

TOPIC 1: USING SPREADSHEETS

Introduction

- Many problems in Mathematics, science and finance requires a person to work with numbers and manipulate them using formulas.
- The simplest of doing this is to manually perform calculations using calculator
- Today, several computer applications have been developed to analyze numerical data
- One of such application is electronic spreadsheets

Definition and types of spreadsheets

- In financial accounting, spreadsheet is an accounting ledger book in which data is organized into rows and columns.

Types of spreadsheets

There are **two** types of spreadsheet namely:

1. Manual or traditional spreadsheet
2. Electronic spreadsheet

Traditional spreadsheets

- A traditional spreadsheet is made up of sheet of papers divided into rows and columns in which data is entered manually.

Creating manual worksheet

- A manual worksheet is a ledger sheet within which values can be entered and arithmetic computations made manually on them
- Manual spreadsheets have been used to:
 - To organize data into tabular format
 - In financial and accounting offices where figures are entered for easier organization and arithmetic computation
 - In stock management where stock values are entered in an organized way.

Electronic spreadsheet

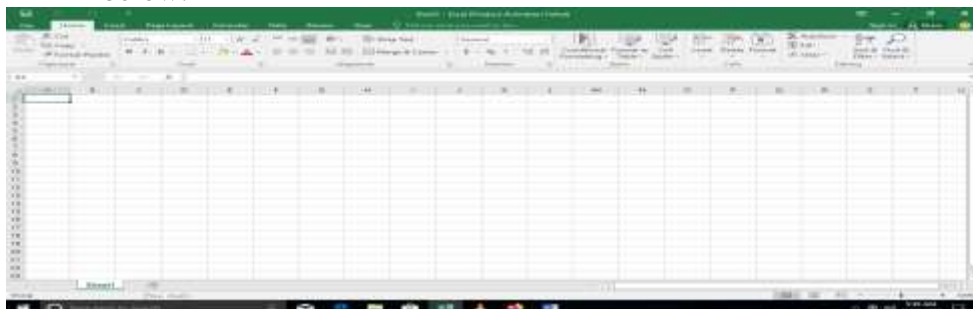
- An electronic spreadsheet is an application software made up of rows and columns, and is used to organize, calculate and analyse numerical data.
- Examples of electronic spreadsheets are: Microsoft Excel, OpenOffice Calc, Lotus 1-2-3 and Core Quattro Pro.

Components of spreadsheets

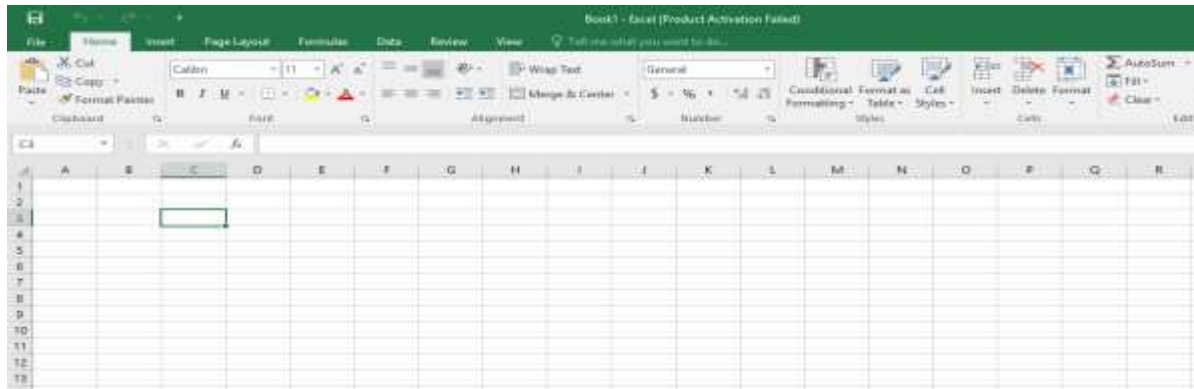
- An electronic spreadsheet has three main components namely

1. Worksheet

- A worksheet is a work area that are made up of rows and columns where data is entered
- Each row is labelled with a number while each column is labelled with a letter as shown below:



- A row is a horizontal arrangement of cells while a column is vertical arrangement of a cell.
- The intersection between a cell and column id called a cell.
- Each cell is referred using the column label followed by the row label.
- The active cell in the *Excel window* below is **C3**



2. Database

- A spreadsheet database is a collection of related data items or records. A record is made up of distinct data elements called fields that together form an entity.

3. Graphs

- A graphs a pictorial representation of the relationship between two or more values on a worksheet.
- In most spreadsheet, graphs are referred to as charts.
- A chart enables the user to present complex values from a worksheet in a simple, easy to understand format.
- Examples of carts include: pie chart, line carts, column chart and bar chart

Uses of a spreadsheet

Some of the uses of a spreadsheet include

1. Arranging information: since worksheets are made up of rows and columns, data can be entered and organized automatically into printable tabular layout
2. Preparation of budget: a spreadsheet is used to prepare budgets and other accounting documents like cash flows and expenditure statements
3. Interest calculation: spreadsheet is used to compute both simple and compound interest
4. Statistical analysis: spreadsheet has tools that enable scientists and other users to perform simple and complex statistical analysis. Simple analysis includes: computation of mean, mode, deviation, sum and product. Complex analysis includes computation of variance, cumulative distribution, regression analysis etc.

Benefits of electronic spreadsheet

Electronic spreadsheet offers various benefits over manual spreadsheets. These include:

1. Electronic spreadsheets enable computations to be done fast, accurate and efficiently
2. Electronic spreadsheet offers a large virtual sheet for data entry and manipulation. A manual spreadsheet has only 30 columns and 51 rows where as electronic spreadsheet has at least 255 columns and 255 rows
3. It is easy to enter data in the worksheet because most spreadsheet provide autocomplete and autocorrect features.
4. Electronic spreadsheet utilizes the storage space on storage media to save and retrieve documents

5. Electronic spreadsheets enable the user to produce neat work because all the work is edited on the screen and clean copy is produced
6. Electronic spreadsheets have better editing and formatting features
7. Electronic spreadsheets have inbuilt formula called function that enable the user to quickly analyse numeric data
8. Electronic spreadsheets automatically adjust the result of a formula if the value in a worksheet are changed. This is called automatic recalculation
9. Graphs let the user provide visual representation of data from a worksheet for easy of interpretation.

Disadvantages of electronic spreadsheets

1. Startup cost including computer and software purchase may be high
2. Learning how to use electronic spreadsheet requires considerable effort and is mostly at a cost
3. Electronic spreadsheet files require to be protected against unauthorized acces and malware like viruses.

Getting started with Microsoft excel

- To start excel, click start, point to All Programs, click Microsoft Office then choose Microsoft excel.

Feature of excel spreadsheet application window

- Excel 2013 differs slightly with earlier version of excel e.g. 2003 that the menu bar has been replaced by menu tabs
- Features of excel are as follows:
 - **Rows:** a row is a horizontal arrangement of cells in a worksheet. It is labelled using numbers 1,2,3..... in the worksheet
 - **Column:** a column is vertical arrangement of cells in the worksheet. It is labelled using letters A, B, C in the worksheet
 - **A cell:** a cell is intersection between a column and a row. A cell pointer indicates the current active cell
 - **Worksheet:** A worksheet is the work area made up of rows and columns where data is entered
 - **Workbook:** A workbook is a spreadsheet file that consists of one or more realated worksheets.
 - **Labels:** columns and rows have labels. Column labels are letters A-Z, AA-AZ, row labels are numbers 1,2,3 in the worksheet
 - **Cell address:** Each cell has an address. The address is column label followed by row label e.g. A1.
 - **Name box:** It displays the address of the current cell
 - **File tab:** Has common commands like New, Open, Save as, Print, Close etc.
 - **Command ribbon:** Each menu as a set of commands like Home ribbon has commands
 - **Formula bar:** Is an input box where a cell entry or a formula is displayed before it is inserted into the active cell.
 - **Worksheet tabs:** worksheet tabs are located at the bottom of a spreadsheet. They are labelled sheet1, sheet2but can be renamed by right clicking the sheet and click rename
- **To navigate through the worksheet, we use the following methods**
 1. Arrow keys let the user move one cell to the next direction of the arrow key

2. Tab key moves the cell pointer on a cell to the right
3. You can directly move a particular cell by clicking the desired cell.
4. Ctrl + Home keys move the cell pointer to the cell A1

Spreadsheet data

- Data entered into a spreadsheet can be classified into four categories namely:
 1. Label
 2. Value
 3. Formulae
 4. Functions

Label

- A label is a text or alphanumeric characters entered in a cell.
- By default, a label is aligned to the left of the cell and cannot be computed mathematically
- A label is usually used to describe a row or column heading
- Sometimes, numbers can be formatted so that they can be used as a label by adding an apostrophe before the number e.g. '1990.

Values

- A value is a numerical number that can be manipulated mathematically
- By default, values are aligned to the right of the cell.

Formula

- A formula a mathematical expression used to perform calculations
- A formula starts with = sign followed by cell addresses and operator eg =B3 + D4, add contents of B3 and D4 and return the sum.

Function

- These are predefined or inbuilt formula
- Example of function is =SUM (B3:D4) which add contents of cells B3 to D4

Cell referencing

- Using cell addresses also called referencing enables Microsoft Excel calculations accurate and automatically recalculates results of a formula in case the value in the cell change. This is referred to as automatic recalculation.
- There are three types of cell referencing used when creating formula and manipulating cell contents and these are:

1. Relative referencing

- A relative referencing is one that changes depending on its position of reference in the worksheet.
- When you copy the cell that contents relative reference says A3 the reference adjusts to reflect the new location
- For example, =A1+B1 is in cell C1 and is copied to C2, the formula reference change to =A2+B2

2. Absolute referencing

- In absolute referencing, the reference is made to a specific address and does not change even if the formula is copied to another cell.
- In excel, absolute referencing is made by placing dollar sign before reference (\$A\$2)

3. Mixed reference

- This is a combination of relative and absolute referencing on a specific cell address to make the row or column relative or absolute
- For example, in A\$3, the row is relative while the column is absolute

Editing worksheet and workbook

- Editing refers to making necessary modification to a worksheet that has already been created.
- It involves deleting entries, copying, moving, find and replace as well as spell checking

Editing cell entries

- There are **two** methods of editing a cell entry:
 1. Using the formula bar: click the cell to display its content and make the changes in the formula bar.
 2. Double clicking: this places the insertion pointer in the cell and then type or modify the cell.

Deleting a worksheet range

- To delete worksheet range, select the cells and click Delete

Copying and moving cell contents

- Select the cells to be copied or moved, right-click and click Copy or Cut. Right-click where you want to put the contents and click Paste

Inserting rows/columns

- Position the cell pointer to where the new row or column is to be inserted
- Right-click and then click Insert
- Choose Entire row or Entire column

Deleting rows/columns

- Select the row or column to be deleted
- Right-click and then click Delete
- Click Entire row or Entire Column

Find and replace

- Press **Ctrl + F** or click **Find and Select** and the dialog box to find the word and replace

Correcting spelling mistakes

- Click Review and click Spelling or press f7

Formatting worksheet and workbook

- Worksheet formatting refers to enhancing the appearance of cell content to make it more readable and appealing to the reader.
- Formatting is done to:
 1. Place emphasis
 2. Catch attention
 3. Review hidden details of worksheet content
- To format cell/cells, select the cells and right click then click Format Cell
- To format font, select the cells and click choose font size and font type.

Formatting numbers

- To format numeric value in a worksheet, highlight the cells and right click then click Format cellss
- The format dialog cells dialog box has the following

Number	Meaning
General	Cells have no specific number format
Number	Used for general display of numbers
Currency	For displaying monetary values eg \$100, MK12
Accounting	Lines up the currency symbols and decimal points
Date	Displays date in specified format
Time	Displays time in specified format
Percentage	Multiply the value in the cell with 100 and display it as a percentage %
Text	Format text to be treated as a text even when numbers are entered
Custom	For number format not predefined in Microsoft Excel

Formatting borders

You may need to put a printable border around the worksheet or range of cells to make it more appealing. To put a border, proceed as follows:

1. Highlight the range you wish to insert borders. Click format cell command to display the dialog box
2. Click the Borders tab to specify border option
3. Click OK button

Formatting rows and columns

- Sometimes, data entered in a worksheet may not fit in a cell
- Therefore, it becomes necessary to adjust the height of a row or the width of a column.
- The default width of a column in Microsoft excel is 8.11 but can be adjusted to any size between 0 and 255. This can be done in two ways:
 1. Move the pointer to the top heading until the mouse pointer turns a cross, then click and drag to the required size
 2. Move the mouse pointer to the row headings of column headings and right click the click row width or column height

Global worksheet formatting

- The word global in this context refers to the entire worksheet. To format the entire worksheet, select the whole worksheet using these two methods:
 1. Clicking the triangular symbol at the intersection of column A and row 1
 2. Pressing Ctrl A on the keyboard
- Once the entire worksheet is selected, use the Format Cells dialog box to format the content

Using Autoformat command

- Autoformat commands allows the user to apply predefined format on selected range of cells. To apply Autoformat, proceed as follows:
 1. Select the range to make it active
 2. On Home ribbon, click the down arrow on **Format as a Table** button in the style group
 3. Select a predefined format to be applied to the selected cells in the worksheet

Formatting entire workbook

- Sometimes, it is necessary to apply the same format to the entire workbook. To achieve this, you must select all the worksheets then apply the desired options
- Whatever is applied on the first worksheet will be reflected on all the other worksheets in the workbook.
- To format entire workbook:
 1. Hold the CTRL key and click the worksheet tabs to select them

2. Once all worksheets are selected, apply desired format to the first worksheet
3. Save the data and then navigate through the worksheet by clicking the sheet tabs. Notice that the format applied to the first worksheet are reflected on the entire workbook

Protecting workbook and worksheets

- A worksheet containing sensitive or confidential information should be protected from unauthorized access.
- There are several techniques for protecting workbook in excel and these are
 1. Making a workbook read only: These allows a user to just view the document but not edit, copy or print the workbook
 2. Encrypt using password
 3. Restricting access by adding digital signature
- To perform all these three:
 1. Click file tab, then Info
 2. Click Protect Workbook
 3. Select **Mark as read** to make the workbook read only, **click encrypt with password** to put a password or click **Add digital signature** to restrict access

Keyboard shortcut

- Excel has keyboard shortcut for performing tasks. The following are some of the keyboard shortcut

	Keyboard key combination	Function
1	CTRL + O	Open file
2	CTRL + N	New file
3	CTRL + S	Save file
4	Esc	Exit current dialog
5	CTRL + X	Cut
6	CTRL + C	Copy
7	CTRL + B	Bold
8	CTRL + I	Italicize
9	CTRL + U	Underline
10	CTRL + T	Insert table
11	CTRL + F4	Close current file
12	ALT + F4	Close excel
13	CTRL + Z	Undo
14	ALT + Y	Redo
15	CTRL + P	Print
16	F4	Repeat last action
17	F1	Open online help documentation
18	CTRL + F1	Hide/unhide commands ribbon
19	Shift + Arrow	Highlights cells
20	CTRL + spacebar	Select current column

Freezing and unfreezing panes

- When working with large document that does not fit on the screen it requires scrolling down so that the column and row headings are seen,
- Therefore, to prevent scrolling, you need to freeze or lock the first row or column from scrolling.
- The main reason for freezing the pane is to make certain column or row that contains headings to be seen when scrolling on large document.
- To freeze pane, proceed as follows:
 1. Move the cell pointer into the cell you want to freeze rows above it or column on its right
 2. On the view ribbon in the Window group, click freeze pane
 3. Scroll horizontally and vertically to view other parts of the worksheet
- To unfreeze, click unfreeze pane from the view ribbon in freeze pane

Hide/unhide columns or rows

- To hide or unhide column or row
 1. Select the column or rows that you want to hide
 2. On the Home ribbon click format in the cells group
 3. Select the command to hide or unhide rows or columns

Working with formulas and functions

- A formula is a mathematical expression used to perform calculation while a function is predefined formula.
- In excel, a formula or function starts with an = sign

Creating formula

- The three elements that make up a user-define formula are:
 1. = sign
 2. Operand
 3. Operator

The following are types of operators

1. Arithmetic operator

- These include additional, subtraction, division and multiplication
- Arithmetic operators mostly follow precedence rule similar to mathematical concept of BODMAS.

Symbol	Description	Example
/	Division	=A2/b2
*	Multiplication	=a2*b2
+	Addition	=a2+b2
-	Subtraction	=a2-b2

2. Relational operators

- Return either true or false depending on the absolute value of the operand being evaluated

Symbol	Description	Example
=	Equal to	=A2=B2
>	Greater than	=A2>B2
<	Less than	=A2<B2
<>	Not equal to	=A2<>B2

<=	Less than or equal to	=A2<=B2
>=	Greater than or equal to	=A2>=B2

3. Operator precedence

- If several operators are used in a formula, Microsoft Excel performs the operations in order shown in the table below
- If the formula has operators of the same precedence like multiplication and division, the expression is evaluated from left to right.
- Enclosing part of the parentheses alters the order of operation by making that part to be evaluated for.

Operators	Name	Precedence
1. -	Negation as -1	1
2. %	Percent	2
3. ^	Exponential	3
4. * and /	Multiplication and division	4
5. + and -	Addition and subtraction	5
6. =, <, >, <=, >=	Relational	6

Creating user-defined formulae

- A user defined formula is created by the user to manipulate numeric data in the worksheet. First click the cell in which you wish to get the results of the formula then type the formula.
- Examples are:
 1. =C2 + D4 add the contents of cells C2 and D2
 2. =B4 * 0.2 displays 20% of the value in cell B4
 3. =F5*1.2 Increases the value in cell F5 by 20%
 4. =(G6/4)*5+6*(3-1) Will be evaluated using precedence rule
 5. =C2-D2 Will subtract contents in D2 from contents in C2
 6. =C2/D2 Will divide contents in C2 by contents in D2
 7. =C2*D2 Will multiply contents in C2 by contents in D2

FUNCTION

- In Excel, a function must also start with = sign followed by function name and arguments. Arguments are cell addresses, numeric, logical or text value enclosed in parenthesis
- Therefore, three elements in function are:
 1. An equal sign =
 2. Function name
 3. Cell range
- In Excel functions are categorized according to the nature of calculations they perform. The following are the categories:
 1. Maths & Trig
 2. Statistical
 3. Logical
 4. Date and Time

● Maths & Trig function

- Maths & Trig stands for Mathematics and Trigonometry.

- This category contains function used to perform mathematical calculations such as Sum as well as trigonometric function such as sine of an angle
 - The following are some of commonly used mathematical function
1. **SUM():** Add values in the selected range of cells. For example =SUM(A1:E1) will add values in cells from A1 to E1
 2. **ROUND():** round numbers to specified decimal places. If the second argument is 0, the number is rounded off to the nearest integer. For example =ROUND(48.2369,3) will return 48.237
 3. **PRODUCT():** multiplies a list of arguments separated by commas. For example =PRODUCT(A1,B3,C2) will multiply values in cells A1, B3 and C2.
 4. **QUOTIENT():** return the integer part of the division. The remainder part is discarded for example =QUOTIENT(10,4) will return 2.

● **Statistical functions**

- The following are some of the commonly used statistical functions:
1. **AVERAGE():** return the arithmetic mean of its arguments. For example =AVERAGE(A1:C1) will return arithmetic mean of values in a cell from A1 to C1
 2. **COUNT():** counts the number of cells that contains numeric value within a range. For example =COUNT(A2:F2) will return number of cell from A2 to F2 that contains numeric value
 3. **MAX():** return the largest number from a range of cells
 4. **MIN():** return the smallest number from the range of cells

● **Logical functions**

- Logical functions return true or false from an expression.
 - Examples of logical functions are IF, COUNTIF, AND, OR, and NOT
1. **IF():** return a value or a label if a condition you specify evaluate to TRUE and another if it evaluates to FALSE

If C5 holds mean score and display PASS if the mean is greater than 50 and FAIL if the mean is less than 50

=IF(C5>50,"PASS",IF(C5<50,"FAIL")) OR IF(C5>50,"PASS","FAIL")

If A2 holds scores, write DISTINCTION if the score is greater than 80, CREDIT, if the score is greater than 60, PASS if the score is greater than 50 and FAIL if score is less than 50

=IF(A2>80,"DISTINCTION",IF(A2>60,"CREDIT",IF(A2>50,"PASS","FAIL")))

2. **COUNTIF():** counts the number of cells within a range that satisfies a certain criteria. For example =COUNTIF(A1:D1,">50") return the number of cells in the range from A1 to D1 that have values greater than 50
3. **SUMIF():** calculate the sum of values in a range of cells that satisfy a certain criteria. FOR EXAMPLE =SUM(A1:D1,"<20") will add values within the range of cells from A1 to D1 that have values less than 20

4. **AND():** Return to TRUE if both expression in comma separated family evaluate to TRUE
e.g, AND(1+2=3, 4+6=10) return TRUE
5. **OR():** return TRUE if one of the expression returns to true eg OR(3-1=2, 4+2=5) will return to TRUE
6. **NOT():** this is a unary operator the reverses the value of a Boolean expression from true to false and vice versa. For example =NOT(2+2=1) will return TRUE

- **Date and Time**

1. **TODAY():** Return the number that represent today's date
2. **NOW():** returns current date and time
3. **DATE():** Return a serial number that represents a particular date Ms. Excel uses year 1900 as a serial number 1. For example =DATE(107,1,4) returns January 4, 2007. Year(1900+1070, month =1 and day=4
4. **HOUR(), MINUTE() or SECOND():** returns the current hour as number 0 to 23, minutes 0 to 59 and seconds from 0 to 59 respectively.

Errors in Microsoft Excel

- The following errors exist in Ms. Excel and their meaning

Error	Meaning
#####	Result when the cell is not wide enough to display the results of calculation
#NAME?	Result when incorrect function name is used or is misspelt e.g. =VERAGE() instead of =AVERAGE()
#VALUE!	Result when incorrect reference is made e,g referencing to a cell that contains labels instead of values
#DIV/0!	Result when a formula attempts to divide by 0 e.g. =C2/D2 when D2 has value of 0 or has empty value
#NUM!	

TOPIC 2: SOFTWARE INSTALLATION

- Software installation (program setup) refers to copying a program into computers storage in a form that it can be executed.
- What determine number of programs installed on the computer are:
 1. Processing power
 2. Available disk space
- Common operations performed during software installation include:
 - Creation or modification of program folders/sub-folders
 - Configuration of windows registry as well as copying of files
 - Environment variables
 - Shortcut icon

FACTORS TO CONSIDER BEFORE SOSTWARE INSTALLATION

- Before installing software whether operation system, device drivers or application software, consider the following:

1. System configuration particular the type and speed of processor, amount of Ram and hard disk space
2. Reading installation manual to get the details on the
 - system requirements
 - warning
 - and user license.
3. Identify the software that will meet the user specific need to avoid installing unnecessary software

Installing operating system

The **two** methods of installing operating system e.g. Windows 7 are:

1. Upgrading from previous version
 2. Fresh installation
- Fresh installation is done by first creating and formatting a primary partition before the installation process starts.
 - However, upgrading from previous windows version means the other windows in the computer will not be formatted but just upgrading it
 - To install a fresh copy of windows, the computer should be setup to boot from a DVD then proceed as follows:
 1. Insert the disk in optical drive and start the computer. After the POST process, set the language and time zone and click next
 2. After clicking install Now, Read the Microsoft User-license agreement terms and click “I Accept the License Terms”
 3. Choose custom(Advance) to install windows afresh or sect Upgrade to upgrade from previous version
 4. Partition the drive into two or more using NTF file system then click format
 5. Windows 7 automatically format the first drive usually labelled drive C as the primary drive
 6. After the copy process is complete, it prompts you to enter username, password and the license key
 7. Follow the windows installation process and provide all the necessary information
 8. Once installation is successfully done, connects to the internet to install importance updates

Configuring windows

- A part from working with files, folders and drivers, windows provide the user with tools that can be used to customize the desktop.
- Such features include:
 1. Arranging multiple application windows on the desktop
 2. Changing the desktop appearance
 3. Setting resolution
 4. Hiding the taskbar
 5. Setting screen saver etc
- All these features can be set by Right-clicking the desktop then click personalized.

Installing Ubuntu

- The word Ubuntu comes from an ancient African word meaning ‘humanity to others’
- Ubuntu is an open source operating system that brings the spirit of humanity to the world of computing.
- It is linux-based distribution available freely and can be installed in computers and phones.
- Before installing Ubuntu, read the guide that comes with the software to see whether the computer meets the specification e.g. processor type, memory capacity and hard disk space
- To install Ubuntu, proceed as follows:
 1. Switch on your computer and insert the disk that contains Ubuntu installation files
 2. If the internet is available, connect to the internet so that Ubuntu gets the latest updates while installing
 3. Select type of installation i.e. Install Ubuntu alongside Windows or replace windows with Ubuntu.
 4. Select verify to verify the type of installation chosen
 5. Click Install Now and installation process will start automatically
 6. Select the location so that Ubuntu set the correct date and time
 7. Select preferred keyboard layout
 8. Setup the login
 9. The rest of the process is done automatically
 10. Finally click start now to restart your computer

Installing device driver

- During installation of these software, a computer is tested whether it has required hardware, operating system and device drivers

Installing device drivers

- Once you installed operating system, you can proceed by installing device drivers and other utility programs like antivirus.
- A device driver is a utility program that controls a device installed in a computer
- For devices such as printer, a keyboard, a flash. A mouse and or a scanner to work, its drivers must be installed first
- A device driver acts as a translator between a device and the program that use the device.
- Common devices such as mouse, keyboard, monitor and flash disks are automatically recognized by most operating system through a process called plug and play (PnP)
- There are any ways of installing device drives but the most common is through installation wizard as follows:
 1. Insert the disk that comes with the device eg. Printer
 2. After verifying that the drivers are in windows device drivers profile, click devices and printer from a start menu
 3. Click add printer and choose add local printer then click Next
 4. Specify the port into which the printer will be connected to e.g. USB
 5. Specify the manufacturer and printer type then click proceed
 6. Type the name of the printer and click Next to start installation
 7. Once installation finishes, print the test page. It is important to print a test page to be sure the drivers are successfully installed.
 8. Read and agree with the user license agreements and click Next
 9. Follow the instructions as directed by the wizard

10. Click restart if the installation requires computer to restart to finish the configuration.

Installing application software

- Most application software available in the market include: word processor, spreadsheet, database management system, desktop publishing software, education software etc.
- Factors which determine kind of application software to install are:
 1. Cost of the software
 2. Authenticity
 3. User documentation
 4. Reliability
 5. User-friendliness
 6. Compatibility
 7. System configuration
 8. User need
 9. Purpose
- According to purpose, application software can be categorized into two:
 1. General purpose application software: such as word, spreadsheet, database and presentation that are packed and made available for general use.
 2. Special purpose software: these are application software designed purposely to handle specialized tasks e.g. desktop publishing software(DTPs), graphic editing software and anti-virus software.

Installing Microsoft Office 2010

1. Insert the Microsoft office 2010 into the optical drive. Read the agreement and click 'I Accept the Agreement'
 2. Once you agree to the terms, installation dialog box is displayed to choose whether to upgrade an existing version or fresh installation called customize
 3. Once you choose customize, the Microsoft deletes the previous office
 4. Click *Upgrade or install Now*
 5. Installation process starts and it takes several minutes
- After the installation completes the first time to open the software to use will ask you to enter product key. It is important for each software to have a product key because it help you to install original copy of the software not trial versions

QUESTIONS

1. Explain the importance of reading the user manual before installing new software
2. Outline the procedure you would follow to install proprietary software
 - a. Install operating system such as windows 7
 - b. Install device drivers for scanner
3. State four factors you would consider before purchasing an application software
4. State three limitations that would hinder the installation of a computer software
5. Explain the in importance of product key that comes with proprietary software
6. What determine number of software to be installed in the computer? Sate two
7. Mention two methods of installing operating system
8. What is the purpose of device drivers?

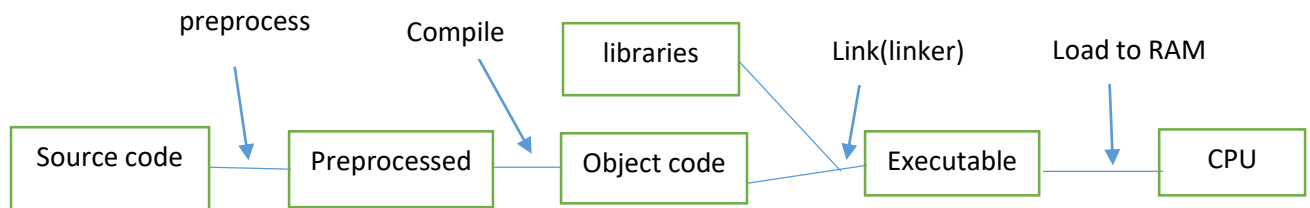
TOPIC 3: PROGRAMMING FUNDAMENTALS

Introduction

- To process any type of data a computer flows a set of a well-defined instructions known as **program**
- Creating a program requires a programmer to provide design of the program called algorithm
- The process of designing the program is called algorithm design
- Algorithm design is both a science and an art because scientific approach and creative thinking is required to come-up with a good design.

Definition of terms used in Programming

- In programming, there are fundamental terms used in programming regardless of the programming language used. The following are some of them
 - **Computer program**
 - A computer program or just a program refers to set of instructions written using programming languages to instruct a computer to perform task.
 - **Programming languages**
 - Just like a formal language, programming language is a formal language that specify the syntax and semantics rules for writing computer programs.
 - Some example of programming languages are: BASIC, C, C++, Java, Pascal, FORTRIN and COBOL etc.
 - **Source code**
 - Source code refers to a set of instructions or statement written by a programmer that are not yet translated into machine-readable form.
 - Source code is mostly a text file written using programming language
 - **Object code**
 - This is a source code that has been converted into machine readable form.
 - To convert source code to object code, language translator such as interpreter, assembler and compiler are used.
 - **Assembler**
 - An assembler converts assembly language program into machine readable form that computer can understand and execute.
 - **Interpreter**
 - An interpreter converts the source code into machine code statement-by-statement allowing the CPU to execute one line at a time.
 - The interpreted line is not stored in the computer
 - This means that every time the program is needed for execution, each line has to be interpreted.
 - This method of interpreting program was common in early computers that did not have enough memory to store the object code.
 - **Compiler**
 - A compiler converts the entire source code into object code.
 - The object code is made into an executable file by carrying out a process called *linking* which combine object code with library files required for execution of the program.
 - After linking process, an executable file is generated and is stored in storage media with file extension as .exe file in Windows operating system environment.
 - The figure below illustrates how a compiler converts source code to executable file



Differences between a compiler and an interpreter

1. An interpreter translates the source code one statement at a time while a compiler translates the entire source code at once before execution.
2. Interpreter translate the program each time it is run hence slower than compiled programs while compiler, the compiled program (object code) can be storage on storage media and run as required hence execute faster than interpreted programs
3. Interpreter, interpreted object codes takes less memory compared to compiled programs while compiler, compiled programs require more memory as the object files are longer.

HISTORY OF PROGRAMMING LANGUAGES

- Hundreds of programming languages have been developed over the years. These languages are classified into **two** broad categories:
 1. Low-level programming language
 2. High-level programming language
- These categories can be subdivided into five generations.
- The low-level language consists of first generation and second generation while the high-level has third generation to fifth generation.

Low-level languages

- Low-level languages are classified as low because they can easily be understood by computers since they require minimal effort to convert into computer object code
- Low-level languages are hardware oriented hence they are not portable i.e. a program written for one computer cannot be installed on another computer.
- Two types of low-level languages are
 1. Machine language (first generation language)
 2. Assembly language (second generation language)

1. Machine language

- Machine language, instructions are written using *binary code*.
- Given that data and instructions are written in binary form, many lines of code are needed to accomplish even a simple task like adding two number.
- A program written in machine language may look like he one below:

```

11100011  00000000  10000011
00011100  10001101  111000111
10001111  11111000  100000001
  
```


- Machine languages are hard for a person to understand what the program is all about unless they have knowledge of machine level programming.
- Furthermore, different CPU's understand different machine language e.g. code for intel Pentium processors may differ from Motorola processor.
- Therefore, before writing the machine code, the programmer has to know for which CP the program is written
- Such programs are hard to write and debug from programmer point of view, but are easy to execute from the computer perspective.

2. Assembly language

- Assembly language was developed to overcome the difficulties of understanding and using machine language.
- This language allows the programmer to write the programs as set of symbolic operation codes called **mnemonics**.
- Mnemonics are basically shortened two to three letter words.
- A program written in assembly language may look like the one below

```

MOVE    AX,    15    (move 15 to register AX)
SUB     AX,    10    (Subtract 10 from the value AX)

Key: MOV – Move; SUB – Subtract; AX- data register

```

- Programs written in assembly languages require an assembler to convert them into machine codes that the computer can understand
- Like machine languages, assembly are also machine depended and therefore programs written for one computer cannot be used in another computer.

Advantages and disadvantages of low-level languages

Advantages

1. The CPU understand machine language with minimal or no effort
2. The processor executes low –level program written in faster because complex instructions are already broken down into smaller simpler ones.
3. Low level languages are stable and hardly crash or break down once written.

Disadvantages

1. Low –level languages are difficult and cumbersome to use and learn.
2. Require highly trained programmers both to develop and maintain programs written in low-level languages.
3. Correcting errors [debugging] in low level languages programs is difficult.
4. Low level programs are machine dependent i.e. they are not portable from one computer to another.

High level languages

- High level languages are close to human language hence they can be read and understood even by people who are not experts in programming.
- High level languages are *machine independent* meaning that a program developed for one computer can run in any computer
- Therefore, a programmer means that a programmer concentrates on a problem solving instead of understanding the architecture of the machine
- High-level language can be classified into five categories:
 1. Third generation languages (3GLs)
 2. Fourth generation languages (4GLs)
 3. Fifth generation languages (5GLs)
 4. Object Oriented Language (OOPs)
 5. Web scripting languages

Third generation languages (3 GLs)

- Third generation languages are also called structured or procedural languages.
- A procedural language makes it possible to break down a program into components called *modules*, each performing a particular task
- The process of breaking down a program into modules or sub-program is referred to as structured programming.
- Structured programming emphasizes the following:
 1. Large programs should be broken down into smaller sub-program each performing a single task
 2. Use control structure in problem solving
- Structured programming offers many benefits because
 1. It is flexible
 2. Easier to read
 3. Easy to modify
- Examples of third programming languages are:
 1. Pascal: developed to help in teaching and learning of structured programming
 2. FORTRAN (FORmula TRANslator): Developed for mathematicians, scientists and engineers to enable them solve their problems.
 3. COBOL (Common Business-Oriented Language): Designed for developing programs that solve business problems.
 4. BASIC (Beginners All-purpose Symbolic Instructional Code): Developed to enable students learn programming easily
 5. C: Used for developing system software such as operating system. It is powerful programming language because of its ability to provide programmers with powerful features of low-level programming language and at the same time understandable as a high-level programming language
 6. Ada: suitable for developing military, industrial and real-time system. Was developed by Ada Lovelace a lady.

Fourth generation language

- Fourth generation language (4GLs) were improvement on 3GLs to reduce programming effort by making the programmer focus more on the problem than algorithm or structure of the program.
- The 3rd generation and 4th generation overlap because it is enhancement of 3rd generation
 - However, unlike the 3GLs, most 4GL have advanced programming tools for

1. Integrating the program with database
 2. Generating reports
 3. Creating graphical user interface (GUI) applications.
 4. Uses application generators that automatically generate program code easy to write.
- Some examples of 4GLs are: PowerBuilder, FoxPro, Python, Progress 4GLs, Microsoft Visual Basic and Delphi Pascal.

Fifth generation languages (5GLs)

- The fifth generation language also called natural language are used to develop systems that solve problem using artificial intelligence.
- Artificial intelligence refers to a computer system that mimic human-like intelligence
- Such intelligence includes:
 1. visual (seeing) perception
 2. speech recognition.
 3. Decision making
 4. Movement
- In 5GLs, the programmer only worries about constraints required for the program to be solved but not algorithm
- Examples of 5GLs are: PROLOG Mercury, LISP and OPS5

Object-oriented programming (OOP)

- Currently, there is shift from structured programming championed in 1970s using 3GLs to object-oriented programming (OOP).
- In OOP, program may consist of *several objects that interact by sending messages to each other.*
- Several objects are linked together through a method known as association to create a complete program.
- It is important to note that OOP is not classified as a separate generation because it is a shift in program development methodology.
- Most programming languages that supported structured programming like C are enhanced to support Object-oriented programming.
- Examples of OOP are: Java, Microsoft Visual Basic. Net, Objective-C, C++, C#, python, Perl, Ruby, Delphi Pascal and smalltalk.

Web development and scripting languages

- Web scripting languages are used to develop or add functionality on web pages
- Web pages are hypertext documents created using Hypertext Markup Language (HTML)
- HTML contains tags that are interpreted by the web browser software to display contents when the file is opened on the browser. A tag is a symbolic, word or character enclosed in angle bracket <> that a browser can interpret it as a command
- Other languages such as Extended HTML (XML) works also like HTML only the difference that XML allows the user to define their own tags instead of using standard HTML tags.
- HTML is not considered as programming language because it does not have declaration part and control structures.
- To add functionality to HTML, scripting languages are used such as JavaScript, VBScript and Hypertext Preprocessor (PHP)
- A script is a small program code written using scripting language then appended into HTML program to add functionality like sliding calendar and form validation

- HTML has an opening tag <> and closing tag </>

Advantages and disadvantages of high-level languages

Advantages

- 1.High-level languages are portable i.e. can be installed in more than one computer
- 2.High-level languages are user friendly, and easy to learn and use
- 3.High-level languages are more flexible. They enhance creativity and innovation of the programmer and increase productivity in the workplace
- 4.It is easier to correct errors

Disadvantages

- 1.Their nature encourages use of many instructions in a statement hence the size of these instructions cause slower program processing
- 2.These languages need more hardware and software resources because programs have to be interpreted or compiled to machine form before execution
- 3.They require large computer memory to be executed

Program development process

- There are five main phases of program development life-cycle (PDLC)

1. Problem definition
2. Algorithm design
3. Program coding
4. Program testing and debugging
5. Program review and maintenance

● Problem definition

- Problem definition refers to one's ability to identify a problem that need to be solved using a computer
- A creative programmer seeks to identify problems and opportunities in the society and seeks to provide computer based solution.
- A good example is the one who developed Microsoft word software after seeing the tedious work of writing using type writer, he came up with software to be used for typing
- The following three situations may motivate a programmer to develop computer program

 1. Problems or undesirable situation that prevent an individual or organization from achieving their goal
 2. Opportunity to improve the current system
 3. Ne directive given by the management or government requiring change in the status quo.

- A problem definition stage ends with documenting hardware and software requirements necessary for solving the problem
- It is this document that enable a programmer to develop an algorithm for implementing the solution.

● Algorithm design

- After the programmer identifies a problem, the next step is to design the solution for solving the problem called algorithm.
- An algorithm is a well-defined step for performing a task or solving problem.

- The algorithm is designed using the following:
 1. Flowcharts
 2. Pseudocode
 3. Structured English statements
- For example, to calculate area of a circle, a programmer may use the pseudocode below to outline steps the programmer will follow to calculate the area

```

Program: Calculate area of a circle
BEGIN
  SET as constant PI= 3.142
  PRINT "enter radius"
  READ radius
  Area = PI * radius
  PRINT area
END

```

- Before coding, the algorithm should be tested for logical error
- **Program coding**
 - This is the stage of writing the program code using programming languages e.g. C, C++ etc.
 - The source code written by the programmer need to be converted to object code using language translators like compiler, interpreter or assembler
 - Most programming languages have common elements and the following are some of them:
 1. Reserved words: Also referred to as keywords have special meaning and can only be used for intended purpose. Some examples are: *for, if, else, while* and *do*
 2. Identifiers: identifiers are programmer identified symbolic names used to identify elements like variables and constants
 3. Operator: are used to perform arithmetic operations e.g. +, *, /, =, and –
 4. Variable: Is a named location in computer's memory for holding data. The contents in variables may change during execution unlike constants whose contents do not change
 - Unlike other programming languages like Pascal, other programming languages are case sensitive so when writing need to be careful with spellings and use of capital letters and small letters
- **Program testing and debugging**
 - Testing is the process of tracing or checking whether the program has errors (bugs) while debugging is the process of correcting identified program errors.
 - There are two types of errors that may be encountered when testing the program
 1. **Syntax error:**
 - These are errors that emanate from improper use of language rules e.g. grammatical mistake, punctuation, improper naming of variables and misspelling of identifiers and reserved words.
 - Syntax error are detectable by the compiler or an interpreter and must be corrected before the program runs
 2. **Logical errors**
 - These errors are not detectable by the compiler or interpreter
 - The program runs but gives wrong output

Therefore

1. Syntax error are detectable by the compiler or interpreter while logical errors are not detectable by the compiler or interpreter
2. In syntax error the errors are detected before the program run while logical errors are detected after the program run
3. Syntax errors result from improper use of language rules while logical error result from improper coding

Tracing program errors

- Tracing the program requires careful step-by-step trace of input, processing and output statements.
- The following is a three-step process of testing an algorithm or program for errors
 1. Dry-run (desk checking): This involves using trace table to check whether the program or algorithm has errors before writing it in a program editor.
 2. Debugging: Once the program is written in a program editor, the programmer uses debugging utilities to detect and correct syntax errors before compiling the source code into object code
 3. Test data: After the program compiles successfully, the programmer carries out trial test data to check for logical and run time error. This is done by entering valid and invalid data to check whether the program produces desirable output.

- **Program review and maintenance**

- Review and maintenance refers to continuous update and fixing of program errors after installation.

Characteristics of a good program

1. **Simplicity**: a program should be kept as simple and easy to understand
2. **Integrity**: tis refers to reliability and accuracy of data. Therefore, mathematical statements should be tested for the accuracy of output
3. **Efficiency**: Good program design should aim at optimizing execution speed and memory utilization to enhance performance
4. **Clarity**: The statements and comments should be clearly written for it to be readable
5. **Modularity**: Complex programs should be broken down into components known as modules

TOPIC 4: INTRODUCTION TO COMMUNICATION TECHNOLOGY

Definition of terms used in communication

Communication

- Communication is the process of using sound, words, symbols, signs, pictures or signals to pass message or information from one person to another.
- The message origin is called a sender or a source while the target recipient is a receiver

Data communication

- Data communication refers to the process of transmitting data signals from one point to another through communication channels

Telecommunication

- This is the use of technology to enable exchange of messages in a form of data and information over a wired or wireless communication media

- Telecommunication technology involves use of telegraph, telephone, radio television and computer

Telecommunication network

- A telecommunication network is an interconnection of telecommunication equipment like telephone, mobile, radio, television and computers using transmission media or links.
- The network enables flow of data from the source to destination.

Computer network

- A computer network is an interconnection of computers using transmission media and networking devices to enable exchange of data.

Information and Communication Technology

- Information and communication technology (ICT) refers to the convergence of computer networks with telecommunication networks like telephone, mobile, radio, television to provide communication platform through which people can share information
- ICT provide electronic communication such as mobile internet, electronic commerce, instant messaging, email, internet radio and digital television broadcasts.

HISTORY OF TELEPHONE AND INTERNET

History of telephone

- Telephone was invented after telegraph.
- Telegraph used a series of dots and dashes(beeps) coded as electrical signals to transmit text character over a long distance
- Alexander Graham Bell improved telegraph to telephone
- Telephone was evolved from the following three categories:
 1. Rotary dial telephone
 2. Touch tone dial telephone
 3. Mobile

Rotary dial telephones

- These were the first phone to be manufactured and were used from 1919 to 1990
- To use the phone, one had to use rotary dial.
- They are not common nowadays in offices and homes
- To **dial** a number, the user puts a finger in the corresponding finger hole and rotates the **dial** clockwise until it reaches the finger stop. The user then pulls out the finger, and a spring in the **dial** returns it to the resting position



Touch tone dial telephone

- These do not have rotary dial but push button keys.
- They are called touch tone dial phones because each button produces a unique sound when pressed, a feature which is common in mobile phone.



Mobile phones

History of mobile phones

- Mobile phone was first demonstrated by Dr. Cooper in 1973
- Mobile phones are portable i.e. they are small and light and therefore can fit in a pocket.
- Mobile phones communicate using cellular wireless network that is set up by the government or mobile service provider.
- Each mobile phone has a special component called Subscriber Identification Module (SIM) card which identifies each subscriber on the network.
- There are **four** categories of mobile phones:

1. Basic/conventional mobile phone

- These are phones designed just to make calls and send text and also have a few monochrome games.
- Basic phones are characterized by:
 - Small
 - Low resolution screen
 - Physical keypad
 - Limited memory capacity
 - Low processing power
- However, some advanced basic phones may have color screen, low resolution camera, QWERTY keypad and ability to access internet



2. Touch screen feature phones

- These phone have the following characteristics:
 - Wide touch screen
 - Ability to process graphics in full
 - Higher memory capacity
 - Powerful processor than basic phone
 - High resolution camera



3. Smartphone

- They have advanced features that make them to operate as computer
- They are characterized by:
 - Powerful processor and touch screen
 - Powerful operating system (Android, iOS, windows) which makes the phone operate like a computer
 - It has high memory capacity ad has ability to access high speed internet and stream online video.
 - High resolution camera with ability to make high definition pictures and videos



4. Tablets

- This phone falls below between phone smartphone and computer in terms of size and processing power
- Tablet differs with computer because it has a slot where SIM card can be inserted in order to support voice calls, text messaging and internet access over mobile networks
- Characteristics of tablets are:
 - A large touch screen, bigger than smartphone
 - Large internal memory capacity
 - Powerful processing, more powerful than that of smartphones
 - Ability to run several applications and connect to high speed internet
 - High resolution screen and camera capable of taking high quality pictures and videos.



USES OF NETWORKS

- Some of the uses of networks include: *Electronic banking (e-banking), internet access at homes and work, Point of Sale(POS) applications, mobile communications, electronic government etc.*

1. Electronic banking

- This is the use of networked computers to offer banking services like cash withdraw, deposits, transfers and electronic payment
 - Electronic banking encompasses the following services and technologies.
 - *Automated Teller Machines (ATM)*
 - ATM machine enables people to withdraw and deposit money in their bank accounts
 - The user provides authentication details by entering PIN (Personal Identification Number)
 - *Internet banking*
 - Customers perform transactions and view their statements online
 - User register with an organization like VISA or MasterCard in order to perform online transaction internet.
 - *Mobile banking*
 - Mobile phones are now used to access bank account to withdraw, deposit, transfer cash, paying bills and buying mobile airtime.
- 2. Internet access at home and work**
- Computer networks enable access to information at homes and workplaces using computers, laptops, tablets and mobile phones using wired and wireless means
 - This support research, access to e-health services and e-commerce
- 3. E-commerce**
- This enable people to buy and sell goods and services online using phone or computers.
 - If e-commerce is done using mobile phones, it is called mobile commerce (M-commerce)
- 4. Point-of-sale(POS) services**
- This enable people to pay for goods purchased in retail stores using electronic money at the point of sale using VISA, MasterCard etc.
- 5. Mobile communications**
- Mobile networks facilitate communications and delivery of services like voice, data and money transfer.
- 6. Electronic government**
- Computer networks are enabling government to deliver electronic services to the citizen e.g. payment of taxes, international trade, application for government documents, electronic identities and passport.
 - This enable government to offer efficient services to the citizen

BENEFITS OF NETWORKS

Some of the benefits of using computer networks include: resource sharing, remote communication, distributed processing facilities, cost effective and reliability

1. Resource sharing

- A resource in the network environment means chart, files, printers, modems, communication links, storage devices, fax machine, programs and other component that can be share on the network.
- Resource sharing enable sharing of files, exchange of emails, sending faxes and printing.
- Centralized access to data and information leads to less worst of time hence productivity
- In computer networks, shared resources may be attached to a network server and other computers on the network send request to the server.

2. Remote communication

- In the presence computing environment, computer engineers are faced with two problems:
 - i. Roaming of officer who by virtue of their work keep on covering long distance away from workplace
 - ii. Solving the problem of remote access to the organization's information so that they can have up-to-date content or updated information on server
- The problem of roaming has been addressed by development of portable computers like laptops
- The problem of access to the network has been addressed by remote communication.
- Remote communication refers to the transmission of data signals between two communication devices located in different geographical areas.
- A computer that tries to access resource from another computer on the network is called a remote client while a computer being accessed is called remote server.
- Remote communication has been made possible by use of wireless communication media e.g. radio waves, microwave and satellite
- With remote communication, people can share information and pass message over the internet while at homes without necessarily going to work which increases productivity.

3. Distributed system

- Distributed processing refers to processing of data by interconnected computers located in different geographical areas.
- In distributed processing, users that processing is distributed but will think that everything is taking place at their own computer.
- This is different in centralized processing where all data and information is put in one computer called a server and all computers access from it.
- In distributed computers, files reside on the user's computer rather than on central server.
- This enables branch offices have their own server to keep files rather than relying on central server.
- The advantage of distributed system is that:
 1. The failure of central computer does not affect the operations of other terminals
 2. Processing load is shared equally hence no time wastage

4. Cost-effectiveness

- Networks are cost effective in the organization
- This is so because resources like printers are shared on the network.
- An organization may have one printer or fax machine which can be connected to all computers of the organization and allow all users access it using network.
- People also can send email on internet reducing cost for posting letter.
- Companies also hold video conferencing instead of conducting meetings and therefore save travelling expenses.

5. Reliability

- A computer network is reliable in two ways:
 1. Data is transferred with minimal or no error from source to destination
 2. In case one computer breaks down, users can still access internet from other computers

LIMITATIONS OF NETWORKS

- The following are disadvantages of computer networks: security issues, high cost of installation cost, moral and cultural effects, spread of terrorism and drug trafficking, and over reliance on networks.

1. *Security issues*

- Data and information transmitted over a computer network is prone to illegal access.
- It can be tapped by unauthorized user as it travels from source to destination
- This can be overcome by encrypting the data with password before it is sent

2. *High initial cost*

- The initial cost of buying hardware and software may be very high.

3. *Social-cultural effects*

- Children may have access to pornographic movies which may result in premarital sex, as well as drug and substance abuse

4. *Spread of terrorism and drug trafficking*

- Internet provides good environment for the spread of illegal activities such as terrorism and drug abuse
- Terrorists and drug traffickers use internet for network for their business communication

5. *Over-reliance on network*

- Most organization today have stopped using manual operations.
- This means that their business processes depend on computer networks
- Therefore, the disadvantage is that if the network fails or goes down, all system in the organization are brought to halt.

ELEMENTS OF COMMUNICATION SYSTEM

- A communication system consists of terminal device, communication channels and transmission media that enable exchange of message between users of the system.
- A communication system has the following elements:
 1. Message source
 2. Transmitter
 3. Communication channel
 4. Receiver
 5. Message user
 - **Message source**
 - This is the person who wants to send the message across the communication system
 - The message source may want to make telephone call, send email, chat etc.
 - **Transmitter**
 - This is the terminal equipment that receives a message from the source and converts it to a format that can be transmitted on the channel
 - A transmitter can be a computer, radio, TV
 - **Communication channels**
 - A communication channel is a transmission media through which data and information flow
 - A channel carries the coded message from the transmitter to the receiver using signal that can flow through it
 - **Receiver**
 - A receiver is a terminal equipment that get the transmitted message from the channel and decodes it before presenting it to the user.
 - It could be computer, mobile phones, radio tuner etc.
 - **Message user**
 - This is a person who is the target recipient of the message.

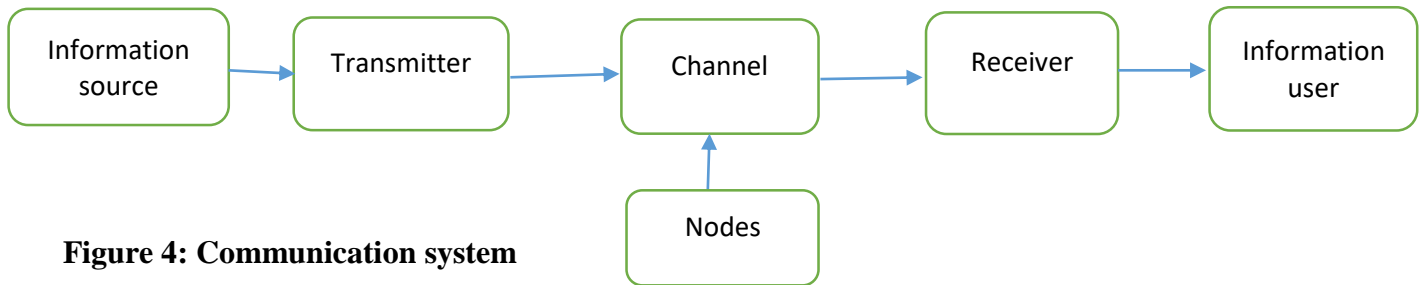


Figure 4: Communication system

NETWORKING DEVICES

- Communication devices is made up of several devices.
- These networking devices enable transmission of data signals from the source to destination.
- Generally, devices connected to the communication medium can be classified into two broad categories:
 1. Data Terminal Equipment (DTE)
 2. Data Circuit-terminating Equipment (DCE)

Data Terminal Device

- Data terminal equipment (DTE) is a device at both ends of the communication network that converts user information into signals at the source or reconvert signals at the destination.
- Examples of DTEs include: desktop computers, mobile phone, laptops, tablets and Personal Digital Assistants (PDAs)

Data Circuit-terminating Equipment

- Data Circuit-terminating Equipment (DCE) also known as Communication equipment's refers to devices used to establish, maintain and terminate communication session between DTE (Data source) and its destination.
- DTE is an interface between data terminal equipment and communication media.
- Some examples of DCEs include: Network Interface Card(NIC), modems and Codecs, hubs, bridge, repeaters, routers, gateways, switches and access points

1. Network Interface Card(NIC)

- Network interface card creates a physical connection between the computer and transmission media.
- It is plugged into an empty expansion slot on the motherboard.
- Network interface cards has ports at the back in which terminated ends of a network cable can be plugged.



-

Modems and codecs

- A modem converts a signal from digital to analog form before transmission over analog media while a codec converts an analog signal to digital form for transmission via digital medium.
- At the receiving ends, terminal devices convert the signal to original form.



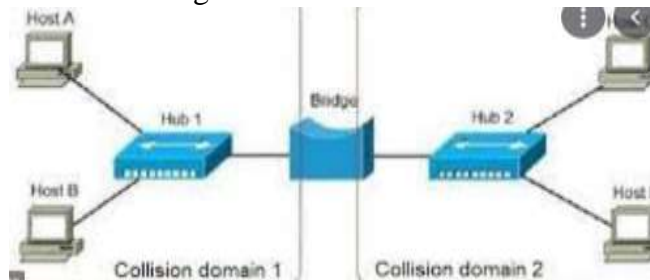
2. Hubs

- A hub also called concentrator is a component that connects computers on Local Area Network and relay signals from one computer to another.
- A hub transmits signals by broadcasting them to all computers on the network.
- After the signal is broadcasted, the computer whose address is on the message picks the message from the network.
- The increase in broadcast range can lead to what is called broadcast storm on the network
- Broadcast storms refers to a condition where network is overwhelmed with messages making communication impossible



3. Bridge

- A bridge is a network device that determine the appropriate network segment for which a message is meant for delivery.
- A bridge can divide a busy network into segments to reduce network traffic.
- The purpose of using bridge is to:
 1. Expand the length and number of stations that a segment can support
 2. Reduce overall traffic flow by allowing broadcast only in the data destination segment of the network
- A bridge makes sure that packets that are not meant for a particular segment are not broadcasted in that segment.



4. Repeaters

- A repeater receives data from one segment of a network, cleans it to remove any distortion, boosts it and then sends it to another segment.
- Repeater broadcasts to all segments which may lead to broadcast storm.
- However, a repeater eliminates the problem of attenuation

5. Router

- A router interconnects different networks and directs the transfer of data packets from one source to destination.
- Routing depends on network address.
- Each network has a unique address
- All the computers from the same network have same network address but different host number.
- The router receives the packet from a computer on the network and checks the destination's network address and passes it to that network which then passes to the host address.
- Some routers combine the function of bridge and routers called brouter.



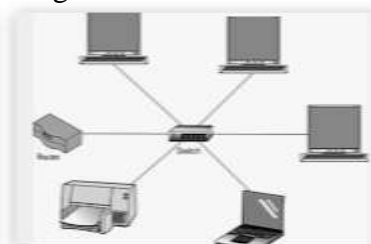
6. Gateways

- A gateway provide access to the device on Wide Area network or internet
- Gateway software may be installed in a router to access internet.
- A gateway is the most powerful internetwork device because of its ability to convert data across different internetwork architecture and protocol.



7. Switch

- A switch is s device that forward packet directly to addressed node without broadcasting.
- A node is an equipment on the network.
- A switch transmit data by connecting by connecting two nodes point-to-point
- Because data is not broadcasted as hub, it reduces the problem of broadcast storm.
- Note that some hubs are configured to function as switch and are called intelligent hub.
- Switch are more expensive that hub.



WIRELESS COMMUNICATION DEVICES

- These are devices which allow communication without using wires.
- Some of the most common devices used in wireless communication include Wireless Access point and Antenna.

1. Wireless Access Point

- This is a component used to extend local area network.
- It is access point to a wired network to people who have wireless devices like smartphone, PDAs, laptops and desktops



2. Wireless antenna

- This is a device mounted indoors or outdoors to extend wireless network to the surrounding buildings
- It is used to propagate radiowaves, microwave or infrared waves that carry data to be received by access point in the surrounding.



3. PCMCIA card

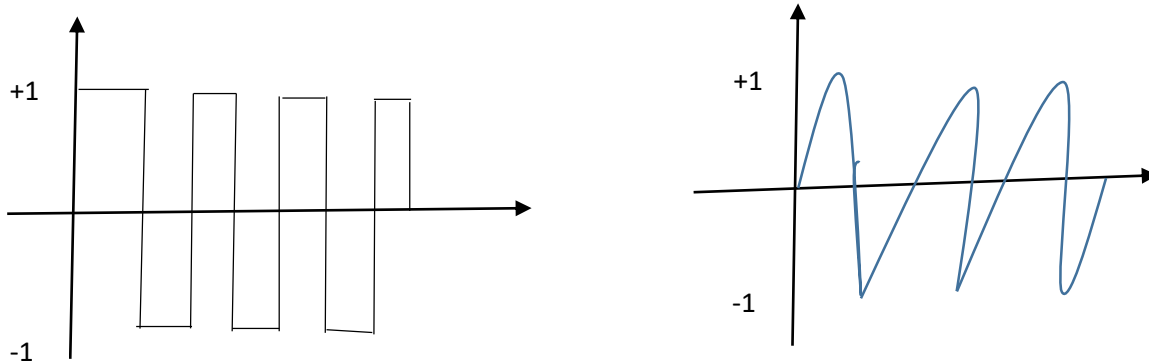
- A Personal Computer Memory Card International Association (PCMCIA) adapter is an add-on card inserted into a device such as PDA or laptops in order to enable wireless communication between the device and the wired network server.



DATA SIGNAL TRANSMISSION

Terms used in data signal transmission

- Some terms used in data communication include: *data signal, signal modulation and demodulation, multiplexing, bandwidth, baseband, broadcast transmission and attenuation.*
- 6. **Data signal:** this is a voltage level in the circuit which represents the flow of data. In communication, data signal can either be analog or digital in nature
 - Analog is made up of continuous wave form while digital data is made up of a non-continuous discrete signal



Although the two graphs look different, they repeat themselves at equal time interval. Electrical signals of this nature are said to be *periodic*. Generally, a periodic wave representing a signal can be described using the following parameters:

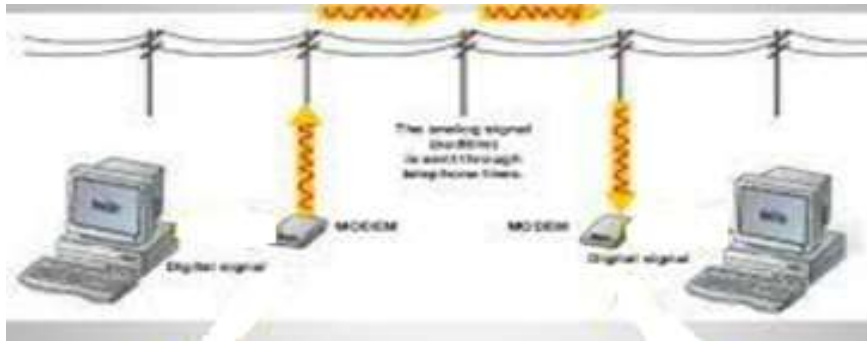
1. Amplitude (A)
2. Frequency (f)
3. Periodic time (T)

Amplitude: Amplitude is the maximum displacement that the waveform of an electrical signal can attain. For example, the amplitude of the electrical signals is 1.

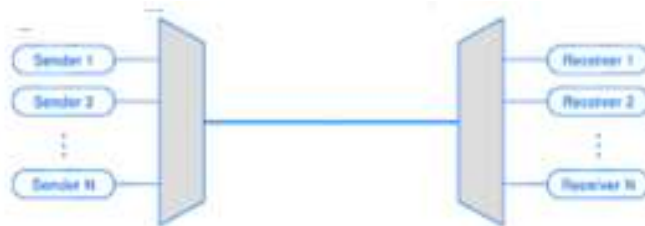
Frequency (f): Frequency is the number of cycles made by signal in one second. It is measured in units called hertz (Hz). Hz is equivalent to 1 cycle/second

Periodic time (T): The time taken by a signal to complete one cycle is called periodic time (T). periodic time is given by $T = 1/f$, where f is frequency of the wave.

7. **Signal modulation and demodulation:** This is the process of converting data signals to and from a form that is suitable for transmission over a transmission medium.
 - A modem converts a digital signal to analog signal to be transmitted over analog telephone line a process called modulation
 - At the receive end, another modem converts back analog signal to digital form a process known as demodulation.



8. **Multiplexing:** multiplexing is the process of sending multiple data signal over the same medium. Demultiplexing is the process of separating the multiplexed signal at the receiving end.
- Imagine a situation where 100 computers in town A want to communicate with 100 computers in town B. if multiplexing is used, each of the computers in town A will need a direct cable linking it to another in town B. however, with multiplexing, the computers can be made to share a single cable lied between two towns hence save cost.



9. **Bandwidth:** bandwidth is the maximum amount of data that a transmission channel can carry at any one time. For example, a certain cable transmitting 100mbps (mega bits per second) is said to have 100 Mbps bandwidth.
10. **Baseband signal:** Baseband signal is a digital signal that is generated and fed into a transmission medium without modulation. The signal takes forms of voltage of different magnitudes applied to the medium. Only one signals can be sent at a time
11. **Broadband transmission:** In broadband transmission, analog signals are transmitted over the transmission medium using different frequencies. This means that several data signals can simultaneously be sent through the same medium at different frequencies. Frequency bands between these data signals prevent them from overlapping.
12. **Attenuation:** This is decrease in magnitude and energy of a signal as it progressively moves along transmission medium. If the signal is not boosted, it is totally lost along the way and may never reach the destination. Attenuation is minimized by placing a *repeater station* along the medium at appropriate distance.

CLASSIFICATION OF COMMUNICATION NETWORKS

- Communication networks can be classified as either *circuit switched*, *packet switched*, or *message switched*.
1. **Circuit switched network**
- In circuit switched network, a dedicated line has to be set before data is sent from source to destination. All the data is sent through the dedicated connection.

- Example of such networks are telephone network and dial-up network

Advantages of circuit switching

- i. Communication entities enjoy dedicated connection
- ii. Data is sent through the same path from source to destination

Disadvantages of circuit switching

- i. Inefficient utilization of communication channels since even when the link is underutilized, other devices cannot use it.
- ii. Circuit switching communication is expensive in terms of set-up cost and bandwidth utilization.
- iii. Lack of error localization means a broken link means the entire communication breaks down.

2. Packet switched network

- In packet switched networks, a message is broken down into small tokens called packets, serialized and sent over the network to the destination.
- Each packet follows its own route to the destination and there is no dedicated connection hence many users can use the same link at a go.

Advantages of packet switching

- i. Efficient utilization of communication channels since many users can share the same channel
- ii. Cheaper communication costs because no setup cost is required
- iii. Error to message are localized i.e. if a packet becomes damaged only that packet needs to be reset. Also if the link breaks, the packet can be routed through available channels.

Disadvantages of packet switched.

- i. Routing of packets from source to destination is required.
- ii. Assembling of packets at the destination node requires computing effort.

3. Message switched networks

- In message switching, an entire message is sent from one node to the next then forwarded to the next until the message reaches the destination.
- Nodes have special memories called buffers for storing messages then forwarded them.

Advantages of message switching

- i. Transmission efficiency is greater since message can share channel
- ii. Message priorities can be set on the network
- iii. Since the next route is determined from the current node, more efficient routing of message is possible.

Disadvantages

- i. Long messages can dominate the channel at the expense of others
- ii. Nodes must have large storage capacities and forward messages.

DATA TRANSMISSION MEDIA

- Data signals cannot be sent from one place to another without medium of communication.
- A communication media is physical(wired) or wireless channel
- In networking data communication media can be divided into two categories:
 1. Communication using cable (physical media)
 2. Wireless communication (wireless media)

Communication using cables (physical media)

- The main distinguishing characteristics of physical media is that data is transmitted from the source to destination through a physical channel such as copper cables.
- The electrical signal is propagated through the cable from source to destination
- There are several types of physical transmission media but the most common are:
 1. Two wire open line cables
 2. Twisted pair cables
 3. Coaxial cables
 4. Fibre optic cables

1. Two-wire open line

- Two-wire open cable is made up of two parallel copper wires separated by a plastic insulator.
- They are most used in telecommunication network to transmit voice signals



- Although the plastic insulator is meant to reduce interference called **crosstalk**, their linear nature allows an electromagnetic field to build around them during heavy data transmission which may cause interference to the signal.
- The wire also captures environmental frequencies e.g. radiowave hence causing *noise* in transmission channel.
- In data communication, the word noise refers to unwanted signals picked up by the channel

2. Twisted pair cables

- A twisted pair cable is made up of two solid copper wire twisted around each other in a double helix manner.
- The winding of the wire is meant to reduce the build-up of electromagnetic field around the two wires as they transmit data.
- Twisted wire cables are used to transmit both voice and data signals.
- The two common twisted pair cables are
 1. Unshielded twisted pair (UTP)
 2. Shielded twisted pair cable (STP)



- Unshielded Twisted Pair (UTP) cables do not have a shield that prevent electromagnetic interference (EMI) from the environment. The cable is therefore susceptible to noise and signal interference.
- The noise may come from lightening sparks, radio frequencies or radiation from spark plugs in motor vehicle.
- Therefore, UTP is not suitable in the environment that are electrically “noisy”
- The alternative is to use STP that has cable pairs.
- Shielded Twisted Pair (STP) is similar to Unshielded Twisted Pair (UTP) except that a wrapped around the wires protect them from noise.
- Twisted pair cables are categorized into groups according to the data transmitted and maximum rate of transmission as shown in the table below:

Category	Suitable for transmitting	Speed (max.limit)
Cat 1	Voice	Less than 1 Mbp
Cat 2	Data	1 Mbps
Cat 3	Data	16 Mbps
Cat 4	Data	20 Mbps
Cat 5	Data	100 Mbps
Cat 6	data	200 Mbps

Most organization today use cat 5 and cat 6 twisted pair to set Local Area Network

Example 1

A student typed an e-mail to send over internet at a speed of 100 Mbps. Calculate the maximum number of characters that can be sent per second if each character consists of 8 bits.

Solution

$$\text{Characters per second} = \frac{100 \times 1 \times 10^6}{8} = \frac{100 \times 1\,000\,000}{8}$$

$$= 12\,500\,000 \text{ characters per second}$$

Although twisted pair cables support high data rates of up to 100 Mbps, they suffer from attenuation. Therefore, an amplifying device called repeater must be installed.

The advantages of twisted pair cabling include:

- It is easier to set up network media because UTP cables are widely available
- Devices used to set up UTP network are cheap and readily available
- UTP cables are cheaper because of mass production for telephone use

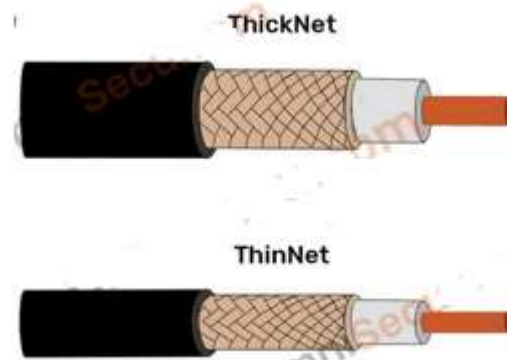
The disadvantages of twisted pair cabling include

- UTP connection suffers high attenuation
- It is sensitive to electromagnetic interference and eavesdropping (interception of communication between two parties by a malicious third party)
- It has low data transmission rate as compared to fibre optic cables

1. Coaxial cables

- A coaxial cable resembles a cable that is used to connect television antenna to a television set.

- It is called a coaxial cable because it has a copper core (coax) which may be of solid copper wire surrounded by a dielectric material.
- The dielectric material is then surrounded by mesh conductor which is covered by a shield making the cable more resistant to electromagnetic interference than the twisted pair cable.
- The shield and the insulation protect the cable from frequency interference (RFI) and electromagnetic interference (EMI).
- Although the cable has better protection against magnetic interference than twisted pair cables, it has a moderate protection against magnetic interference
- The diameter of the centre core determine attenuation rate.
- The thinner the core, the higher the attenuation rate. Data is carried in coax n a form of direct current (d.c).
- Coaxial cable has a bandwidth of up to 1Gbps (Gigabits per second) hence it is used as a network backbone. A good example is a cable that is used to connect different networks between building and routing trunk calls in telecommunication.
- **Two types of coaxial cables are:**
 1. Thin coaxial cable also called thinnet: has one dielectric insulator
 2. Thick coaxial cable also called thicknet: has two dielectric insulators around the core and is thicker than thinnet



Advantages of coaxial cables are:

1. They are stable even under high transmission rate
2. They have high bandwidth compared to twisted pair cables
3. They are capable of carrying voice, data and video signal simultaneously
4. They are more resistant to radio and electromagnetic interference than twisted pair cables.

Disadvantages of coaxial cables include:

1. Thick cables are hard to work with
2. Coaxial cables are relatively more expensive to buy and to install as compared to twisted pair

Local area network established using coaxial cables is difficult to troubleshoot and maintain. So many people use twisted pair instead of coaxial cable.

3. Fibre optic cable

- Fibre optic is one of the latest transmission media used in local and wide area network.
- Instead of transmitting data signals using electronic signals, fibre optic cables uses visible light to transmit data from one point to another on a network.

- The electrical signals from the source are converted to light signals then propagated along the cable. The source has a Light Emitted Diode (LED) which convert electric signal to light.
- At the receiving end, a *photosensitive* device is used to convert the light back to electric signal
- The fibre optic cable is made up of:
 - **Core:** is a central part of the cable and is made of a hollow transparent or black
 - **Cladding:** is a single protective layer surrounding the core. It has some light bending characteristics in that, when the light tries to travel from the core to the cladding, it is redirected back to the core. This is why even if a fibre optic cable is bent into coils and light signals is inserted at one end, it will still be seen coming out of the other end.
 - **Buffer:** the buffer surrounds the cladding and its main function is to strengthen the cable.
 - **Jacket:** it is the outer covering of the cable.

Types of fibre optic cables

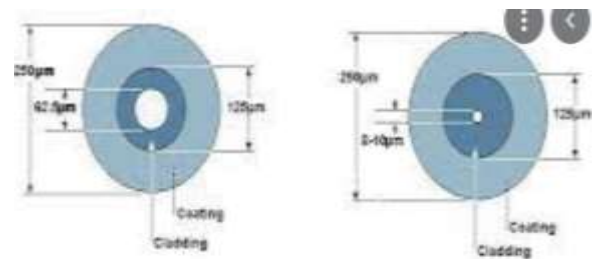
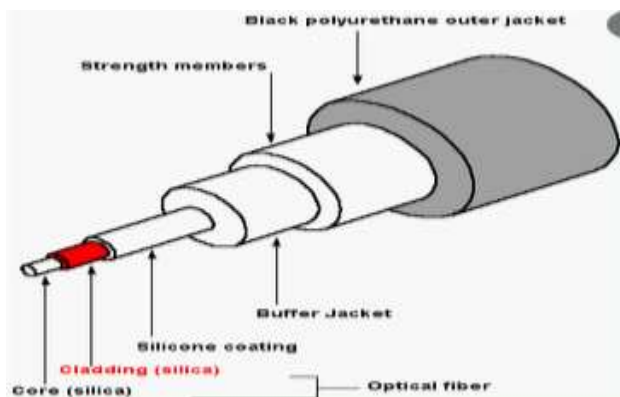
- The fibre optic cable can be classified into two categories namely: *single mode* and *Multimode* fibre optic cable

1. Single mode fibre cable

- Has a narrow centre core
- The light in the cable takes one path through it.
- Because of this, it has a very low attenuation rate and is preferred for long distance transmission
- It has a bandwidth of 50 Gbps which is higher than that of twisted pair's 100 Mbps
- Single mode fibre is very expensive and requires very careful handling during installation

2. Multimode fibre cable

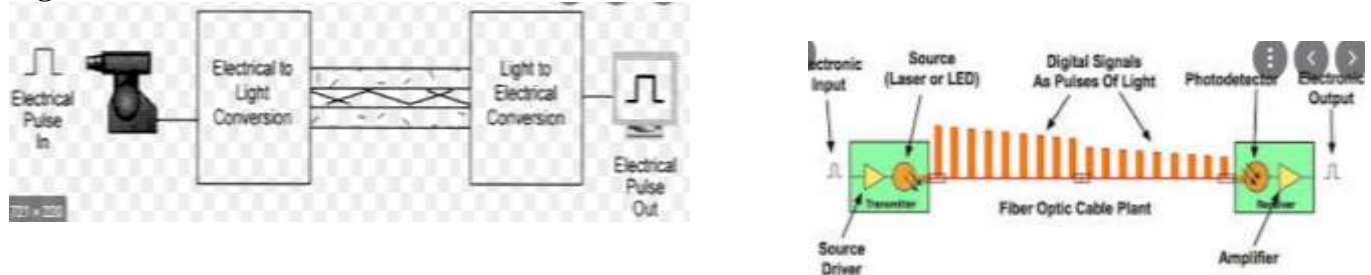
- Has a thicker core than the single mode.
- It allows several light rays to be fed in the cable at an angle.
- Because of this multiple light signals navigating the cable at the same time, distortion of the signal is possible
- Multimode cables have high attenuation rate and are usually used for shorter distance than single mode



- In a fibre optic cable, data signals travel as a light through the core, due to total internal reflection. Total internal reflection occurs when light travels from optically dense medium

such as glass to less optically dense medium such as air. When light travels from optically dense medium, it is refracted away from the main normal point to the ray deviate so far away from normal making it *refracted* rather than being *reflected*.

Figure below shows how a fibre based network transmit data from source to destination.



The advantages of fibre optic cabling include

1. It is immune to electromagnetic interference and eavesdropping
2. It supports high bandwidth
3. Can be used as a backbone in wide area network because it has low attenuation rate
4. Can be used in a highly flammable places because they do not generate electrical signals
5. It is smaller than copper hence ideal for space limited situation.

The disadvantages of fibre optic cabling

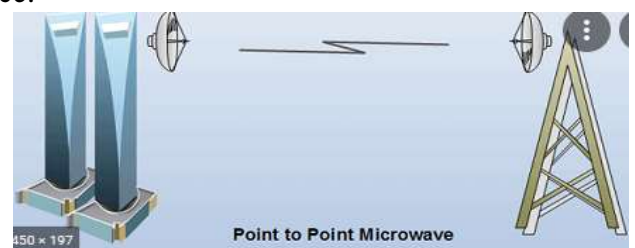
1. Connecting devices and the media are expensive
2. Installing is difficult because cable must be carefully handled
3. It is relatively complex to configure

Wireless communication (unbounded media)

- Wireless communication media is a type of media that is used to transmit data from one point to another without using physical connection.
- A transmitting antenna and aerial facilitates the communication
- Examples of wireless transmission media include
 1. Microwave
 2. Satellite
 3. Radiowaves
 4. Infrared transmission
- They all use different frequencies of the electromagnetic spectrum. The diagram below shows an electromagnetic spectrum
- All the waves travel at the speed of light

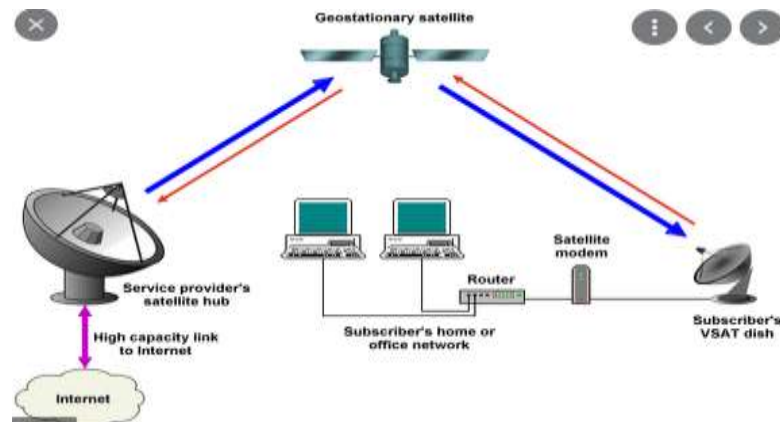
1. Microwave transmission

- Microwave frequencies range from about 3GHz to 40GHz on the electromagnetic spectrum.
- In networking, microwave is suitable for making *point to point* transmissions.
- This means that a signal is directed through a focused beam from transmitter to a receiver station.
- Due to their small wavelength, they easily release their energy in water as heat hence they are also used in making domestic kitchen appliance.

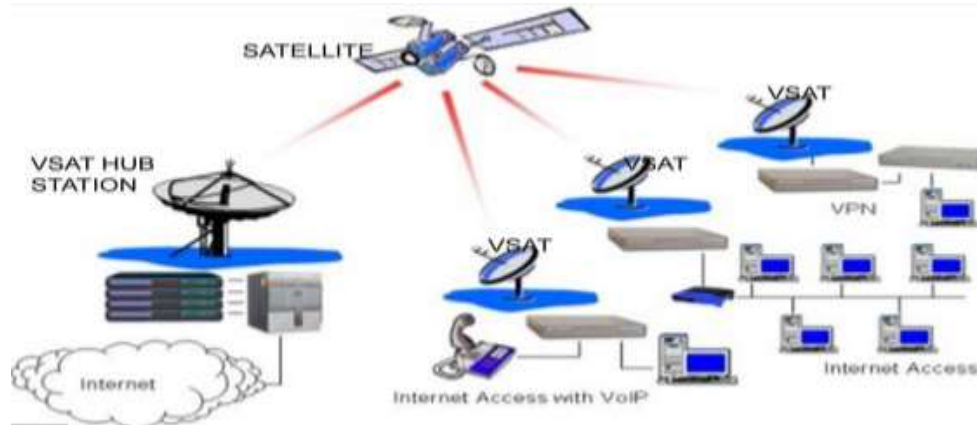


2. Satellite communication

- A satellite is a relay station. It has a parabolic dish with an antenna fixed on them to focus on a narrow beam towards a satellite in space
- A satellite has **three** main components:
 1. Transmitter earth station: that set up uplink to the satellite in order to transmit data.
 2. A satellite: it receives, amplify and transmit the signal to a receiving earth station via a downlink frequency that is different from that of the uplink so as to avoid interference with the uplink signal.
 3. Receiving earthstation: that would receive and send signal on the other side of the globe



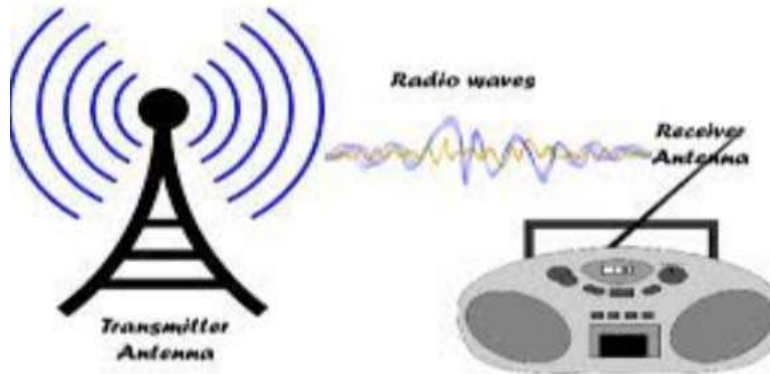
- The new trend in microwaves uses Very Small Aperture Terminal (VSAT) technology which uses a very small satellite dish used to transmit both data, radio and TV communication.
- The VSAT is mounted on a roof enables direct access to satellite communication instead of having to go through a state owned by the gateways.
- **Figure** below shows how VSAT is used to connect two locations to communicate network set up to enable two laptops in geographically desperate locations to communicate.



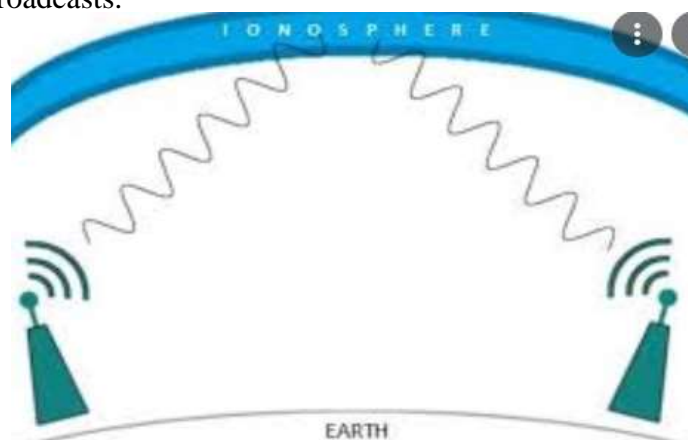
- In VSAT setup, the satellite produces a strong signal that can be received by a satellite dish antenna of only 2 meters in diameter.
- The signals are decoded using a decoder which is plugged directly to television set or computer.

3. Radio communication

- Radio waves are omnidirectional i.e. They start from a central point and spread outwards in all directions.
- As they travel outwards, the energy emitted by the waves spreads outwards over the covered area. The waves are radiated into the atmosphere by a radio frequency antenna at constant velocity
- Radio waves are not visible to a human eye
- **Figure** below shows how radio waves are propagated between transmitting station and the receiving station.



- They are used in radio and television broadcasts.
- Data can also be transmitted over radio communication channels, so instead of laying a telephone cables between two towns that are far from each other, radio waves transmission can be used to connect the two towns.
- Radiowaves can be of *high frequency*, *very high frequency* or *ultra-high frequency*
 - **High frequency:** signal is directed by propagating it to ionosphere of the earth. The ionosphere will reflect the signal back to the surface and the receiver will pick it. The challenge of this is that signals may be intercepted by unauthorized parties
 - **Very high frequency (VHF):** radio waves are transmitted along the earth's surface. The challenge of this is that signals will attenuate at the horizon so a repeater is needed to amplify the signal. It is commonly used in 'walkie-talkie' technology.
 - **Ultra high frequency (UHF):** radiowaves can be made to follow an even narrower and direct path to the receiver than very high frequency. So is popular in horizon limited broadcasts.



4. Bluetooth technology

- It is a worldwide and a shortrange radio technology that enable people to use handheld communication devices such as phones and PDAs to access internet.
- A network of Bluetooth enabled device is called Wireless Personal Area Network (Wpan0 or *piconet*).



5. Infrared transmission

- Like radiowaves, infrared waves are not visible to human eye.
- Communication is achieved by having infrared transmitter and receiver which should be within line of sight in the same room.
- Two people can communicate with each other in the same room using their phones which has this technology.
- The devices must maintain line of sight

Advantages of wireless communication

1. Wireless medium is flexible in operation as compared to wired i.e. devices can be moved around without losing access to the network
2. Wireless network can span a large geographical area
3. Wireless communication can take place via satellite even in very remote areas that do not have physical infrastructure such as telephone lines.

Disadvantages of wireless communication

1. It is relatively difficult to establish or configure
2. The initial cost is high

TRANSMISSION MODES

- Data can be transmitted using different ways or modes. The following are common modes:
 1. Parallel transmission mode
 2. Serial transmission mode
 3. Simplex transmission mode
 4. Half duplex transmission mode
 5. Full duplex transmission mode

✓ **Parallel transmission**

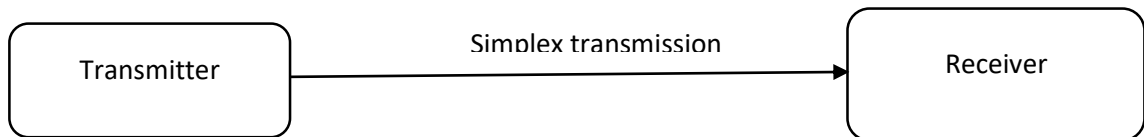
- In parallel a set of data lines or bus is used to transmit data from one device to another simultaneously. The bus is usually 1 byte (8-bits), 2 bytes, 32 bytes or 64 bytes.
- This mode of data transmission is common in the following areas:
 1. Between computer components that are connected to the motherboard e.g. transfer of data from memory to the processor.
 2. Transfer of data from computer to other peripheral devices e.g. printer

✓ **Serial transmission**

- In serial transmission data is sent as a string of 0s and 1s, one after another over a communication link.
- This is most common transmission mode.
- When the computer gets data from the network, it converts it from serial to parallel mode using a special memory called buffer. The data is then read from this memory using parallel mode

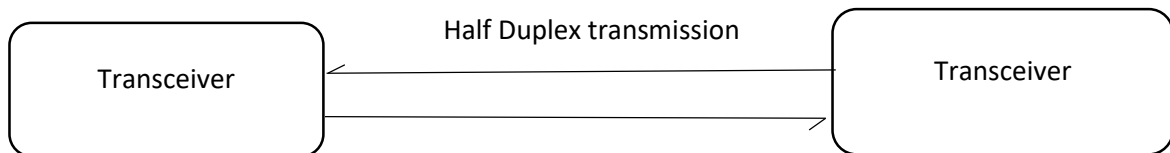
✓ **Simplex transmission**

- In this mode, there is one-way transmission of data.
- The sender sends the data and the recipient receives it and cannot send the response back to the sender over the link
- Examples of simplex are
 1. Radio tuner at home
 2. Television transmission



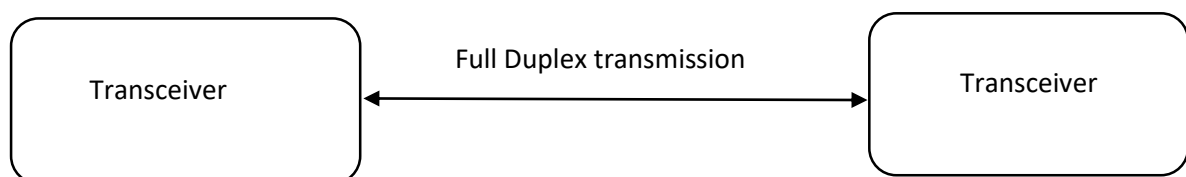
✓ **Half duplex transmission**

- In this mode, two-way communication is possible over the communication link but not simultaneous.
- The sender sends the message and after finishing, the recipient is allowed to send back the reply. An example of this is two-way press to talk radio e.g. walkie talkies



✓ **Full duplex transmission**

- In this mode, data can travel on the channel in both directions simultaneously
- Examples include:
 1. Computer communication on the network e.g. Sending emails, instant messaging
 2. The telephone calls



TOPIC 5: TROUBLESHOOTING COMPUTERS

- The term troubleshooting refers to the process of diagnosing and trying to resolve computer hardware or software related problems.
- The following problems will be discussed:
 1. Failure to load the operating system during booting process
 2. The computer stops responding (hanging) now and then
 3. Abnormal restarting of a computer
 4. Failure of the monitor to display
 5. Fatal operating system and device drivers' failure.

HARDWARE RELATED FAILURE

The following are problems that you may experience as a result of failure of basic hardware components:

- **Computer boot failure**

- When a computer is started, the BIOS performs a Power on Self-Test (POST) to check for the presence and status of existing hardware components.
- Errors found during POST are typically indicated by error messages on the screen or by a series of beeps.
- If the computer produces beep sound, count the beeps and note whether they are short or long.
- One beep indicates that all components passed the POST.
- Alternatively, the computer may display error code starting from numbers 120 or 162 that represent the problem with motherboard or processor.
- Error starting with 2 indicates memory failure while errors starting with 3 indicates keyboard failure.

To troubleshoot the startup problems above:

1. Start the computer to initiate the POST process
2. Press special keys or combination of keys (mostly DEL, ESC, CTRL + ESC or CTRL + ALT + ESC) to display the BIOS set-up
3. In the BIOS setup screen, make the necessary changes. NOTE: Never make changes that you are not sure of, otherwise you may make the computer malfunction.
4. Save the configuration changes and restart the computer

- **Motherboard, memory or processor failure**

- The following are signs of motherboard, memory or processor failure experienced after turning on a computer:
 1. Failure to complete the POST
 2. Computer displays a LED light instead of green
- Such errors are rare because most motherboard and processor prevent the computer from issuing error codes and some RAM errors are not reported to the computer at all.
- RAM errors may result when the RAM is not firmly plugged into the slot or the RAM module has a problem. To resolve RAM error, proceed as follows:
- Disconnect the computer from the power and open the system unit and locate the slot where the RAM module are plugged. Connect the RAM module to the slot firmly and start connect the computer to the socket and start it again.

- If the problem persists, there must be a problem with the RAM or motherboard socket. In this case, replace the RAM module or the motherboard.

- **Power supply unit failure**

Power supply failure may fail due to:

1. Power surge
2. Failure of the cooling fan located inside it.

To resolve the power supply unit failure, do the following:

1. Check to make sure the power supply is properly connected to power outlet or UPS is turned on.
2. Check the power selector to ensure that it has the right settings for your geographic region, for example in most countries, the voltage is 240V and others 110V
3. Open the casing and check whether the power cable that connect to the unit is firmly attached to P1
4. If the problem persists, replace the unit with a new one. Never try to open and repair the power supply because it may cause serious body injury

- **Failure of the cooler fan**

- A computer has several fans such as that of:

1. Power supply unit
2. Microprocessor
3. Chassis

- The fans protect delicate computer components from the damage caused by overheating

- When the fans start to wear out, it makes a whining or grinding noise

- To protect the fan from failure, do the following:

1. Place the computer in the dust free place if it is on the dusty place and cover it always
2. Use blower to blow out dust that may have settled in the computer parts
3. In case one of the fans happen to fail, turn off the computer, unclip it and replace it with a new one

- **Computer restarting abnormally**

- If the computer is restarting or shutting down abnormally, the problem might be due to

- ✓ Operating system configuration
- ✓ Hardware failure
- ✓ Or virus attack

- If the problem is serious, the computer may display a blue screen with a message such as "*Fatal exception error has occurred*" before shutting down or restarting. To resolve the problem, do the following:

1. Confirm that all hardware device drivers are properly installed using device manager
2. If the problem is related to operating system, follow this procedure:
 - ✓ Press a combination keys Ctrl + Alt + Del persistently to restart the computer
 - ✓ Press f8 to display Windows Safe Mode
 - ✓ Choose safe mode for windows to load with minimal settings. Scan the disk or check for any software related problems in the device manager
 - ✓ If the problem persists, operating system may be corrupted by malware. In this case use up-to-date antivirus to scan the boot sector virus

- ✓ If all of these fails, reinstall or repair the operating system using recovery disk created during installation. If this fails again the last option is to install fresh operating system.
- **Removable media read error**
 - One of the symptoms of a floppy drive problem is a message stating that there is an error reading from or writing to a disk, an error message “*Error writing to disk*”.
 - This type of a message indicates that storage media may be corrupted or malfunctioning tape or disk drive.
 - To resolve this problem, try one of the following:
 1. Open the disk in different computers to rule out disk failure as cause of the problem
 2. If the problem is not due to storage media, clean-up the drive laser lamp or read/write head using cleaning toolkits available in most computer vendor shops
 3. If the drive problem persists after cleaning, replace it with a new one
- **Hard drive failure**
 - If you start a computer and get error message starting with 16**, it means that the computer does not recognize or cannot communicate with the hard drive. To resolve this problem, proceed as follows:
 1. Enter into BIOS setup to ensure that a proper hard drive type is selected.
 2. If error message persists, the disk may have crashed, consider replacing it.
- **Monitor display problem**
 - After the system unit, the next important component is a monitor.
 - Display problems may cause the following health related problems such as:
 1. Eyestrain
 2. Fatigue
 3. Headache
 - These problems have been minimized by replacement of CRT screens by TFT flat panel screen which are safer and more comfortable to use.
 - Whether flat panel or CRT, a user may experience some of the following failure related problems:
 1. Continuous beeping
 - This is indication of missing monitor or missing or faulty video card.
 - Check to ensure that the monitor is properly attached to the video card.
 2. **No display or flickering monitor**
 - If the monitor fails to display and does not issue a beep code, the first thing is to move the mouse or press any key on the keyboard, in case the computer is on sleep mode or standby
 - On the other hand, flickering may be caused by poor refresh rate settings of failing monitor. The refresh rate determine how often the display gets redrawn.
 - To resolve the display problem, try one of the following:
 - i. Make sure the monitor is properly plugged into the power outlet and turned on and also that brightness is set at adequate level
 - ii. If this step does not solve the problem, check whether the monitor is properly attached to the VGA port
 - iii. If the problem is not related to the power or VGA, test the monitor using another computer before declare it dead!
 - iv. Replace the monitor with a new one
 3. **Repeated display elements**

- Repeated display elements is due to use of an improper resolution setting. This setting result in multiple copies of the same image
- To resolve this problem, reduce the resolution
- **Keyboard and mouse failure**
- Common keyboard and mouse settings are due to improper connection on the PS/2 port or damaged pins.
- However, with USB interface, failure may be due to mechanical failure of the device itself.
- Irregular movement of the mouse pointer across the screen suggest dirty mouse rollers or ball. Most mice have replaced mechanical mouse with optical mouse
 - i. These types of mice need to be cleaned but they are much more reliable than older mechanical mouse. For a keyboard that has failed completely or other keys fails, replace it with a new one.
 - ii. USB controller failure. USB device's operation depends on the function of the USB controller. USB failure result from:
 - ✓ lack of enough power
 - ✓ excessively long or faulty USB cables
 - ✓ improper storage of USB drivers
- **problem with sound**
- the component that make up a computer audio system are the sound controller, speaker and the sound device drivers.
- If the computer does produce sound, try the following:
 - i. Adjust the volume to adequate level. In addition, check to make sure that they ar plugged into the sound port.
 - ii. Ensure that the power cable is properly attached and that the speakers are turned on.
 - iii. If the speakers and the cables are not faulty, turn your attention to the sound drivers
 - iv. If the problem is still not resolved, open the computer and make sure that the sound card (if is an add-on) is securely seated in the expansion slot.

SOFTWARE RELATED PROBLEMS

- When you buy a new computer, most likely it may have no operating system. The following are problems you may experience:
- **Missing operating system**
- After the POST process, the computer checks for the presence of operating system. if the operation system is not installed, the message "Missing operating system" may be displayed.
- In this case install the operating system. If you are sure you installed the operating system, he problem could be boot sector or hard disk related problem
- A boot sector is where the boot instructions are installed after installing the operating system. To resolve the problem:
 1. Enter into BIOS setup screen and check whether the disk is visible
 2. If the disk is ok, reboot the computer using system recovery disk and try to repair the operating system
- **Corrupted registry**

- In windows, registry is the database that keeps records of all system and application software installed on the computer
- If the registry is corrupted,
 - ✓ The computer may fail to boot
 - ✓ The desktop may fail to load
- To troubleshoot this problem:
 1. Repair the registry using recovery disk or restore registry backup or reinstall the operating system
 2. If the system can start in safe mode, locate the malfunctioning devices in device manager and disable it.
- **Windows protection error**
 - windows protection error is displayed during startup before the desktop is displayed.
 - This problem occurs when the critical windows drivers fail to load. To deal with this problem:
 1. Restart the computer in a safe mode. If windows do not load, use recovery disk to repair the operating system
- **Problem of non-responding system**
 - Non-responding system also called hanging refers to computer failing to respond to commands. To resolve the problem
 1. Press Ctrl + Alt + Del keys to display the Task Manager
 2. In the task manager window, click the Process Tab and then select non-responding process eg explore.exe
 3. Click **End process** button to terminate the application

PRINTER RELATED PROBLEMS

- A printer is one of the most commonly used devices to produce hard copies. Some of the problems related to printer are as follows:
 - **I/O print error:** indicates that the computer cannot properly communicate with the printer. Ensure that correct printer is selected and turned on. If it doesn't work, reinstall the printer drivers.
 - **Paper jam:** is a situation where a paper has sticks inside the printer as you are printing. Paper jam stops the current printing job until it is cleared. To clear it, locate and remove the paper. If the jam is done frequently, that means the papers are too heavy so try to change the papers.
 - **Poor print quality:** This is resolved by replacing toner/ink or laser head/drum. Sometimes print quality may be due to poor connection between the computer and the printer, so make sure the proper drivers are installed.
 - **Toner/Ink cartridge problem:** this normally happens when the toner is low so refill it or replace the toner cartridge.
 - **Smudged printout:** In laser printer, smudged are due to drum failure to fuse the toner onto the paper. For inkjet printer, smudged are due to touching the printout before the ink dries up. In dot matrix printer, it is due to stuck pins. To troubleshoot:
 1. In dot matrix printer, replace the print head or replace the head.
 2. In laser printers, consult the user guide that may be helpful in locating the problem relating to the fuser

REVISION EXERCISE

1. Identify symptoms associated with failure of a RAM modules
2. A user complains that the mouse does not move smoothly on the screen. Explain the reason
3. When a user tried to access a hard drive, he received “Invalid Drive” error. Explain the possible cause and problem.
4. A customer complains that her computer spontaneously reboots and sometimes does not start at all, which device is most likely causing this problem?
5. When the customers’ computer was first configured after buying, it was playing audio and video CDs and DVDs, but after sometime, it produces no sounds at all. What might be the problem?
6. When the computer was switched on, it showed an error message starting with 16** followed by other characters
 - a. What does the message mean?
 - b. Explain two possible ways of troubleshooting this problem.

TOPIC 6: USING DESKTOP PUBLISHING SOFTWARE

- Publishing is the process of selecting, collecting, preparing and producing printed or electronic work in the form of books, newspapers, magazines, scientific papers, pictures, music, movies, documentaries and electronic books.

Definition of Desktop Publishing

- Desktop Publishing (DTP) refers to the process of designing publications of professional quality such as newspapers, invitation cards, posters, fliers, journals and books using a specialized desktop software.
- Desktop publishing software is a software used to create publications of professional quality.
- Some examples of DTPs are:
 1. Adobe PageMaker
 2. Microsoft publisher
 3. quarkXpress
 4. adobe InDesign
 5. adobe illustrator
 6. CorelDraw
 7. serifPagePlus
 8. Apple Page 2
- Before selecting a particular DTP software, it is important to identify the operating system environment in which the operating system will run.

Benefits of desktop publishingk

- Although word processor can be used to create professional publications, DTP software offers the following benefits:
 1. Every item on a page is contained in a frame hence can be edited and formatted independently
 2. DTPs provide more control on how texts and graphics can be arranged and formatted

3. Frames containing text or graphics need not to flow in logical sequence. For example, a story on page 1 may be continued on page 8
4. DTPs provide master pages used to set commonly layout which may be repeated on several pages.
5. In DTPs, publications can be printed in form suitable for commercial digital or offset printing using colour separations
6. Most DTPs have predefined templates such as brochure, booklets, posters and business cards available
7. Multiple stories from different authors can be handled with ease
8. DTPs enhance visual communication to different audience
9. DTP ensures file print properly in their true colour, fonts and measurements

Types of DTP software

- Generally, DTP software can be classified into two broad categories namely

1. Graphic-based DTPs

- These DTPs are specifically used to edit and format graphic objects such as pictures and vector drawing.
- Vector drawings are free hand drawing such as those drawn by fine artist
- Examples of Graphic-based DTPs include adobe Photoshop, adobe illustrator and CorelDraw.
- These softwares have superior graphic handling capabilities such as setting resolution, brightness, contrast, cropping and filling images with colour.

2. Layout-based DTPs

- These software are used specifically to design page layout for text and graphics
- Examples of layout-based DTP software include Adobe PageMaker, Microsoft Publisher and Adobe InDesign.

Purpose of desktop publishing software

- The main purpose of using desktop publishing software is that they give the person designing publications a lot of controls on:
 - Graphic design: using CorelDraw and Illustrator helps one to design vector images using drawing tools.
 - Page layout design: DTPs are used to design layout by setting picture and object locations, dividing a page in a number of newspaper columns and adding layers. A layer is arrangement of objects on top of each other with each object being on its own layer
 - Printing: printing is a main goal of publications. DTPs offers more flexibility in printing like image colour.

Examples of publications

- There are main examples of publications that can be created using DTP software. The following are examples:
 1. **Newspaper:** daily publications bearing news, sports etc
 2. **Magazine:** is a publication containing news, features, specialist knowledge etc that target a particular audience
 3. **Book:** is a publication in a particular subject area or featuring a particular story

4. **Calendar:** a publication showing the date and days of a week, month and year

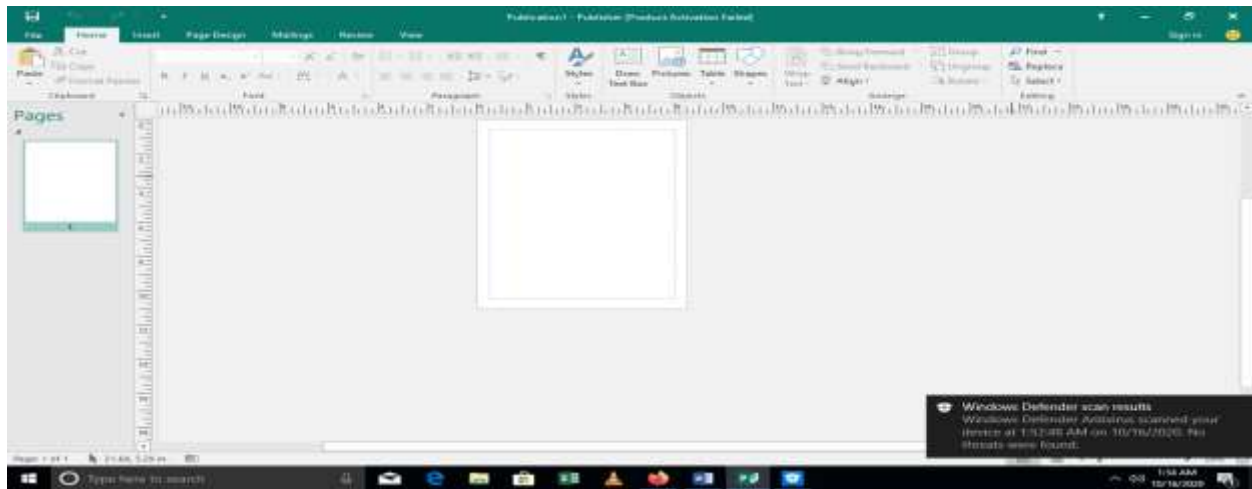
Designing a publication

- The following are factors to consider before designing publications
- 1. Decide the type of publication: how many columns and paper size
- 2. Decide the layout of publication: This enables you to select proper appropriate template or use master page to create common layout
- 3. Decide on about colour scheme, fonts, margins, orientation, graphics etc and make sure the page is properly setup

Features of DTP software

- Most DTPs provide the user a variety of tools for designing, manipulating and editing a publication. The following tools are common in most DTPs:
 - **Select tool:** used to select, move and resize images and texts
 - **Text tool:** Used to draw text frames, insert and manipulate text
 - **Shape tools:** for drawing basic shapes like rectangle and for importing objects
 - **Zoom tool:** used for magnifying publication
 - **Rotate tool:** used for rotating text or graphics

Getting started with Microsoft publisher



Features of Microsoft publisher 2013

1. **Menu Tabs:** Contains ribbon command to manipulate a publication i.e. file tab, insert, Page Design, mailing, Review and View tabs
 2. **Printable area:** contains objects to be printed
 3. **Ruler:** horizontal and vertical ruler used to perform measurements on texts and objects
 4. **Master pages:** main pages used to create common layout for large publications. You insert page number, footer and headers
 5. **Design tool:** Has tools used to design and manipulate text and graphical objects
- The following are tools available on the Home, Page Design and Ribbon used to create and manipulate a publication

TOOL	PURPOSE	RIBBON
Draw Text Box	For inserting text within text box	Home and Insert

Pictures	Used for inserting graphical objects e.g. pictures and clip arts	Home and Insert
Tables	Used for inserting tables	Home and Insert
Shapes	For drawing shapes like triangles, circles	Home and Insert
Select	For selecting graphical objects to be manipulated	Home and Insert
Page	Used to add pages into publication	Insert
Picture placeholder	Used to draw picture frame that reserves a space for a picture to be inserted later	Insert
Page Parts	Used to insert preformatted contents e.g. heading	Insert
WordArt	Used for inserting artistic letters or words on publication	Insert
Insert file	Used for importing contents from existing document file saved on your computer	Insert
Object	For inserting contents from external source and placing I your publication as embedded or linked object	insert
Page Number	Used to insert page numbers	insert
Change template	Used for changing or applying predefined template	Page Design
Orientation	Used to change orientation to portrait or landscape	Page Design
Master Page	Used to design Master pages that contains common layout to be applied to other pages of the publication	Page Design

Creating publication

- Open Microsoft publisher, then choose a template for your publication and click create

Setting up New publication

- Sometimes, it is important to change setup options of publications such as page size, margin and orientation. Proceed as follows”
 1. On the File tab, click page setup
 2. Specify the following in the dialog box that appear
 - a. Select page size in the Blank Page Size Box
 - b. Select margin size on the right and adjust them
 - c. Click Advance option to specify more settings
 - d. Click OK

Setting up publication using master pages

- To create a publication that has several pages such as a book or a report, it is important that you design a common layout for all pages using master pages.
- With master page, you create, modify and delete content that appear in the rest of the pages.
- Master page settings apply to all pages in the publication until you specify otherwise and cannot be renamed or deleted from the publications
- To set up a publication in publisher using master page
 1. On Vie ribbon, click master page
 2. Use master page tools or menu tabs to edit or define master pages’ layout
 3. Click close master page button to switch back to other pages of the publication

Inserting text, graphics and tables

Inserting text into publication

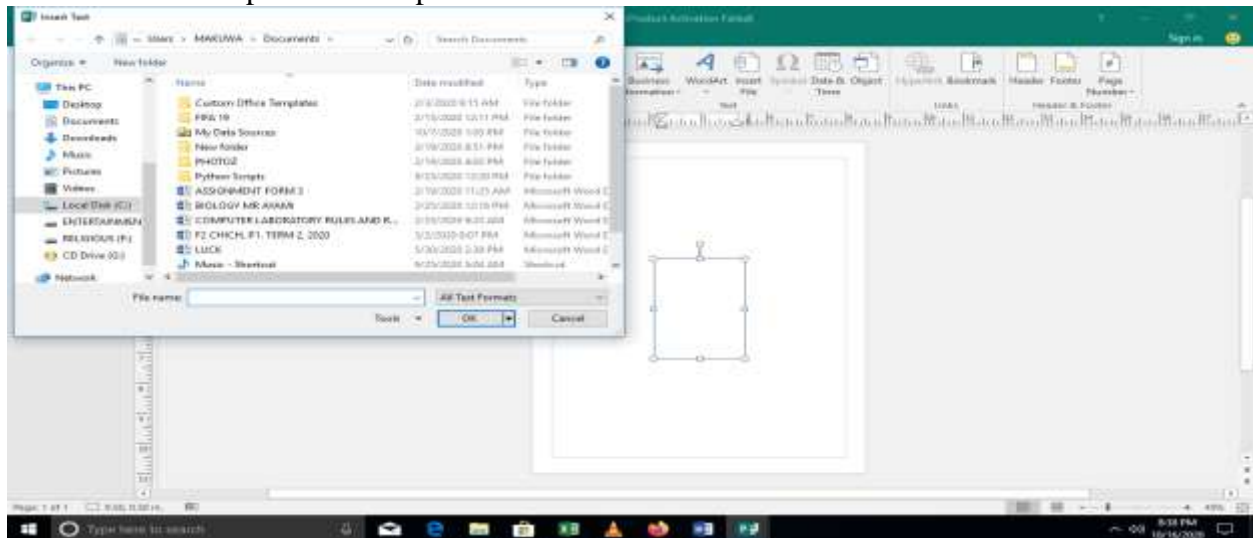
1. Click text toll from the tool box

2. On the empty area on the pasteboard or printable area, drag to define the text box
3. Type the text

Note: you can create artistic text using the WordArt frame tool

Importing text from a word document

- Instead of typing, you can import text from existing word document. Proceed as follows:
 1. On the insert ribbon, click insert file
 2. Select the file in the dialog box that appear and click OK
 3. The text is pasted into a printable area

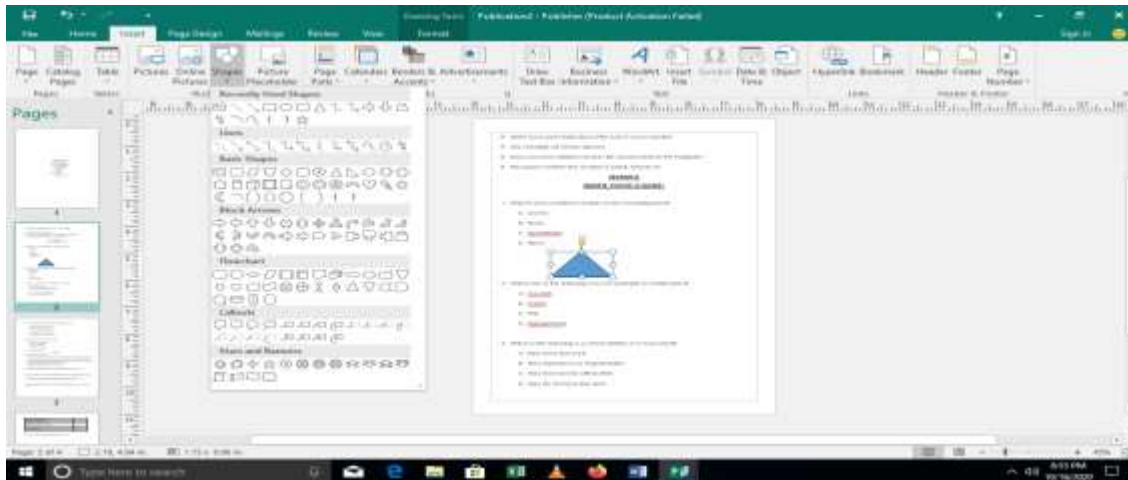


Linking Text frames

- In publisher, when a text frame spills over to another page or column, the plus sign appearing at the bottom or top of the frame means that it is connected to a previous or next page or column. This is referred to as a threading.
- Once text is threaded, you can easily redirect the flow of the text in them than you can with unthreaded textbox
- To thread text frames, proceed as follows:
 1. Click the first textbox to activate the Text Box tools tab
 2. On the textbox Tools ribbon, click Create Link button located in the linking group
 3. Click the textbox you want to connect to the first one. Text box that will connect will display the link icon. Use the connected text box to continue the story.

Creating basic shapes

- Publisher allows the user to create basic shapes such as lines, ellipse, rectangles and other polygons using drawing tools on the insert shapes.
- To display the shapes, click insert tab and Shapes as shown below



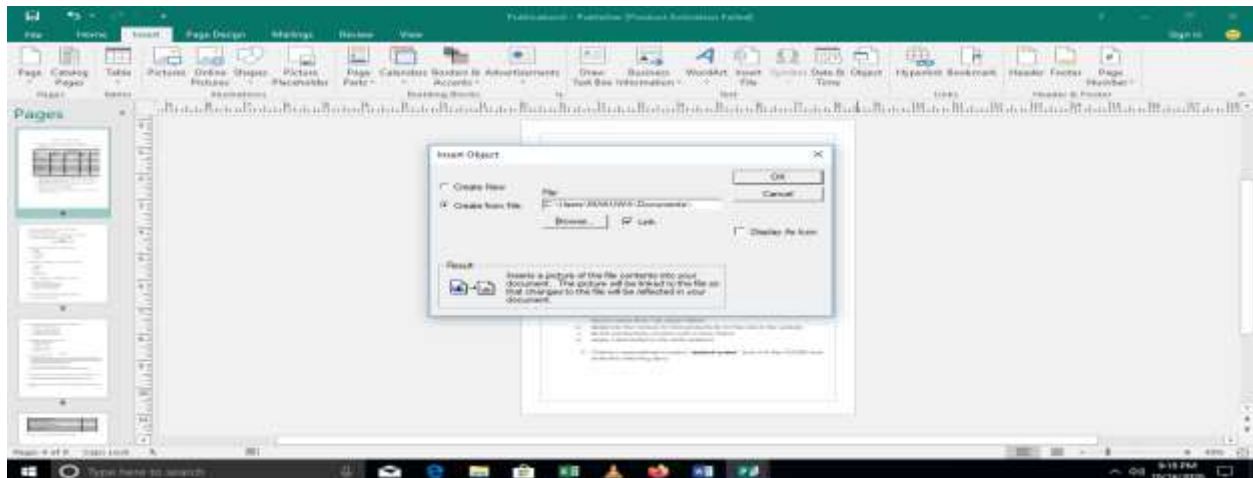
Once you insert the shape, you can Right click it and select Format AutoShape and make the formatting.

Inserting pictures

1. On the insert tab, click picture button to display insert picture box
2. In the dialog box, select the drive or folder where the picture file is located
3. DoubleClick the file or click the File then insert

Object linking

- In desktop publishing, Object Linking and Embedding (OLE) refers to importing an object or existing file into a publication.
- An OLE can be manipulated as part of the publication or as a shared image between the source and current document
- If an object is linked to the source publication, any change applied to the source object are reflected in linked image within a publication. This is because the destination file stores an image or a copy of the source file
- On the other hand, if the object is embedded, no direct link exists. The embedded object becomes part of the publications and updates on the source file do not affect the embedded object
- To embed or link a file:
 1. On the Insert tab, click Object in the text group
 2. In the Insert object dialog box that appears, click **Create from file** option
 3. Click the Browse button to select the file you want to link or embed
 4. To create *link*, make sure the checkbox labelled *link*, is checked as shown in the diagram below. For embedding, leave the checkbox unchecked
 5. Click ok to insert the object.



Inserting tables

A table is used to organize text into rows and columns. When dealing with a table, the following terms are used:

1. Row: a horizontal arrangement of a cell
2. Column: a vertical arrangement of a cell
3. Cell: the intersection between a row and a column

Rows and columns belonging to one table behave like one even when the table overflows to other pages.

To insert table in publication,

1. On the Insert tab, click table button in the table group
2. On the dropdown menu that appear, drag the mouse pointer to select the number of rows and columns
3. To draw table larger than 10×8 , click insert table in the create table dialog box and specify number of rows and columns

Editing publication

- Editing a publication involves making changes to text and graphical objects.
- The procedure for editing publications is similar to that for editing word document discussed earlier

Deleting text and objects

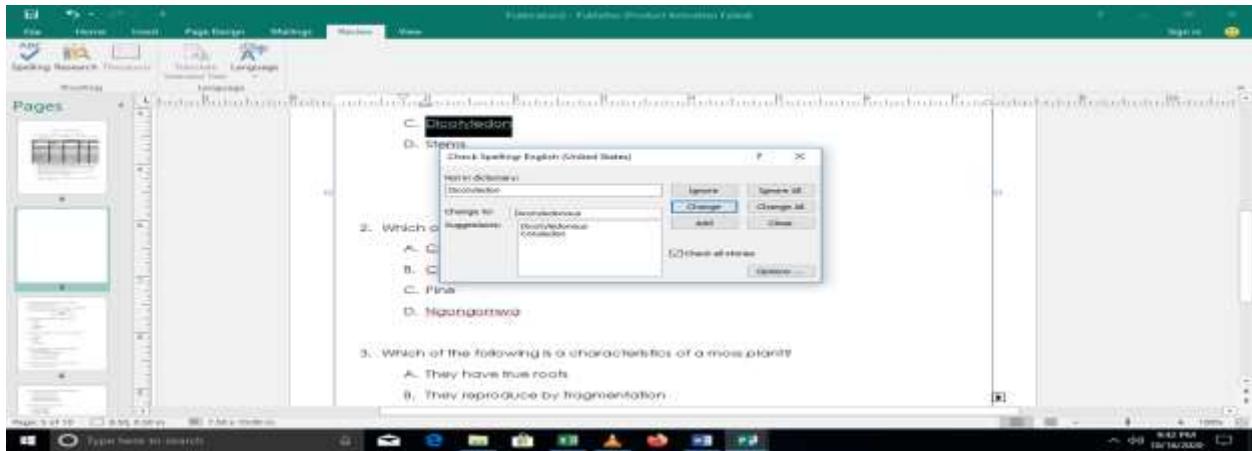
- Select or highlight the text or object then press Delete button or Backspace button

Copying and moving text

- Select the text to copy or move, right click and then click copy or cut then paste where you want it to be.

Spell checking a publication

- To check spelling mistakes, proceed as follows:
 1. Click Review button
 2. Click the spelling button
 3. In the dialog box, make sure **check all stories** box checkbox is selected
 4. Replace or ignore the misspelt words
 5. Click OK to close the button



Find and replace

To search for a word in a publisher, proceed as follows:

1. On the Home ribbon, click Find or replace to display the dialog box
2. In the search for box, type the word or phrase to be searched
3. Click replace option button. In the Replace With box, type the replacement word or phrase.
4. Click find next or Replace All button

Editing publication layout.

- Sometimes you may decide to change the entire design of your page layout. To do this, use master page as follows:
 1. Switch to Master page
 2. Make the necessary changes then switch back to other pages

Editing graphical objects

- In editing graphical objects, properties such as size, position, colour and brightness are enhanced or modified.

Moving and resizing object

- Click the object and drag the mouse until to reach the size you want or move the object

Changing picture attribute

- This include changing content, colour and brightness
 1. Select the object to activate the picture
 2. Using picture tools adjust the required picture properties
 3. Edit the picture using other tools in the picture style, Arrange, Crop and Size

Formatting publication

- Formatting refers to enhancing the appearance of a publication by applying special effects or attributes to the layout, text and graphical object
- To format text in the publication, select the text and choose the formatting eg adding superscript and subscript in the Home ribbon.

Paragraph and page formatting

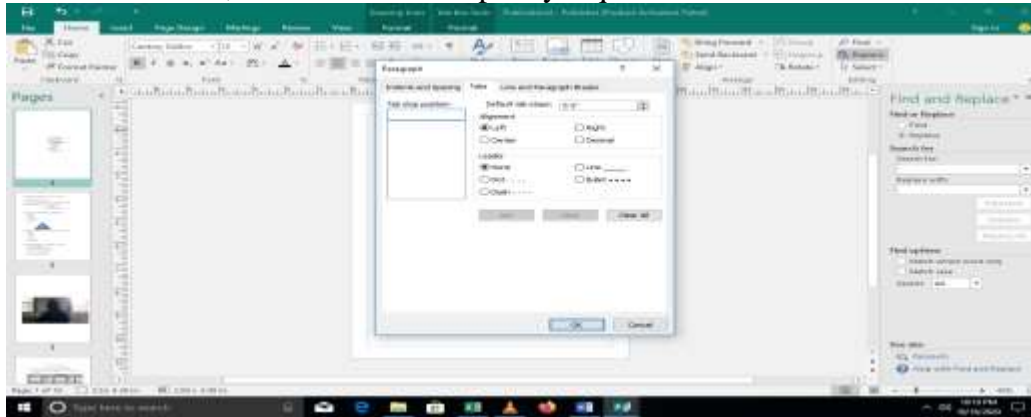
- Paragraph and page formatting involves aligning text, indenting, adding column guides, inserting headers and footers

Text alignment

- You can align the text to left, centre, right or justified by selecting the text and click alignment in the Home ribbon

To set tabs and indent

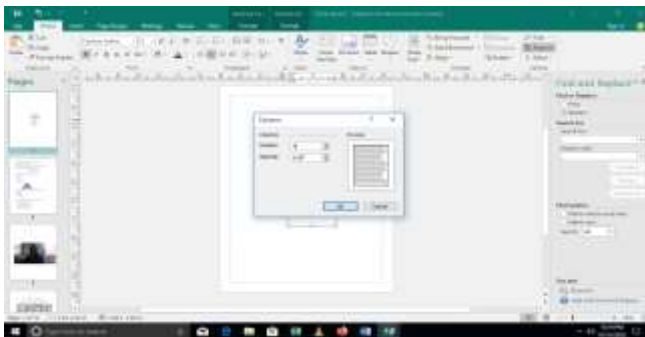
1. On the Home tab, click Paragraph Launcher icon to display paragraph dialog box
2. Click tabs and set to required tab stops
3. To indent, click indents and specify required indentation



Inserting column guides

By default, page is made up of one column. To divide the page into more columns:

1. On the Home ribbon in the Paragraph group, click Column button
2. Select number of columns
3. Click more columns if you want more than two columns and specify number of columns in the dialog box that appears as below



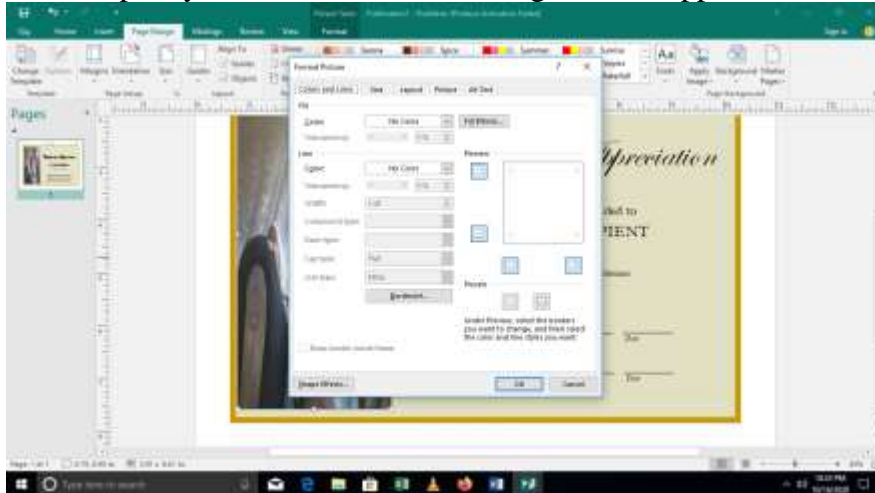
Inserting headers and footers

- Headers are lines of text, page numbers or dates that appear at the top of every page, footers appear at the bottom of every page.
 - To insert header or footer
1. Click view tab and then Master page button to switch to master page view
 2. On the master page click Show Header/Footer button
 3. To insert page numbers, click insert page numbers
 4. To insert text, type the content in the header or footer text frame

Formatting shapes and graphical objects

Fill and stroke

- Filling refers to applying a solid colour or pattern to a drawn shape while stroke refers to the outline or line style.
 - To fill the background colour and change stroke in publisher, proceed as follows”
1. Select the object to activate the Format ribbon, under drawing Tools
 2. On the format ribbon, specify the shape style, effects and other properties
 3. To apply more formatting, click Format Auto Shape Launcher in the shape style group
 4. Specify more formats in the dialog box that appear



Rotating objects

To rotate object in publisher:

1. Select the object
2. Hold down the Ctrl key and drag the rotational handle that appear above the object
3. Rotate the handle in clockwise or anticlockwise

To arrange objects in publisher

1. Select the object while pressing Shift + Tab
2. On the Format ribbon, click Bring forward or Send Backward to select arrange option from the list

Cropping graphical object

Cropping is hiding unwanted parts of a graphical objects particularly a picture. To crop an image

1. Select the object to activate the Format ribbon under picture tool
2. From the format ribbon, click crop button under group
3. Position the cropping pointer over a placeholder on the objet and drag inwards to crop

Grouping objects

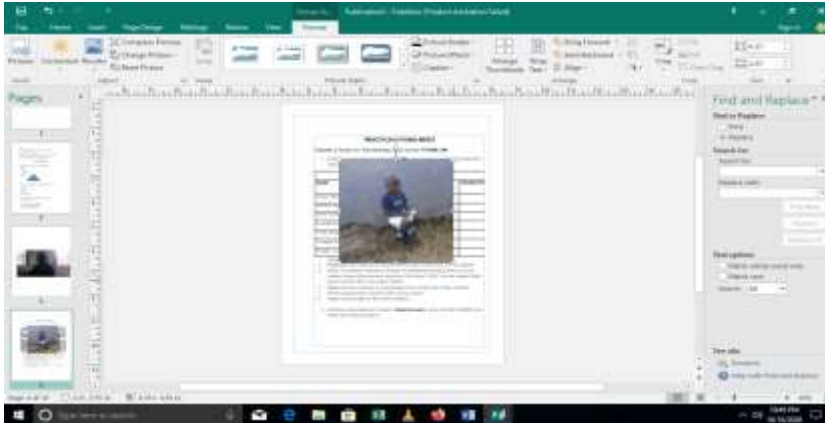
If you have several objects in publication, you may want to group them together

1. Hold the Shift key as you click each object
2. Right click the selections then click Group the context menu

NOTE: you can Ungroup using the same procedure only that you select Ungroup command

Wrapping the object

Text may be wrapped around the object as shown below



To wrap text around a graphical object

1. Double click the picture to activate Format ribbon
2. On the Format ribbon, click Wrap Text button to display dropdown list
3. Select wrapping option such as square, Tight or through from the list

Printing publications

- Unlike other application programs discussed earlier e.g. word processing, printing in DTPs is a much more technical. This is because you may prefer to print a picture in a separate colours referred to as colour separation.
- You can also insert crop marks and other details required for commercial printing
- To print publication, proceed as follows:
 1. On the File tab, click print
 2. Under printer option, click printer properties hyperlink to set print option in the dialog box
 3. To specify advanced print properties such as inserting crop marks, click the arrow on the right of the printer, then click advanced option settings
 4. In the dialog box that appear, use tabs such as Marks and breeds to specify advance option

SAMPLE QUESTIONS

1. Define the term electronic spreadsheet
2. List four examples of spreadsheet programs available in the market
3. Explain three main components of electronic spreadsheet
4. State five advantages of electronic spreadsheet over the manual worksheet
5. Differentiate between
 - a. Formula and function
 - b. Relative and absolute cell referencing
 - c. Relational and arithmetic operator
 - d. DATE() and TODAY() function
6. The formula $\$A1+B\1 was entered in cell C1. How would the formula appear if copied to F2?
7. Explain the arithmetic operator precedence
8. Why do we need to freeze pane?
9. Describe the process of setting password to protect workbook from unauthorized users
10. How would you increase the value 50 by 30% in excel worksheet?
11. Describe the procedure of specifying list of users who can open, modify, copy or print a protected worksheet
12. Describe two ways of completing data entry
13. How does Microsoft excel determine that an entry is a formula?
14. Outline the procedure for clearing contents in a cell
15. Explain how you would copy a formula using absolute cell referencing
16. Explain how you would print a worksheet in landscape orientation
17. Explain steps you would follow to insert rows and columns in a worksheet
18. Explain the important of Autoformat feature command
19. Explain the term filter and how is a filter differs from a hide
20. Differentiate between computer program and computer programming
21. State three factors to consider before installing any software
22. Explain three disadvantages of using spreadsheet
23. Describe five networking devices
24. Differentiate between crop marks and cropping a graphical object
25. Differentiate between object linking and object embedding
26. State five advantages of DTP software over word processor
27. List four network system that are not computer-based networks
 1. Define the following: a. communication network, b. computer networks, c. information communication technology
 2. Define the term data communication
 3. Briefly describe the history of development of telephones
 4. State four uses of communication networks
 5. Give two disadvantages of networks
 6. Differentiate between network server and workstation
 7. Explain the concept of distributed processing in networking
 8. Why is network more reliable than standalone computer?
 9. Explain the three most common types of computer networks in use today
 10. What is resource in networking
 11. Differentiate rotary dial and push button'

12. What is touch tone phones?
13. Write the following in full
 - a. ARPANET
 - b. Internet
 - c. SIM
14. State three functions of a SIM card
15. Define the term communication channel
16. Differentiate between a router and a gateway
17. Why is a switch preferred to a hub on the network?
18. Compare and contrast brouter and router
19. Explain the importance of a gateway on networking
20. State two disadvantages of circuit switching
21. State one disadvantages of message switching
22. How can you reduce a broadcast domain on a network that uses a hub
23. What device is inserted in a laptop or Pc TO make it a wireless compliant?
24. Draw a diagram depicting elements of communication
25. Differentiate between DTE and DCE
26. Differentiate between remote client and remote host
27. Define the term bandwidth
28. Define the term transmission media
29. State one different between single mode and multimode fibre.
30. If you want to link networks separated by long distance, what fibre optic cable would you use and why?
31. Satellite communication relies on_____ transmission
32. Describe electromagnetic spectrum
33. Highlight two advantages of satellite communication
34. What type of radio communication relies on earth's ionosphere?
35. Describe one technology that can be used to set up a piconnet
36. Name the parts of a twisted pair
37. State one application area where coaxial cables are used
38. Two line open cables are virtually obsolete. True or false?
39. Give two advantages of fibre optic media
40. Give two advantages of fibre optic cable
41. Define the term pitch as used in twisted pair cabling
42. Give two advantages of coaxial cables
43. Differentiate between single mode and multimode fibre
44. Describe VSAT technology
45. Explain the concept of line of sight in wireless communication
46. Differentiate between parallel and serial transmission
47. How is a serial transmission converted to parallel on reception of data?
48. With the help of a well labelled diagram and atleast one example in each, describe the following:
 - a. Simplex communication
 - b. Half duplex communication
 - c. Full duplex communication