brought in sea changes and transformed the organisational structure, working and culture. Computers and computer programmes have flooded into the organisations of all kinds and types giving no chance to escape from their influence. They are widely used in human resource management.

Human Resource Planning:

The vast data is required for human resource planning. Top management wants to prepare a long-term strategic planning for human resources. Human resource information system provides necessary information required for making essential projections regarding human resources requirements. The information can also be utilized for acquiring human resources, their promotion, transfer and career planning. Job analysis information helps in human resource planning.

Acquisition of Human Resources:

Acquisition of human resources is done through recruitment and selection. Human resource information system is a tool that provides a lot of help in internal posting of jobs which is done through recruitment. It is an internal source of recruitment. The complete information regarding skill, competence, knowledge, experience, training, educational qualification, age, sex etc. available to the human resource executive through HRIS enabling him to fill up the vacant position by way of promotion or transfer.

External recruitment also made easy with the help of computerised information's maintained by the organisation by way of keeping a track record of unsolicited applicants and at times taking the help from private employment agencies who maintain databases regarding various types of human resources available in different organisation and or other persons in search of jobs. The acquisitions of human resources by way of selection are quite lengthy and complicated procedure is adopted. All these complications are made easy by way of using computerised information. Test and scanning of applications are accurately performed through computers hence saving a lot of time and cost.

Training and Development:

In the area of training and development the computer has been used to a greater extent. There are computer assisted instructions that are widely used training techniques. Computer assisted instructions (C.A.I.) are the programmed learning methods.

Earliest in 1924 the use of rudimentary teaching machines was made but with the advent and availability of computers the programmed training is in vogue now. The computerised training system is utilized for hosts of job holders that include mechanics, clerks, pilots etc. Computer simulation of real job situation is of particular importance and it is on the job training method. It also helps trainee to gain practical experience.

Under computer managed instructions the trainees' competence is assessed by the computer before start of the training. The assessment continues till the end of the training. The assessment makes the trainer to modify training contents to suit the trainee's needs. Under computer based training, the facilities of computer aided instructions and computer managed instructions are combined together. Being comprehensive it provides many advantages to the trainee through effective learning.

Computer -based training (CBT) provides immediate feedback. A commoner gets more knowledge through CBT than in classroom training. The training through CBT can be provided at the place of working or where the trainees assemble. It is cost effective.

No costs are incurred on trainer as it is the programmed-based training. There is an improvement in CBT with the addition of video which is high tech training technique and is known as interactive video training. CD-ROM is also used for executive development. It is up to the organisation to make a choice of appropriate computerised training technique depending upon the availability of funds and the type of employees and executives undergoing training.

The high tech training methods have high initial investment but once purchased it is very cost effective. The evaluation of trainees and training programme can be immediately available which is not possible under other traditional training techniques.

Computer can store the information relating to trainees, their performance and their needs for further training. Up to date information in this respect can be made available as and when required by the human resource manager or any executive for that matter.

HRIS modules can be used to record the training received and cost of training can be monitored. There is a constant need to update the skills and knowledge of the employees and executives to meet the growing needs of the organisation. The computerised training programmes fulfill these needs of the organisation.

Career and Succession Planning:

Career planning requires thorough check up of one's own preferences, abilities, skills, competence, knowledge and expertise and values and their matching with the job requirements at the higher level available in the organisation or in other organisation. This is easily and accurately done by the computer for the individual employee and executive, and organisation.

The organisation can keep track of such ambitious employees and executives. Such personnel are very conscious of their career and career path and do not hesitate in leaving the organisation if an opportunity in their career path is denied to them.

One can say that career planning and computer applications are made for each other. The detailed inventory in respect of human resources of the organisation and the job details can be stored in a computer. Succession

system is another area where computer play an important role in suggesting a suitable person to succeed a retired one at a position. This can be easily maintained for employees and executives both.

Compensation

Compensation is yet another area where computer applications can be made. The compensation includes salary, wages and other benefits. The information required in this system is payroll and financial records. Human resource information system aids in wage and salary administration.

Several software packages are available in this respect to maintain and monitor the compensation administration. The employee gets the information relating to the salary drawn by him and compulsory deductions from the salary along with his leave records till date every month.

It saves manual labour of maintaining the large and heavy ledgers. The details regarding employees' contribution to provided fund, the interest thereon is also maintained and at regular interval the employees are handed over the details.

Performance Appraisal

If merit or performance is rated by an individual may be superior in rank and hierarchy, there is a scope for biased attitude. Computer can provide unbiased solution to the problem. Modules are available to help in evaluating performance. There are several software's available in evaluating the performance of the employees and executives having several rating scales in critical areas of performance. The organisation can make use of the relevant scales of evaluating the performance of its employees of various grades and ranks by varying the rating scale provided by the software.

Safety and Health

Safety and health at workplace is very essential. Healthy employees free from any disease having all the parts of body intact and safe are the assets of the organisation. The organisation having such human resources should boast upon itself. It deserves credit for excellent provisions in respect of safety and health of its employees.

It is a dream away from facts. But organisation can take utmost care of its employees keeping the records of occupational diseases, injuries and make the employees aware of them from time to time and also draw attention of the employees towards hazardous chemicals and other such materials and their use.

Human resource information system can develop a software and maintain the records of various categories of occupational diseases, their dangers, how people suffer from them, medical treatment available, methods of prevention, safety measures at the workplace, the cares to be taken etc.

The employees can be, through computer network at regular intervals or daily, made aware of all these and warn of the hazardous after effects. Computer in this respect can provide a healthiest system for safety and health of the human resources of the organisation. The computers aid in respect of maintaining health, cope up with stress, change in lifestyle and adopting the one that suits to his or her health, dieting etc.

Human Relations

Maintaining better human relations is a problem faced by many organisations. Every organisation expects better human relations and smooth functioning. The relations between union and management should be smooth and of cooperation. The computers can help in keeping the records of negotiations between unions and management, the agreements reached between the two.

Computer network helps in reminding the executives of the agreements and agreed terms between the management and unions. Executive's personal computer can be connected to an on line information search and retrieval system human relations information network. Employees can also have the access to the system knowing fully well what their leaders agree or disagree to. This promotes complete transparency in human relations or industrial relations in the organisation.

In modern times giant corporate bodies are coming up with global network employing lacks of employees and other officials across the world. They have different points of views and demand. To maintain them efficiently and satisfy their needs, it is therefore necessary for the organisation to develop an expert system that enable to have opinion survey of the employees, their perception, and advice. Computers help in streamlining the process and through this network, executives have at hand information and close contacts with the employees. Any problem crops up at any plant anywhere can be immediately attended and nipped it in the bud. Expert system can be developed to keep qualitative information along with quantitative one.

In this way, computers play a vital role in human resource management. Computers aid in facilitating smooth working and worry free environment at the plants, offices and at homes.

7.3 BLOCKCHAIN

Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network.

What is Block Chain Integration?

Block chain Integration is a powerful technology which creates an immutable record of transactions that can be used to optimise business processes, enhance security, and maintain trust between stakeholders. It reduces costs by removing middlemen and ensuring that transactions are quickly and accurately fulfilled.

What is the Main Purpose of Block Chain?

The purpose of the block chain is to share information among all parties that access it via an application. Access to this ledger in terms of reading and writing may be unrestricted ('permissionless'), or restricted ('permissioned').

What is artificial Intelligence (AI)?

Artificial intelligence is intelligence—perceiving, synthesizing, and inferring information—demonstrated by computers, as opposed to intelligence displayed by humans or by other animals. "Intelligence" encompasses the ability to learn and to reason, to generalize, and to infer meaning.

What exactly does Artificial Intelligence (AI) do?

AI enables technical systems to perceive their environment, deal with what they perceive, solve problems and act to achieve a specific goal. The computer receives data - already prepared or gathered through its own sensors such as a camera - processes it and responds.

How Does AI Work?

What Is Artificial Intelligence? Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence. While AI is an interdisciplinary science with multiple approaches, advancements in machine learning and deep learning, in particular, are creating a paradigm shift in virtually every sector of the tech industry.

Artificial intelligence allows machines to model, or even improves upon the capabilities of the human mind. And from the development of self-driving cars to the proliferation of generative AI tools like ChatGPT and Google's Bard. AI is increasingly becoming part of everyday life — and an area companies across every industry are investing in.

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Machine Learning

What is Machine learning? Machine learning is a form of artificial intelligence (AI) that teaches computers to think in a similar way to how humans do: Learning and improving upon past experiences. It works by exploring data and identifying patterns, and involves minimal human intervention. It is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy.

Types of Machine Learning

Machine learning involves showing a large volume of data to a machine so that it can learn and make predictions, find patterns, or classify data. The three machine learning types are supervised, unsupervised, and reinforcement learning.

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AI Benefits, Challenges and Future of AI

Combined values of block chain and Artificial Intelligence (AI)

Authenticity

Block chain's digital record offers insight into the framework behind AI and the provenance of the data it is

using, addressing the challenge of explainable AI. This helps improve trust in data integrity and, by extension, in the recommendations that AI provides. Using block chain to store and distribute AI models provides an audit trail, and pairing block chain and AI can enhance data security.

Augmentation

AI can rapidly and comprehensively read, understand and correlate data at incredible speed, bringing a new level of intelligence to block chain-based business networks. By providing access to large volumes of data from within and outside of the organisation, block chain helps AI scale to provide more actionable insights, manage data usage and model sharing, and create a trustworthy and transparent data economy.

Automation

AI, automation and block chain can bring new value to business processes that span multiple parties — removing friction and adding speed, and increasing efficiency. For example, AI models embedded in smart contracts executed on a block chain can recommend expired products to recall, execute transactions — such as re-orders, payments, or stock purchases based on set thresholds and events — resolve disputes, and select the most sustainable shipping method.

Mobile Optimisation:

Mobile optimisation is the process of adjusting your website content to ensure visitors can easily access and navigate your site on mobile devices. In today's consumer landscape, if an organisation is not strategically optimizing its marketing efforts for mobile, it is likely falling short in reaching customers, and missing out on sales. If you feel your company may be lagging behind the mobile curve.

There are six mobile optimisation tactics that you can utilize for improving your mobile marketing efforts:

1. Optimise Email for Mobile Usage

While it may seem like an obvious channel for marketers, brands all too often neglect email marketing as it pertains to mobile. Marketers need to be sure they're sending mobile-friendly emails; whatever of the email content, from a welcome email to a purchase confirmation, customers expect to be able to easily read and navigate the email regardless of the device they're using at the time.

Imagine an email is originally, and successfully, viewed on a desktop computer, but then the customer wants to show their friend a featured product on their mobile device. If that email isn't optimized for mobile, it can

result in a frustrating experience, potentially causing you to lose not only potential customers but also risking negative social media sharing. Every email must be viewable and engaging, regardless of device.

2. Create Engaging, Mobile-Centric Experiences

Mobile optimisation and marketing strategies must be carefully implemented or brands risk alienating their customer base. After all, marketers are reaching customers on one of their most personal possessions: their mobile phones.

Brands must provide highly personalized, engaging, and mobile-centric content across all of these channels in a way that is consistent as the user jumps from one interaction to another. Beyond ensuring their website is mobile responsive, brands can increase the personalisation of product recommendations and in-app messaging, and automatically trigger personalized responses as the app is used, boosting conversion rates and increasing the number of active customers.

In addition, brands must also ensure their customer service and assistance support is mobile-centric. FAQs and contact information must not only be available, but also built to accommodate a wide range of screens for maximum effectiveness.

After all, customers tend to have short attention spans when using mobile devices.

As such, if they must search or zoom in for assistance, they are likely to simply navigate away, or close the app altogether.

All customer experiences, from shopping to buying to customer support, must be mobile optimized and streamlined.

3. Utilize Mobile Messaging Tactics

Remember all those people you would see on their mobile devices if you walked down a street or sat down in a coffee shop? Many of them would likely be using text or SMS messaging at the moment you saw them. More than 4.2 billion people worldwide use text as a communication method, and billions of texts are sent every day. This level of usage represents a major opportunity for marketers to reach their customers in one of the most impact ways yet: intelligent SMS marketing. Adding mobile messaging to a marketing strategy allows brands to reach their target customers even when they are offline. These mobile messages, whether in or out of app, can work within existing omni-channel strategies to create maximum value for customers.

4. Track Mobile Behavior

In order to best optimize mobile experiences, marketers must know the mobile behaviors and preferences of each target audience segment. Capturing data directly from the mobile device is, obviously, the best way to do so. Tracking app events, from installation to key interactions, can provide detailed information critical for segmentation and setting up triggered events across all mobile channels.

5. Test and Retest Mobile Tactics

To be successful in the increasingly mobile world, marketers must to continue to test and retest their mobile strategies, and optimize them according to the results. Mobile tactics change fast and often; one that worked six months ago will no longer be as effective or impact today. Real-time data and insights provided by tracking data will allow marketers insights into how their customers interact with their mobile devices and into the performance of their mobile marketing programs.

6. Make Every Word Valuable

Mobile phones aren't the ideal conduit for long form reading, so keep that in mind. Leverage images, videos, and other forms of visual content to supplement your writing. Keeping viewers engaged on your site will help them along on the customer's journey.

More than ever, customers are initiating relationships with brands through mobile by engaging via social media channels, downloading apps, or visiting mobile sites. When a visitor lands on your site, you need to take advantage of every second that you have their attention. Be direct, engaging, and let them know what separates your brand from the competitors.

Examples of Machine Learning

Real-World Examples of Machine Learning (ML) are:

1. Facial recognition.
2. Product recommendations.
3. Email automation and spam filtering.
4. Financial accuracy.
5. Social media optimisation.
6. Healthcare advancement.

7. Mobile voice to text and predictive text.
8. Predictive analytics.

The HR analyst should be able visualize and predict the level of impact of the burning issues on the organisation and find ways to tackle them and make planning for avoiding such issues in future. The core issues which are dealt by HR analytics are about employee turnover rate and their retention, evaluation of employees, deciding salaries and benefits, designing and improving employee training programmes and measuring work burden on employees by using.

Below diagram represents HR issues which can be dealt and tackled by HR analyst so as to avoid impact on the business and overall performance of the organisation.



Fig 7.2: workforce analytics and planning

How to Solve HR Problems Using Data and Analytics?

Human Resource analytics: is at the intersection of three bodies of knowledge.

Human Resource Management: sets the meaning and purpose of the analytics.

Data Warehousing: knowing how to process and store HR data efficiently, automation of collection of data and cleaning data. Statistical Analysis, Presentation and Interpretation: helps in translating the identified HR issues into appropriate analyses and communication of results.

7.4 Conclusion

We can easily conclude on this chapter, once it is established that candidate can understand the application of appropriate technology trends in accelerating the human resources management using artificial intelligence, machine learning and more also, the introduction of block chain integration with digital learning, mobile optimisation and E-performance management which comprises of system design to capture data and review at multiple levels, work with employees to determine the type of data to be captured and support performance improvement which are vital in enhancing the management of human resources. Finally, the solution provider must establish a performing monitoring system that provide feedback on employee to enhance productivity.

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7.6 Exercises

1. What do you understand by digital HR transformation?
2. Define and explain the concept of artificial intelligence.

3. State and enumerate the effect of block chain integration in human resources management.
4. How does machine learning and artificial intelligence enhanced the performance of an employee.
5. What effect does digital learning has on the performance of an employee.

Multiple Choice Questions

1. The basic managerial skills in HR are ----- (a) To supervise (b) To motivate (c.) To stimulate (d) All of these
2. The actual achievements compare with objectives of the jobs ----- (a) Job performance (b) Job Evaluation (c.) job description (d) None of these.
3. HR planning involves four distinct phases ONE of this stage is ----- (a) Business Scanning (b) Forecasting human resource records (c.) Organisation development (d) Planning.
4. ----- is a performance measure of both efficiency and effectiveness (a) Organisational behaviour (b) Organisational citizenship (c.) Employee Productivity (d) None of these.
5. Job evaluation is based on the: ----- (a) complexity of the job to perform (b) Conceptual skill required by the job (c.) Relative job worth for an organisation (d) Physical skill required by the job.
6. Which of the forecasting techniques is the fastest ----- (a) Work study techniques (b) Flow Model (c.) Ratio trends Analysis (d) HR demand forecast.
7. Human Resources Information System is ----- (a) An Integrate of core process into streamlines system (b) Collaborate core process into streamlines system (c.) Plan core process into streamlines system (d) All of these.
8. e-HRM stands for ----- (a) Electronic-HRM (b) Economic- HRM (c.) Equal-HRM (d) None of these.
9. Recruitment and selection must be effective to ensure it ----- (a) offset high labour turnover (b) Deliver highest caliber of individual at optimum cost (c.) Encourages new blood into the organisation (d) To have backup in case of sickness and absence.

10. What techniques are used when analysing internal supply? ----- (a) Turnover rate (b) Inflows and Outflows (c.) condition of works and absenteeism (d) All of these.

CHAPTER EIGHT

DIGITAL HUMAN INTERPLAY

The aim of this chapter is to introduce candidates or students to the knowledge of developing an interacting medium or dashboard between human intelligence or reasoning and system itself with a common working environment and more also, understand the importance of HCI in our day-to-day lives with the following objectives:

- (i) Students should be able to understand the design process.
- (ii) Students should be able to understand the usability criteria of a design process in software development.
- (iii) To learn the iterative process as a crucial customer feedback to inform critical decision towards usability.
- (iv) To understand design rationale of recording those design decisions.

8.0 Introduction

The primary objective of Digital Human Interplay or HCI is to design systems that make them accessible, usable, efficient, and safe for anyone and everyone. This implies that people with a wide range of capabilities, expertise, and knowledge can easily use HCI-designed systems. It also encompasses people with disabilities.

8.1 What Is DHI OR HCI?

A digital interface is the medium through which humans interact with computers. Interfaces represent an amalgamation of visual, auditory, and functional components that people see, hear, touch, or talk to as they interact with computers (digital devices).

Human-computer interaction (HCI) is the field of study that focuses on optimizing how users and computers interact by designing interactive computer interfaces that satisfy users' needs. It is a multidisciplinary subject covering computer science, behavioral sciences, cognitive science, ergonomics, psychology, and design principles.

The emergence of HCI dates back to the 1980s, when personal computing was on the rise. It was when desktop computers started appearing in households and corporate offices. HCI's journey began with video games, word processors, and numerical units.

However, with the advent of the internet and the explosion of mobile and diversified technologies such as voice-based and Internet of Things (IoT), computing became omnipresent and omnipotent.

Technological competence further led to the evolution of user interactions. Consequently, the need for developing a tool that would make such man-machine interactions more human-like grew significantly. This established HCI as a technology, bringing different fields such as cognitive engineering, linguistics, neuroscience, and others under its realm.

Today, HCI focuses on designing, implementing, and evaluating interactive interfaces that enhance user experience using computing devices. This includes user interface design, user-centered design, and user experience design.

HUMAN-COMPUTER INTERACTION

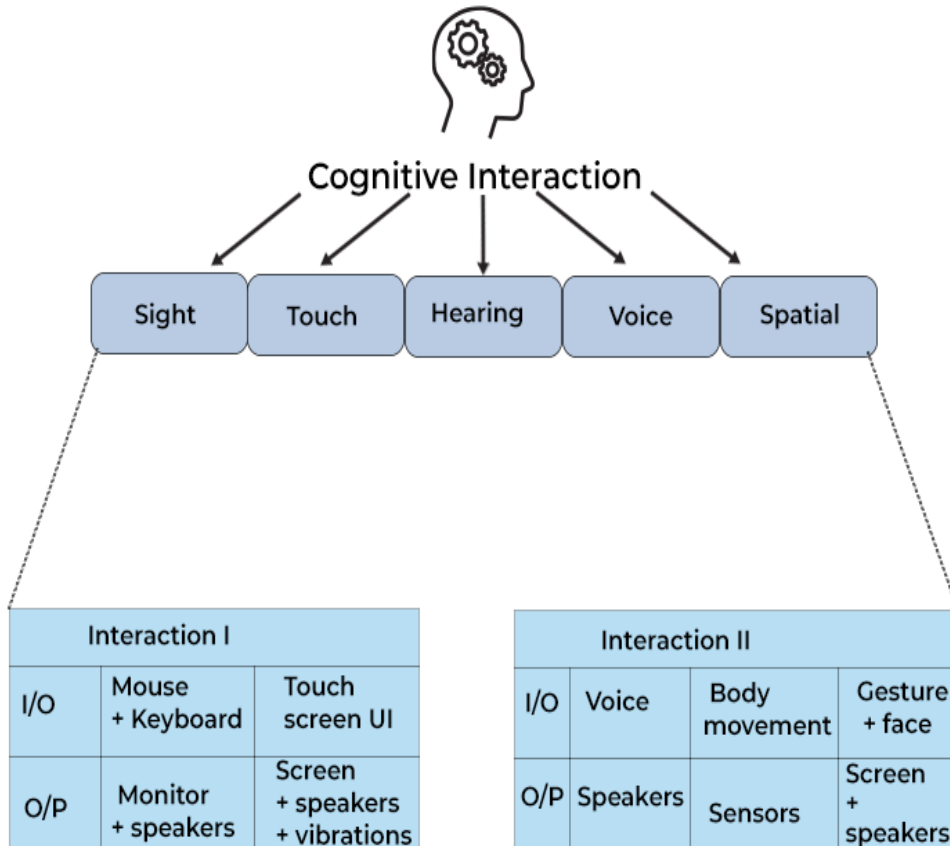


Fig 8.1: Human-Computer Interaction

8.1.1 Key components of HCI

Fundamentally, HCI is made up of four key components:

1. The user

The user component refers to an individual or a group of individuals that participate in a common task. HCI studies users' needs, goals, and interaction patterns. It analyses various parameters such as users' cognitive capabilities, emotions, and experiences to provide them with a seamless experience while interacting with computing systems.

2. The goal-oriented task

A user operates a computer system with an objective or goal in mind. The computer provides a digital representation of objects to accomplish this goal. For example, booking an airline for a destination could be a task for an aviation website. In such goal-oriented scenarios, one should consider the following aspects for a better user experience:

- a) The complexity of the task that the user intends to accomplish.
- b) Knowledge and skills necessary to interact with the digital object.
- c) Time required carrying out the task.

3. The interface

The interface is a crucial HCI component that can enhance the overall user interaction experience. Various interface-related aspects must be considered, such as interaction type (touch, click, gesture, or voice), screen resolution, display size, or even color contrast. Users can adjust these depending on the user's needs and requirements.

For example, consider a user visiting a website on a smartphone. In such a case, the mobile version of the website should only display important information that allows the user to navigate through the site easily. Moreover, the text size should be appropriately adjusted so that the user is in a position to read it on the mobile device. Such design optimisation boosts user experience as it makes them feel comfortable while accessing the site on a mobile phone.

4. The context

HCI is not only about providing better communication between users and computers but also about factoring in the context and environment in which the system is accessed. For example, while designing a smartphone app, designers need to evaluate how the app will visually appear in different lighting conditions (during day or night) or how it will perform when there is a poor network connection. Such aspects can have a significant impact on the end-user experience.

Thus, HCI is a result of continuous testing and refinement of interface designs that can affect the context of use for the users.

8.1.2 Importance of HCI

HCI is crucial in designing intuitive interfaces that people with different abilities and expertise usually access. Most importantly, human-computer interaction is helpful for communities lacking knowledge and formal training on interacting with specific computing systems.

With efficient HCI designs, users need not consider the intricacies and complexities of using the computing system. User-friendly interfaces ensure that user interactions are clear, precise, and natural.

1. HCI in daily lives

Today, technology has penetrated our routine lives and has impacted our daily activities. To experience HCI technology, one need not own or use a smartphone or computer. When people use an ATM, food dispensing machine, or snack vending machine, they inevitably come in contact with HCI. This is because HCI plays a vital role in designing the interfaces of such systems that make them usable and efficient.

2. Industry

Industries that use computing technology for day-to-day activities tend to consider HCI a necessary business-driving force. Efficiently designed systems ensure that employees are comfortable using the systems for their everyday work. With HCI, systems are easy to handle, even for untrained staff.

HCI is critical for designing safety systems such as those used in air traffic control (ATC) or power plants. The aim of HCI, in such cases, is to make sure that the system is accessible to any non-expert individual who can handle safety-critical situations if the need arises.

3. Accessible to disabled

The primary objective of HCI is to design systems that make them accessible, usable, efficient, and safe for anyone and everyone. This implies that people with a wide range of capabilities, expertise, and knowledge can easily use HCI-designed systems. It also encompasses people with disabilities. HCI tends to rely on user-centered techniques and methods to make systems usable for people with disabilities.

4. An integral part of software success

HCI is an integral part of software development companies that develop software for end-users. Such companies use HCI techniques to develop software products to make them usable. Since the product is finally consumed by the end-user, following HCI methods is crucial as the product's sales depend on its usability.

5. Useful for untrained communities

Today, user manuals for general computer systems are a rarity. Very few advanced and complex computing systems provide user manuals. In general, users expect the systems to be user-friendly and enable them to access the system within a few minutes of interacting with it. Here, HCI is an effective tool that designers can use to design easy-to-use interfaces. HCI principles also ensure that the systems have obvious interfaces and do not require special training to be used. Hence, HCI makes computing systems suitable for an untrained community.

Examples of HCI Technological development are: light several tools, gadgets, and devices such as wearable systems, voice assistants, health trackers, and smart TVs that have advanced human-computer interaction technology. Let's look at some prominent examples of HCI that have accelerated its evolution.

1. IoT technology

IoT devices and applications have significantly impacted our daily lives. According to a May 2022 report by IoT Analytics, global IoT endpoints are expected to reach 14.4 billion in 2022 and grow to 27 billion (approx.) by 2025. As users interact with such devices, they tend to collect their data, which helps understand different user interaction patterns. IoT companies can make critical business decisions that can eventually drive their future revenues and profits.

A recent development in the field of HCI introduced the concept of 'pre-touch sensing' through pre-touch phones. This means the phone can detect how the user holds the phone or which finger approaches the screen first for operation. Upon detecting the user's hand movements, the device immediately predicts the user's intentions and performs the task before the user gives any instructions.

Another HCI-related development is that of 'Paper ID'. The paper acts as a touch screen, senses the environment, detects gestures, and connects to other IoT devices. Fundamentally, it digitizes the paper and executes tasks based on gestures by focusing on man-machine interaction variables.

2. Eye-tracking technology

Eye-tracking is about detecting where a person is looking based on the gaze point. Eye-tracking devices use cameras to capture the user's gaze along with some embedded light sources for clarity. Moreover, these devices use machine learning algorithms and image processing capabilities for accurate gaze detection.

Businesses can use such eye-tracking systems to monitor their personnel's visual attention. It can help companies manage distractions that tend to trouble their employees, enhancing their focus on the task. In this manner, eye-tracking technology, along with HCI-enabled interactions, can help industries monitor the daily operations of their employees or workers.

Other applications include ‘driver monitoring systems’ that ensure road security. Moreover, in the future, HCI-enabled eye-tracking systems may allow users to scroll through a computer screen just by rolling their eyeballs.

3. Speech recognition technology

Speech recognition technology interprets human language, derives meaning from it, and performs the task for the user. Recently, this technology has gained significant popularity with the emergence of chatbots and virtual assistants.

For example, products such as Amazon’s Alexa, Microsoft’s Cortana, Google’s Google Assistant, and Apple’s Siri employ speech recognition to enable user interaction with their devices, cars, etc. The combination of HCI and speech recognition further fine-tunes man-machine interactions that allow the devices to interpret and respond to users’ commands and questions with maximum accuracy. It has various applications, such as transcribing conference calls, training sessions, and interviews.

4. AR/VR technology

AR and VR are immersive technologies that allow humans to interact with the digital world and increase the productivity of their daily tasks. For example, smart glasses enable hands-free and seamless user interaction with computing systems. Consider an example of a chef who intends to learn a new recipe. With smart glass technology, the chef can learn and prepare the target dish simultaneously.

Moreover, the technology also reduces system downtime significantly. This implies that as smart AR/VR glasses such as ‘Oculus Quest 2’ are supported by apps, the faults or problems in the system can be resolved by maintenance teams in real-time. This enhances user experience in a minimum time span. Also, the glasses can detect the user’s response to the interface and further optimize the interaction based on the user’s personality, needs, and preferences.

Thus, AR/VR technology with the blend of HCI ensures that the task is accomplished with minimal errors and also achieves greater accuracy and quality. Currently, HCI research is targeting other fields of study, such as brain-computer interfaces and sentiment analysis, to boost the user’s AR/VR experience.

A recent development in this regard has been enabled via ‘Dexta Haptic Gloves.’ These VR gloves can sense and process touch parameters such as surface hardness, softness, etc.

These gloves can memorize a user’s finger movements by locking and unlocking the finger joints as they interact in the VR environment. Later, the gloves can replicate the recorded data of feelings across various degrees in real life.

5. Cloud computing

Today, companies across different fields are embracing remote task forces. According to a 'Breaking Barriers 2020' survey by Fuze (An 8×8 Company), around 83% of employees feel more productive working remotely. Considering the current trend, conventional workplaces will witness a massive rejig and transform entirely in a couple of decades. Thanks to cloud computing and human-computer interaction, such flexible offices have become a reality.

Moreover, an employee can access data on the cloud from any physical location by exploiting cloud-based SaaS services. Such virtual settings streamline workflows and support seamless collaboration with remote teams across industry verticals without impacting productivity. Thus, with time, the idea of traditional offices will cease to exist, mainly because of SaaS and HCI.

8.1.3 Goals of HCI OR DHI

The principal objective of HCI is to develop functional systems that are usable, safe, and efficient for end-users. The developer community can achieve this goal by fulfilling the following criteria:

Have sound knowledge of how users use computing systems

Design methods, techniques, and tools that allow users to access systems based on their needs

Adjust, test, refine, validate, and ensure that users achieve effective communication or interaction with the systems. Always give priority to end-users and lay the robust foundation of HCI to realize the above points, developers must focus on two relevant areas: usability and user experience. Let's look at each category in detail:

a. Usability

Usability is key to HCI as it ensures that users of all types can quickly learn and use computing systems. A practical and usable HCI system has the following characteristics:

How to use it: This should be easy to learn and remember for new and infrequent users to learn and remember. For example, operating systems with a user-friendly interface are easier to understand than DOS operating systems that use a command-line interface.

b. Safety: A safe system safeguards users from undesirable and dangerous situations. This may refer to users making mistakes and errors while using the system that may lead to severe consequences. Users can resolve this through HCI practices. For example, systems can be designed to prevent users from activating specific keys or buttons accidentally. Another example could be to provide recovery plans once the user commits mistakes. This may give users the confidence to explore the system or interface further.

c. Efficiency: An efficient system defines how good the system is and whether it accomplishes the tasks that it is supposed to. Moreover, it illustrates how the system provides the necessary support to users to complete their tasks.

d. Effectiveness: A practical system provides high-quality performance. It describes whether the system can achieve the desired goals.

e. Utility: Utility refers to the various functionalities and tools provided by the system to complete the intended task. For example, a sound utility system offers an integrated development environment (IDE) that provides intermittent help to programmers or users through suggestions.

f. Enjoyable: Users find the computing system enjoyable to use when the interface is less complex to interpret and understand.

2. User experience

User experience is a subjective trait that focuses on how users feel about the computing system when interacting with it. Here, user feelings are studied individually so that developers and support teams can target particular users to evoke positive feelings while using the system.

HCI systems classify user interaction patterns into the following categories and further refine the system based on the detected pattern:

- a) Desirable traits – satisfying, enjoyable, motivating, or surprising
- b) Undesirable traits – Frustrating, unpleasant, or annoying.

8.1.4 Which Disciplines Contribute to HCI?

The field of HCI or DHI covers a wide range of topics, and its development has depended on contributions from many disciplines and faculties. Some of the main disciplines which have contributed to HCI or DHI are:

1. Computer Science
2. Cognitive Psychology
3. Social Psychology
4. Ergonomics/Human Factors
5. Linguistics
6. Artificial Intelligence
7. Philosophy, Sociology & Anthropology
8. Engineering & Design

Some development Advancement in Human-computer Interaction are:

1. **Voice Guided User Interface**

Voice-guided UI is a new trend in the market, where users can interact with the technology using only their voice. We can command and instruct these Voice Guided devices to perform tasks like playing music, controlling electronic devices, or set reminders, etc with the help of IoT & AI.

2. **Gesture Guided User Interface**

We are already using the gesture-guided interface on our mobile phones or touch screen devices for navigation through swipes, taps, or pinches.

Tech companies are constantly imbibing these techniques to enhance the interaction on wearable devices too.

3. **Virtual/Augmented Reality**

Virtual reality headsets allow us to engage in truly immersive experiences. As technology evolves, we may perform more of our daily tasks using a headset instead of a laptop and keyboard. Augmented reality lets us experience the world while administered by technology.

4. **Wearable Technology**

Wearable technology has started enhancing the user interface for smartwatches and fitness monitors that allow us to track our vital signs and keep a check on our health with just a few taps.

What are human-computer interaction examples?

- a) Interaction with a mobile app
- b) Browsing
- c) Smart Watches
- d) Virtual Reality/ Mixed Reality/ AR
- e) Voice Search Technology
- f) Gaming wearables and devices
- g) Other IoT devices

HCI in the software development process

Design Process:

- a. Study the existing system.
- b. Investigate a competitive system.
- c. Manual sketching of task without using computer system (flow chart)
- d. Choose an absolute scale.
- e. Design your own prototype (iterative design)

f. Test the design and modify to correct any false assumptions that were revealed in the testing.

8.2 Conclusion:

This chapter of the study pack can be concluded with the in-depth knowledge of human-computer interaction, the design process, the basics of interface design and the introduction of HCI in the software development process which will definitely enhance the usability, efficiency, utility (durability) and end-user experience. It also introduces candidates to the design issues, solutions and the types of application needed an issues discovered and the effectiveness of the interface design to the end-user.

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2. Human Machine Interface Design for Process Control Applications (2019) - Jean-Yves Fiset.
3. Human Computer Interaction: Fundamentals and Practice (2015) - Gerard jounghyun Kim.
4. Human Computer Interaction: Design issues,solutions,and Applications(2019) - Andrew Sears,Julie A. Jacko.

8.4 Exercises

1. What do you understand by Digital Human Interface?
2. Enumerate stages of software development.
3. State and explain the involvement of HCI in software development.
4. What are the trends in the User Experience Industry driven by human-computer interaction?
5. Mention and discuss some of the applicable areas of Digital human Interface with examples.

Multiple Choice Questions

1. Digital Human Interface simply means ----- (a) Interaction of Human with system components (b) Human reasoning capacity with system (c.) System abuse by human activities (d) All the Above.
2. The involvement of HCI in software development is ----- (a) To design an interface for human and machine interactions (b) To develop a software prototype (c.) To create human solving problem platform (d) To generate backup proceedings.
3. Find the Effector in the given list ----- (a) Computer (b) Limbs (c.) Device (d) Human.

4. Process in reading ----- (a) Syntactic and Semantic analysis (b) Syntactic and Setting analysis (c.) Synchronous and Semantic analysis (d) System and Semantic analysis.
5. Usability is an ----- (a) Effectiveness of Human Performance (b) Effectiveness of System Performance. (c.) Adoption of System Upgrade (d) All the Above.
6. Human Digital Interface design involves ----- (a) Taking care of constraints an trade-off (b) Understanding the raw materials (c.) Design prototype Testing (d) All the Above.
7. The study and design of HCI centralizes on getting to know ----- (a) Users and the context (b) Machine and Interface (c.) None of the above (d) Blend the needs and the resources.
8. Reasoning is the process of ----- (a) Draw conclusions (b) Thinking (c.) Forgetting (d) Interference.
9. Deductive reasoning derives ----- (a) Logical conclusions (b) Radical conclusions (c.) Magical conclusion (d) None of the Above.
10. Multimedia Authoring software is ----- (a) Macromedia Director (b) Macromedia Flash (c.) Movie Maker (d) All the Above.

CHAPTER NINE

DATA ENCRYPTION

The main objective of this chapter is for the candidates/students to learn different ways of securing data, files and every other confidential information about employees, organisation and her practice.

The candidates/Students are also expected to acquire different types of techniques such as encryption and decryption, coding and encoding information for security purpose, maintain the integrity of Data in custody(entrusted), learn to set access permissions and query employee database using SQL commands.

9.0 Introduction

The spontaneous growth in human resources development as an expected growth to determine the performance of an economy, well-being of a state, organisation and individual life, there is a reason to have huge amount or complex data from various field of life that call for Data security, proper management and Integrity.

Data encryption is a way of translating data from plaintext (unencrypted) to ciphertext (encrypted). Users can access encrypted data with an encryption key and decrypted data with a decryption key.

9.1 What Is Cybersecurity?

From the perspective of computing, Cybersecurity can be defined as the practice and techniques employed to protect program, network, and imperative data from unauthorized intervention.

Security can be categorized into cybersecurity and physical security, both of which are put in place to prevent any form of unauthorized access to a computerised system or database. As the fundamental role of cybersecurity involves protecting the integrity and confidentiality of data, it is also known as information security.

Cybersecurity helps prevent;

- a) Identity Theft
- b) Cyberattacks
- c) Data Breach

Three main principles are followed by organisations adopting cybersecurity: Confidentiality, Integrity, and Availability, which are collectively known as the CIA triad. These are referred to as pillars of security and have to be followed stringently.

9.2 Main Purpose of Data Encryption

Data encryption protects digital data privacy stored on computers and sent via the Internet or other computer networks as one of the methods used in cyber security. The encryption method with a modern encryption algorithm has replaced the old data encryption standard (DES).

These encryption algorithms provide secrecy and are at the heart of essential security activities like authentication, integrity, and non-repudiation. Authentication allows for verifying a communication's origin, while integrity ensures that the contents of a message have not changed since it was delivered.

Non-repudiation also assures that a message sender cannot deny providing the news.

Protecting your data

There are massive amounts of sensitive information managed and stored online in the cloud or on connected servers. Encryption uses cybersecurity to defend against brute-force and cyber-attacks, including malware and ransomware. Data encryption works by securing transmitted digital data on the cloud and computer systems. There are two kinds of digital data, transmitted data or in-flight data and stored digital data or data at rest. Modern encryption algorithms have replaced the outdated Data Encryption Standard to protect data. These algorithms guard information and fuel security initiatives including integrity, authentication, and non-repudiation. The algorithms first authenticate a message to verify the origin. Next they check the integrity to verify that contents have remained unchanged. Finally, the non-repudiation initiative stops sends from denying legitimate activity.

What is Plaintext?

Plaintext is usually ordinary readable text before it is encrypted into ciphertext, or readable text after it is decrypted or unencrypted information that may be input to an encryption operation.

In cryptography, plaintext usually means unencrypted information pending input into cryptographic algorithms, usually encryption algorithms. This usually refers to data that is transmitted or stored unencrypted. Plaintext is what encryption algorithms, or ciphers, transform an encrypted message into. It is any readable data — including binary files — in a form that can be seen or utilized without the need for a decryption key or decryption device.

What is Ciphertext ?

Ciphertext simply means conversion of a plain message into unreadable syntax to ordinary person which in turn could be a decrypted message into readable plain text.

Here is an example that converts ciphertext into a plaintext; you must shift each letter three letters forward in the alphabet. So “JV PBZOBQ QBUQ” reads “MY SECRET TEXT”. In this case, the key to the cipher is 3: you shift each letter three places back or forward in the alphabet to encrypt or decrypt it

CONVERSION OF PLAINTEXT INTO A CIPHERTEXT WITH KEY

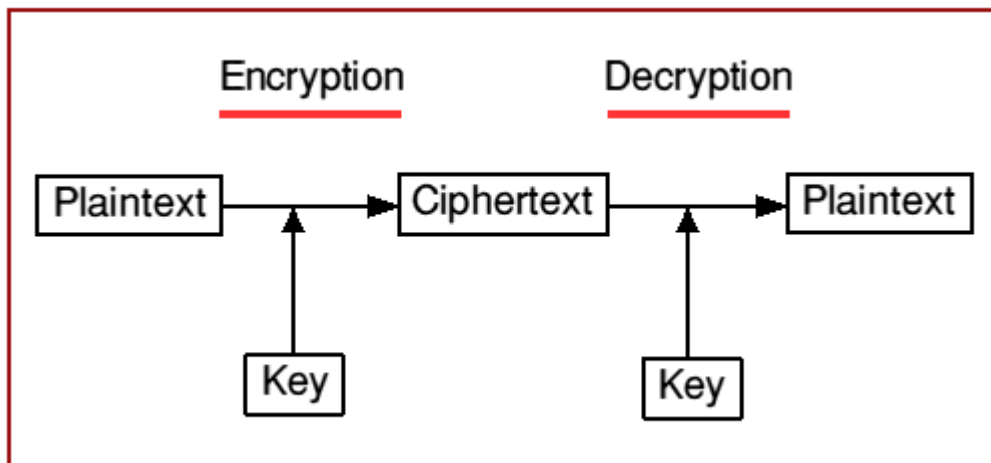


Fig 9.0: The Encryption and Decryption method of either cipher/plain text

9.2.1 Types of data encryption: asymmetric vs symmetric

There are several different encryption methods, each developed with different security and security needs in mind. The two main types of data encryption are asymmetric encryption and symmetric encryption.

Asymmetric Encryption Methods

Asymmetric encryption, also known as Public-Key Cryptography, encrypts and decrypts the data using two separate cryptographic asymmetric keys. These two keys are known as a “public key” and a “private key”.

Common asymmetric encryption methods:

1. **RSA:** RSA, named after computer scientists Ron Rivest, Adi Shamir, and Leonard Adleman, is a popular algorithm used to encrypt data with a public key and decrypt with a private key for secure data transmission.
2. **PKI (Public key infrastructure):** PKI is a way of governing encryption keys through the issuance and management of digital certificates.

Symmetric Encryption Methods

Symmetric encryption is a type of encryption where only one secret symmetric key is used to encrypt the plaintext and decrypt the ciphertext.

Common symmetric encryption methods:

- a) **Data Encryption Standards (DES):** DES is a low-level encryption block cipher algorithm that converts plain text in blocks of 64 bits and converts them to ciphertext using keys of 48 bits.
- b) **Triple DES:** Triple DES runs DES encryption three different times by encrypting, decrypting, and then encrypting data again.
- c) **Advanced Encryption Standard (AES):** AES is often referred to as the gold standard for data encryption and is used worldwide as the U.S. government standard.
- d) **Twofish:** Twofish is considered one of the fastest encryption algorithms and is free to use.

The two main kinds of encryption are symmetric encryption and asymmetric encryption. Asymmetric encryption is also known as public key encryption. In symmetric encryption, there is only one key, and all communicating parties use the same (secret) key for both encryption and decryption.

9.2.2 Benefits of Data Encryption

With more and more organisations moving to hybrid and multcloud environments, concerns are growing about public cloud security and protecting data across complex environments. Enterprise-wide data encryption and encryption key management can help protect data on-premises and in the cloud.

Cloud service providers (CSPs) may be responsible for the security of the cloud, but customers are responsible for security in the cloud, especially the security of any data. An organisation's sensitive data must be protected, while allowing authorized users to perform their job functions. This protection should not only encrypt data, but also provide robust encryption key management, access control and audit logging capabilities.

Robust data encryption and key management solutions should offer:

- a) A centralized management console for data encryption and encryption key policies and configurations
- b) Encryption at the file, database and application levels for on-premise and cloud data
- c) Role and group-based access controls and audit logging to help address compliance
- d) Automated key lifecycle processes for on-premise and cloud encryption keys

9.2.3 How do You Secure Data?

There are four (4) major Ways to Protect Your Organisation's HR Data

1. Start with a Data Inventory. Protecting organisational and customer data requires an understanding of what you currently hold.
2. Train Staff about Common Threats.
3. Clarify Which Laws Apply to You.
4. Adopt More-Secure HR Technology.

How to use Encryption to Protect Data?

Encryption uses complex mathematical algorithms and digital keys to encrypt data. An encryption algorithm (cipher) and an encryption key encode data into ciphertext. Once the ciphertext is transmitted to the recipient, the same or different key (cipher) is used to decode the ciphertext back into the original value.

The Data Encryption Process

Plaintext data is encrypted using an encryption technique and an encryption key. The procedure produces ciphertext, which can only be seen in its original form if decoded with the correct key. The same secret key, symmetric-key ciphers encrypt and decode a message or file. While symmetric-key encryption is substantially quicker than asymmetric encryption, the sender must exchange the encryption key with the receiver before decoding the message.

As businesses increasingly need to securely share and maintain large keys, most data encryption services have evolved and employ an asymmetric method to exchange the secret key after encrypting data using a symmetric

technique. Asymmetric cryptography, often known as public-key cryptography, on the other hand, employs two distinct keys, one public and one private.

As it is known, the public key may share with everyone, but the private key must keep secret. The Rivest-Shamir-Adleman (RSA) algorithm is a public-key cryptosystem commonly used to safeguard sensitive data, mainly when it transfers over an unsecured network such as the Internet.

The popularity of the RSA method stems from the fact that both the public and private keys may encrypt a message to ensure the secrecy, integrity, validity, and non-reliability of electronic communications and data through digital signatures.

Database Encryption

Database encryption is the process of converting data, within a database, in plain text format into a meaningless cipher text by means of a suitable algorithm. Database decryption is converting the meaningless cipher text into the original information using keys generated by the encryption algorithms. Database encryption can generally be defined as a process that uses an algorithm to transform data stored in a database into "cipher text" that is incomprehensible without first being decrypted.

Application of Encryption in Human Resources/Personnel management

HR staff should ensure that all employees are receiving the necessary corporate training, which includes expectations around computer and internet usage. HR staff should also consider implementing periodic tests to ensure that security stays on top of employees' minds.

Applications of DES Algorithm

The DES algorithm is used whenever a not-very-strong encryption is needed. It can be used in random number generators or even as a permutation generator. One of the most important practical applications of the DES algorithm is to create triple DES legacy systems with three keys.

What is DES and how it works?

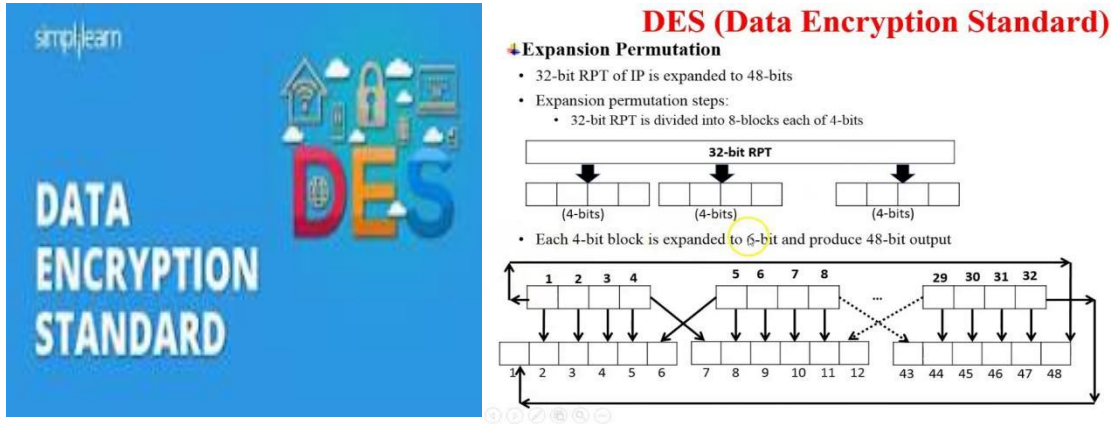


Fig 9.1: *Permutation expansion of DES*

The DES (Data Encryption Standard) algorithm is a symmetric-key block cipher created in the early 1970s by an IBM team and adopted by the National Institute of Standards and Technology (NIST). The algorithm takes the plain text in 64-bit blocks and converts them into ciphertext using 48-bit keys.

DES uses the same key to encrypt and decrypt a message, so both the sender and the receiver must know and use the same private key. DES was once the go-to, symmetric key algorithm for the encryption of electronic data, but it has been superseded by the more secure Advanced Encryption.

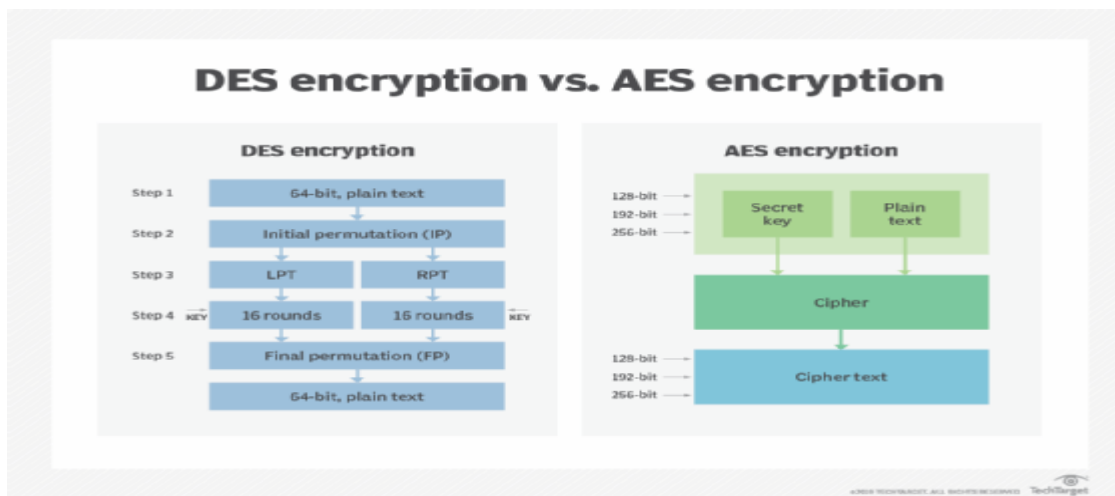


Fig 9.2: *comparison of DES Vs AES Encryption Algorithms*

How to Keep Information Secure in the Workplace?

Here are eight (8) suggestions to help keep your confidential business documents secure

1. Implement a Workplace Information Destruction Policy.
2. Implement a Clean Desk Policy.
3. Train Employees on the Importance of Document Security.
4. Include a non-disclosure clause in employment agreements.
5. Limit access to sensitive information.
6. Have a strict visitor policy.
7. Secure paper document storage.
8. Always back up.

In summary, Encryption encrypts data (messages or files) only to be read or accessed by authorized persons. Encryption software scrambles the data being delivered using complicated encryption algorithms.

Once received, the data may be decrypted using a key given by the message's source. When it comes to encryption technology, strength, length, and compatibility all play a role in working. Because encryption makes information unreadable to an unauthorized entity, data stays private and secret, whether transferred or kept on a system. Unauthorized parties will only observe a disorganized swarm of data.

Furthermore, encryption technology helps ensure data integrity since specific encryption algorithms defend against forgery and manipulation. The capacity of technology with the encryption method to secure information necessitates the effective management of encryption and decryption keys by authorized parties.

Implement a Workplace Information Destruction Policy

Leaving what should be shredded up to your employees is risky business. Do you want your employees deciding what sensitive information is and what is not? Having a predefined information destruction policy will help alleviate any questions as to what to destroy and when implementing a Workplace Information Destruction Policy, it should contain provisions for both day to day documents and ones that have a longer document life cycle.

(i) Day to Day Documents – Implementing a Shred-all policy is of utmost importance. This means that ALL documents (from post-its to customer information) are shredded or placed into the shredding bins. NO MATTER WHAT. This takes away the complication of your employees making the decision of what should

be shredded and significantly reduces the risk of a security breach. This is a simple, yet extremely effective strategy to mitigate any risk.

(ii) Documents that need to be retained for a period of time – It is important to know what the document retention rules are for your business. Documents such as tax files, employee records or medical records that need to be retained for a particular time period must be stored and destroyed in a secure way. As part of your policy, all documents must be stored in a secure, locked area to ensure the safety of the information. Boxes should be indexed so you know what is in the box and when it can be destroyed. Once the retention period has passed, all documents should be shredded in a timely manner.

(iii) Implement a Clean Desk Policy- leaving sensitive documents on your desk makes them more susceptible to a breach. Whether they are left in full view or in a file folder, it makes it easy for visitors, cleaning staff or other employees to access confidential information. All documents should be locked up at the end of the day. No paper or confidential information should be left out on desks. Locking up this information ensures it remains secure while the documents are still in use.

(iv) Train Employees on the Importance of Document Security- Employees should be trained to handle confidential and proprietary information with care and to respect the sensitivity the information. Specifically, you should train your employees to: Protect confidential information, regardless of the media type for the entire life cycle of the information, Shred All paper documents regardless of their sensitivity and lock up all sensitive documents when not in use Share confidential information only with those who need to know. Have a written, signed, confidential non-disclosure agreement before disclosing confidential information to third parties Promptly report any actual or suspected unauthorized access to management.

(v) Include a non-disclosure clause in employment agreements-It is best practice to ensure that your employees sign a confidentiality and non-disclosure agreement to protect your sensitive business information. This will safeguard your company and make your employees aware that they are not to distribute or share information that is proprietary.

Confidentiality provisions in an employment contract make it clear that your business is serious about confidentiality, and can help prevent problems from a legal and practical perspective.

(vi) Limit access to sensitive information-A company with confidential information should be careful to limit access to confidential information to only those employees who have a “need to know”. Hard copies of documents should be kept locked, and electronic copies should be password protected.

(vii) Have a strict visitor policy- Where appropriate, visitors to a workplace should sign a confidentiality agreement upon arrival. In addition, they should be escorted at all times and should be kept away from areas where they may be exposed to confidential information (unless they have a “need to know”).

(viii) Secure Paper Document Storage- For all physical documents, steps need to be taken to ensure they are at as little risk as possible of theft. Start by making sure where they are all kept is locked at night. Employees should be trained in locking away sensitive documents and checking they are safe. It can also be useful to invest in secure offsite storage for those documents that require a longer retention period. The information is then professionally managed and under high quality protection. You will still have access to all paper documentation when required.

(ix) Always Back Up- Where possible, always back your information. Physical documents should be scanned and saved on secure servers. If the worst does happen and any of your secure documents are lost or stolen or damaged, you will still have access to them when you need them. Need help implementing these measures?

9.3 Conclusion

This chapter can be concluded with the trends of above skills in data protection, data accessibility, and several techniques mentioned that could be deployed to protect the integrity of both personal and corporate entities including database encryption, it explains the reason for securing vital information and methods of implementation in a workplace, the aspect of data breach must be handled properly. The needs for a strict confidentiality of documents and some strict measure on visitors to avoid eavesdropping and information intrusion are important areas of study to equip the candidates with an adequate knowledge and skills for optimal practice.

9.4 References

1. Introduction to cryptography and its Applications - by Alasdair Mc Andrew.
2. Computer System & Network Security - by Gregory B. White, Eric A. Fisch & Udo W. Andrew.
3. Database and Applications Security: Integrating Information Security & Data Management - by Bhavani Thuraisingham.

4. Cyber Threats, Attacks & Defence Strategies -by Davidson Chisom.

9.5 Exercise

1. What do you understand by the word “Encryption”
2. State the reasons for Encryption and mention major types of Encryption.
3. Define Ciphertext and Plaintext.
4. Highlight a significant difference between Ciphertext and Plaintext.
5. State and briefly explain Data Encryption Techniques.
6. Write an encryption or Cipher text for this plain text WHAT IS YOUR NAME? using three(3)key.

Multiple Choice Questions

1. What is Cyber Security?
(a) Cyber Security provides security against malware (b) Cyber Security provides security against cyber-Terrorists (c) Cyber Security protects a system from cyber-attacks (d) All of the mentioned.
2. What does cyber security protect?
(a) Cyber security protects criminals (b) Cyber security protects internet- connected systems (c) Cyber security protects hackers (d) None of the mentioned.
3. Which of the following is defined as an attempt to steal, spy, damage or destroy computer systems, networks, or their associated information?
(a) Cyber-attack (b) Computer security (c) Cryptography (d) Digital hacking.
4. Which of the following is a type of cyber security?
(a) Cloud Security(b) Network Security (c) Application Security (d) All of the above.
5. What are the features of cyber security?
(a) Compliance (b) Defense against internal threats(c) Threat Prevention (d) All of the above.
6. Which of the following is an objective of network security?
(a) Confidentiality (b) Integrity (c) Availability (d) All of the above.
7. Which of the following is not a cybercrime?
(a) Denial of Service (b) Man in the Middle (c) Malware (d) AES.
8. Which of the following is a type of Cyber-attack?
(a) Phishing (b) SQL Injections (c) Password Attack (d) All of the above.

9. Which of the following is the hacking approach where cyber-criminals design fake websites or pages for tricking or gaining additional traffic?

(a) Pharming (b) Website-Duplication (c) Mimicking (d) Spamming.

10. Which of the following is not a step followed by cyber-criminals in data breaching?

(a) Exfiltration (b) Research and info-gathering (c) Attack the system (d) Fixing the bugs

CHAPTER TEN

DIGITAL PRIVACY AND ETHICS

(Corporate and Personnel Social Media Usage)

One of the major objectives of this chapter is to focus on the objects in the protection of individuals from privacy harms that support responsible innovation, economic development and other important societal objectives by promoting trust and confidence in government and commercial activities.

Therefore, the following activities must be given a prior consideration by candidates /students while discussing or studying Digital privacy and ethics in the context of personnel practice;

- i. Maintain a safe network.
- ii. Maintain Vulnerability Management.
- iii. Prevent unauthorized access.
- iv. Ensure security flaws are immediately reported.
- v. Maintain integrity of data assets.

10.0 Introduction

Digital privacy is often used in contexts that promote advocacy on behalf of individual and consumer privacy rights in e-services and is typically used in opposition to the business practices of many e-marketers, businesses, and companies to collect and use such information and data.

Internet privacy is important because it gives you control over your identity and personal information. Without that control, anyone with the intention and means can manipulate your identity to serve their goals, whether it is selling you a more expensive vacation or stealing your savings.

10.1 Principles of Digital Privacy

The principles of digital Privacy was actually built on Lawfulness, fairness, and transparency that comprises of Purpose limitation, Data minimisation, Accountability, Storage, Integrity and Accuracy (holding).

These seven data privacy principles don't just stand for a governing body and its people; they represent the spirit of data responsibility and respect that individuals ought to demand of their platforms and providers. At their core, they emphasize that personal data collection must be transparent, consensual, and intentional.

The principles create the foundation of data privacy in a digital-first community and can help every one of us better understand just how high a bar we ought to set for the companies that handle our personal data. Now, with that said. *Personal data shall be:*

1. Lawfulness, fairness, and transparency
2. Purpose limitation
3. Data minimisation
4. Accuracy (holding)
5. Storage limitation
6. Integrity and confidentiality (security)
7. Accountability

Principle 1: Lawfulness, fairness, and transparency - *“Processed lawfully, fairly and in a transparent manner in relation to individuals”* Principle 1 looks at how companies collect personal data and set a clear expectation that those collection methods must operate legally, with clear privacy policies and purposes. Brands must articulate why they want your personal data and how they intend to use it.

To take it a step further, data collectors cannot use your data against you. Companies shouldn't, for example, track your web habits without your permission, and then leverage knowledge compelling you to purchase their service. For consumers, this leads to a basic digital right: the right to choose what data you share and how it is used. Many organisations may try to skirt this principle through intentionally dense terms of service and privacy policies. Still, that right to selection treats people like intelligent, responsible, and unique humans, and not as data farms.

Principle 2: Purpose limitation - *“Collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes...”* Companies have to use your data in the way that they promised to apply it. While there is an exception here regarding archiving, scientific, historical, or statistical purposes, Principle 2 emphasizes the purpose of any data collection must be specific, clear, and limited to a relevant scope. For example, private data can't be collected for research purposes and then turned to the marketing team for outreach. Principle 2 ties back to our concept of positive consent—when we agree to let our data be collected, we agree to its use in specific ways. This principle helps ensure that companies cannot repurpose our data in any way beyond the terms of that agreement and that our privacy remains intact.

Principle 3: Data minimisation - *“Adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed.”* Similar to our first principle, Principle 3 ensures that brands only collect data relevant to the task at hand. Essentially, companies can’t hoard data just because they think they might want to use it later.

For example, a company might request your name, email address, and industry to help qualify you as a potential lead for their project, but asking for a home address, mother’s maiden name, and the name of your favorite pet growing up can be a clear violation of privacy. This principle doubles as a way to help contain exposure and personal damage in the event the company’s data is compromised. If companies keep minimal personal data records, bad actors can only steal minimal personal data.

Principle 4: Accuracy (holding) - *“Accurate and, where necessary, kept up to date; every reasonable step must be taken to ensure that personal data that are inaccurate, having regard to the purposes for which they are processed, are erased or rectified without delay.”* Companies can’t just sit on their data. The value of a data set is in its accuracy. Whether that data needs an updated personal address for a snail mail campaign or an accurate evaluation of community real estate prices, when old data is applied to immediate circumstances, it rarely ends well. Principle 4 ensures that collectors maintain their data and take reasonable action to erase or rectify inaccurate or incomplete information.

Principle 5: Storage limitation - *“Kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the personal data are processed.”* Companies shouldn’t just keep your data for as long as they want. Instead, personal data should only be stored as long as needed and then either deleted or anonymize once it has served its purpose. With that said, “as long as needed” tends to be a bit ambiguous between industries and could just as easily be defined as after the transaction ends as it could be the entire lifetime value of the customer.

Principle 5 ensures that collectors don’t retain personal data or reuse personal data beyond its original stated purpose. Like Principle 2, Principle 5 is exempt for historical, statistical, scientific, or archival purposes.

Principle 6 Integrity and confidentiality (security) - *“Processed in a manner that ensures appropriate security of the personal data, including protection against unauthorised or unlawful processing and against accidental loss, destruction or damage, using appropriate technical or organisational measures.”* For the same reason banks keep vaults, data collectors have an obligation to protect the data they collect. This protection model works in two areas—security and redundancy. Companies need systems in place to ensure

the cyber security of their data—bad actors shouldn't be able to access trusted personal data. Likewise, organisations ought to have backups in place if one storage system is compromised.

Principle 7: Accountability - The seventh principle essentially doubles down on the organisational responsibility to adhere to these principles. Data collectors must show that they are taking reasonable action to meet the six previous principles because if a rule isn't enforced, what value does it offer? While these seven data privacy principles are specific to citizens of and organisations operating within the EU, they still carry a relevance and sense of human dignity that organisations ought to aspire to no matter their nation of origin. By setting a set expectation for what brands can and can't do with our personal data, these principles create a more transparent and accessible world for individuals and organisations alike.

Inspired by these principles, *the Invisibly Bill of Rights* highlights the fundamental truths of personal data, including:

- i. Ownership
- ii. Active Consent
- iii. Transparency
- iv. Transferability
- v. Delectability

As the data economy continues to grow, it is our hope that more and more individuals will join our cause and demand the same level of dedication from the platforms we use every day.

Digital Privacy as a Right: What are Its Limits and How to Protect It?

Privacy can be understood as the right of every individual to separate aspects of their private life from the public domain and all human beings have this right. When we talk about digital privacy we refer to this privacy protection in the field of cyberspace.

Currently, this right to privacy is being put to the test, since both governments and the private sector are taking advantage of technology to access the most intimate sphere of citizens, not always with justifiable objectives. For this reason, it is necessary to promote public policies that safeguard us from these abuses and protect our right to privacy. In fact, many countries work to update and improve laws in this area.

What are the Limits of Digital Privacy?

One of the first open front limits in legislative matters is related to the protection of the data of Internet users. Although they do not determine all aspects of privacy, they are a good starting point as a basic element to ensure our personal information in this technological world, since they are an essential part of our digital identity.

The first step in this matter has been given by the European Union with the entry into force in 2019 of the "General Data Protection Regulation" (GDPR), where legislation is in place to protect these new rights. This regulation is innovative, defining rights such as: "the right to be forgotten" or the right to oblivion, which gives citizens the possibility of requiring companies to delete their personal data in certain circumstances. The limits of privacy can be disputed, understanding that it is not an absolute right. It is the discussion that arises when the authorities request access to certain personal information, to the companies, for a criminal investigation.

With the increased terrorist threat in recent years, governments have invaded, to some extent, the private space of their citizens, with the excuse of national security. It is important that we, as a society, have to be careful and have to define the limits of this invasion in order to avoid violation of this fundamental right.

There are also cases where we decide to give up certain aspects of our privacy, to get something in return. For example: when we buy online, we use a public Wi-Fi, etc ... But in some cases we are not aware of what we are giving or to whom. To avoid these abuses is for what is legislated in this regard.

Digital Privacy and Businesses:

The right to privacy concerns not only individuals but also companies, especially since their credibility and the trust of their clients may be affected in the event of an incident and also as public opinion begins to be aware of the matter.

That is why, in the business world, privacy begins to be implemented by design, which will mean a substantial improvement in management models, processes and tools in terms of security.

This positive change is due to the recent legal reforms, such as the GDPR and the proposed Electronic Privacy Regulation (ePrivacy), which will complement it, whose entry into force is scheduled for 2019. And also, that users are increasingly more and more demanding.

As users we have rights which we can demand from companies:

- i. They inform us of what personal data they collect and what the use to be made of them is.
- ii. The request for consent is clear and explicit (it is no longer concealed in the Terms and Conditions).

- iii. A request for consent for each service, without linking it to others, such as for advertising purposes.
- iv. The right to oblivion, in other words, to request the deletion of our data and withdraw the consent.

In the process of studying Digital Privacy and Ethics, there is a need for security monitoring of employees in relatives to personnel management and also be able to monitor any security threat to curb the menace of hackers and other security breach.

Security monitoring is the automated process of collecting and analyzing indicators of potential security threats, then triaging these threats with appropriate action.

Therefore, because there is a need for privacy, hence, Digital privacy is a right that seeks to guarantee the protection of the personal data of users who access a service through the internet. It must ensure that they can know, decide and control the treatment that will be made of their personal data collected on a website, application, or social network.

Digital privacy and Ethics must ensure that the privacy of individual or organisation are been protected and within the context, employees must be working in an healthy condition and be always happy to return to work through encouragement and incentives.

Closed Circuit Cameras Television (CCTV)

Closed-circuit television, also known as video surveillance, is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors.

Closed circuit television (CCTV) records images of people in certain public places including town centres, roads, airports, and on public transport. CCTV images can be used as evidence in court. You can request CCTV recordings of yourself.



Fig 10.1: Different types of closed circuit cameras(CCTV)

Uses Of Closed Circuit Cameras in Designated Areas

The use of CCTV in public places:

CCTV is designed to help prevent and detect crime. It can reassure the public about community safety. It is located in public places to:

- a) provide evidence to relevant enforcement agencies
- b) maintain public order
- c) prevent antisocial behavior and nuisance
- d) provide reassurance
- e) promote economic well being

Cameras record images twenty-four hours every day. CCTV operators watch live images at strategic times in a local monitoring suite. If they notice criminal activity on camera, they can direct police response to the incident.

The Use of CCTV Footage as Evidence:

CCTV can sometimes be used in court as evidence to prove someone was in a certain place or that they committed an offence. It can also improve community safety and prevent crime. For example, deterring someone committing a crime like robbery if they know CCTV will record their actions.

How to Ask for CCTV Footage:

You have the right to access images of yourself that may have been recorded by a CCTV camera system. Public organisations like local councils need to make any personal data available to you if you ask them.

Personal data is information that relates to an individual and is held by a public organisation.

You need to write to the owner of the CCTV system. The owner's contact information is usually on a sign attached to the camera. You need to give them enough information to identify you, for example a specific date and time, and a description of yourself and your clothing.

Rules of Domestic CCTV

Data protection law says that people who capture images or audio recordings from outside their property boundary using a fixed camera, such as a CCTV camera or smart doorbell, should:

1. tell people that they are using recording equipment;
2. in most circumstances, provide some of the recording if asked by a person whose images have been captured;
3. regularly or automatically delete footage;
4. in most circumstances, delete recordings of people if they ask; and
5. stop recording a person if they object to being recorded, but only if it is possible to do so. For example, if they can point the camera in a different direction but still use it for the same purposes, e.g keeping their property safe.

These rules only apply to fixed cameras. They do not cover roaming cameras, such as drones or dashboard cameras (dashcams) as long as the drone or dashcam is used only for your domestic or household purposes.

It is difficult to enforce these rules, as it is not easy to find out if the person acts on a request to delete footage. We wouldn't find it a fair or balanced action to go into a person's home to find out if they were complying with the law or take other enforcement action.

10.2 General Data Protection Regulation

The General Data Protection Regulation is a Regulation in EU law on data protection and privacy in the EU and the European Economic Area. The GDPR is an important component of EU privacy law and of human rights law, in particular Article 8 of the Charter of Fundamental Rights of the European Union.

However, Chapter four of the Nigerian Constitution is dedicated to the fundamental human rights of a Nigerian, from section 33 to section 46. By definition, every individual holding Nigeria's citizenship as recognized in the Nigerian constitution is inherently entitled to these fundamental rights.

In Nigerian context, the right to privacy was also supported by National Protection. The right to privacy is one of the fundamental human rights entrenched in the Nigerian Constitution. Section 37 of the 1999 Constitution provides that: "The privacy of citizens, their homes, correspondence, telephone conversations

and telegraphic communications is hereby guaranteed and protected.” Therefore, any Data of any form through any of the communication medium is hereby protected as entrenched in the constitution of Federal Republic of Nigeria.

How Manage Digital Privacy?



Fig 10.2: Personal laptop use for online activities with personal data security

How to Protect Your Online Privacy

1. Commit to sharing less online.
2. Use strong, unique passwords and two-factor authentication.
3. Tighten privacy settings for your online accounts.
4. Purge unused mobile apps and browser extensions.
5. Block search engines from tracking you.
6. Browse online with a secure VPN.

Application of Digital Privacy in cooperates and personal social media could involve Monitoring of computer system and network surveillance. Computer and network surveillance is the monitoring of computer activity and data stored locally on a computer or data being transferred over computer networks such as the Internet.

This monitoring is often carried out covertly and may be completed by governments, corporations, criminal organisations, or individuals. It may or may not be legal and may or may not require authorisation from a court or other independent government agencies. Computer and network surveillance programs are widespread today and almost all Internet traffic can be monitored. Surveillance allows governments and other agencies to maintain social control, recognize and monitor threats or any suspicious or abnormal activity, and prevent and investigate criminal activities.

The advent of programs such as the Total Information Awareness program, technologies such as high-speed surveillance computers and biometrics software, and laws such as the Communications Assistance For Law Enforcement Act, governments now possess an unprecedented ability to monitor the activities of citizens.

10.3 Conclusion

This chapter focuses on the objects in the protection of individuals from privacy harms that support responsible innovation, economic development and other important societal objectives by promoting trust and confidence especially in the areas of personal privacy, data protection. It also introduces students / candidates to some of the equipment often used to curtail security breaches and how to use them without infringing on others right to privacy. Application of Digital Privacy in cooperate and personal social media that involve Monitoring of computer system and network surveillance also gives positive direction in conformity with the digital and ethic practice in corporate and personal social media.

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4. Threat Modelling: Designing for Security (2014) - Adam Shostack.
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10.5 Exercises

1. Define and explain Digital Privacy and Ethics.
2. State and discuss the seven principles of Data privacy.
3. Discuss the *Invisibly Bill of Rights* highlighted in the fundamental truths of personal data.
4. State the rules and control of domestic CCTV
5. What do you understand by general Data Protection and state ways to protect your online privacy?

Multiple Choice Questions

1. _____ deals with the protection of an individual's information which is implemented while using the Internet on any computer or personal device.
(a) Digital agony (b) Digital privacy (c) Digital secrecy (d) Digital protection.

2. Which of the following online service's privacy cannot be protected using Tor?
(a) Browsing data (b) Instant messaging (c) Login using ID (d) Relay chats.
3. Which of the following do not comes under the three pillars of digital privacy?
(a) Information privacy (b) Individual privacy (c) Communication privacy (d) Family privacy.
4. Which of the following is not an appropriate solution for preserving privacy?
(a) Use privacy-focused SE (b) Use private Browser-window (c) Disable cookies (d) Uninstall Antivirus.
5. Which of the following is a private Search-engine and do not track our searching data?
(a) Google (b) Search Encrypt (c) Bing (d) Yahoo.
6. It is necessary to use _____ for maintaining searched data privacy.
(a) Private email services (b) Private search engines (c) Tor Browser (d) Private Browser window.
7. _____ allow its users to attach to the internet via a remote or virtual server which preserves privacy.
(a) Cookie removers (b) VPNs (c) Tor browser (d) Private Search Engines.
8. The _____ transferred between your device & the server is securely encrypted if you are using VPNs.
(a) data (b) virus (c) music files (d) document files.
9. The data transferred between your device & the server is securely _____ if you're using VPNs.
(a) locked (b) sealed (c) packed (d) encrypted.
10. Which of the following is not an appropriate solution for preserving privacy?
(a) Use privacy-focused SE (b) Close all logical ports (c) Do not use malicious sites and torrent sites
(d) Use VPN