# TOPIC 1: SORTING AND FILTERING DATA

- Sorting refers to arranging data in ascending or descending order
- Sorting helps in quick retrieval of records for example in telephone directory
- To sort the range of row, proceed as follows:
    1. Highlight the row that you want to sort
    2. Click Sort & Filter icon on the Home tab in the Editing group
    3. Select sort **A to Z** or **Z to A** if the row has words like list of names or **largest to Smallest** or **Smallest to Largest** if the row has numbers or select custom sort as shown below:
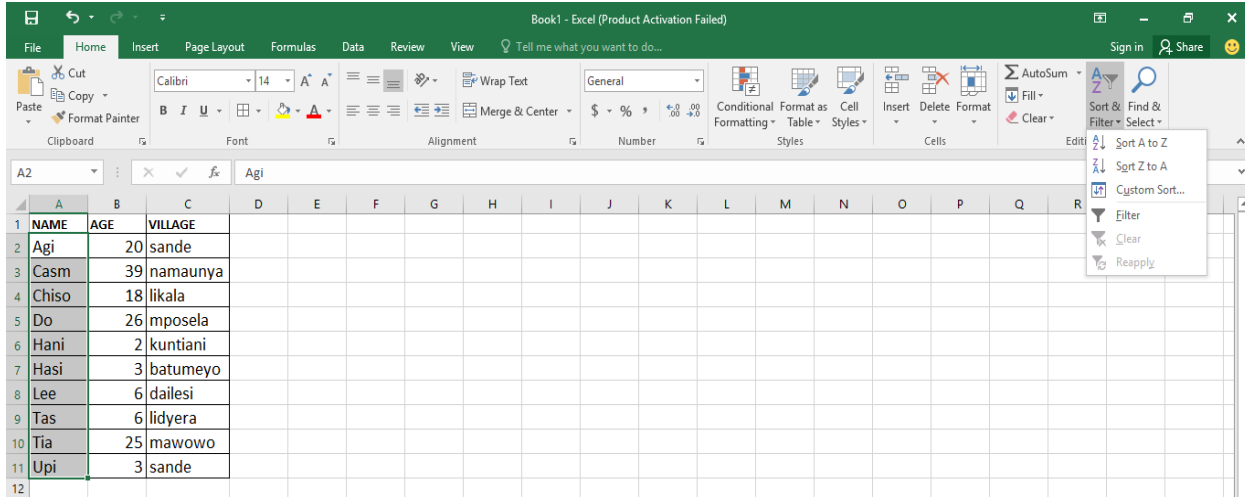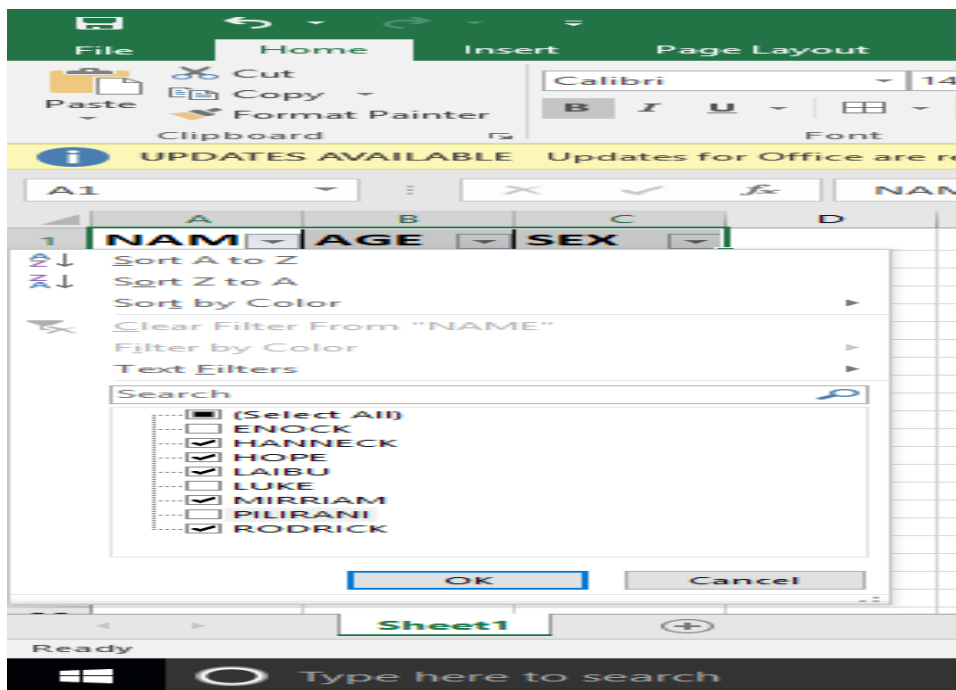

FILTERING

- Filtering is a quick and efficient method of finding and working with subset of data in a list
- Filtering is a process of displaying list of data that meet certain criteria or condition you specify
- Microsoft has **two** commands for filtering:
- The autofilter: Uses simple criteria and include filter by selection
- Advanced filter: It uses more complex criteria

Using autofilter

- The autofilter command can be applied to only one list on a worksheet at a time.
- To autofilter a list:
1. Click a cell in the list to be filtered
2. On the data tab in the Sort & Filter group, click Filter. The filter drop down arrows are inserted on the top cell of each column.
3. To display only the specific value, uncheck all the values you do not want to appear and check all values to appear then click OK

You can also filter by selecting Text Filters and specify the criteria

Advanced filter

1. The advanced filter works a slight different than the autofilter in that you have to manually specify a criteria.
1. On the Data tab in the Sort & Filter group, click Advanced. In the Advanced Filter dialog box, do the following
2. Select the "Filter the list in place" option
3. In the List range, specify the range of values o be filtered
4. In the Criteria range box, specify the range that covers the column and the criteria as shown below:
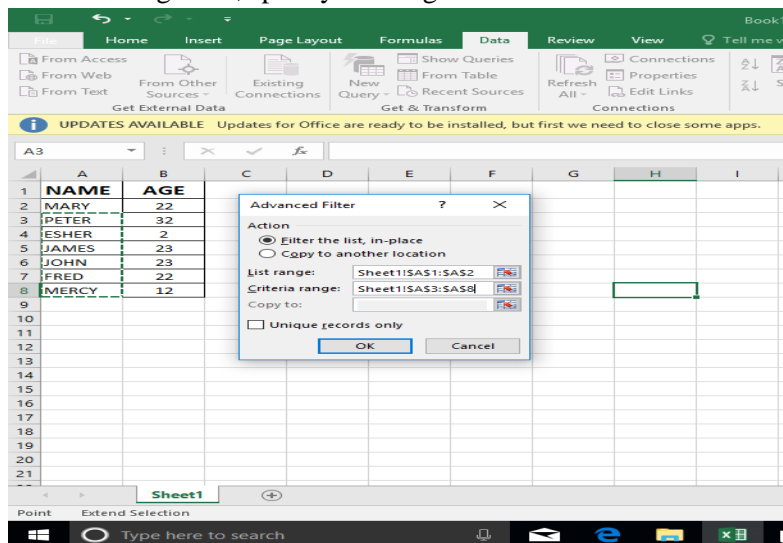
Creating charts and graphs

- A chart also known as a graph is a pictorial representation of underlying data on a worksheet.
- Charts makes it easy for users to see comparisons, patterns and trends in data.
- Charts helps in analyzing data
- A chart is linked to the worksheet data it is created from, and whenever data on the worksheet is modified, the chart is updated automatically.

Types of charts

- Some of the types of charts available in Microsoft Excel include:
    1. *Column charts*: represents data as a cluster of columns comparing values across categories

2. *Bar charts*: represents data using clustered bars arranged horizontally. It is used o compare values across categories
3. *Pie charts*: used to present data on a circular pie, portioned into sectors representing each item being analyzed.
4. *Line graphs*: represents data as lies with markers at each data value in x-y plane
5. *Scatter charts*: compares pairs of values on same axis using scatted dots
6. *Area graphs*

Creating charts

To create charts
1. Select the range of data for which you want to create chart
2. On the Insert tab, select the type of chart you wish to create
3. Then click OK

Formatting and editing charts
- Once the chart has been created, the patterns, colours, size, location and orientation can be changed.
- Once you double click the chart, Toolbar appears on the screen to enable you to edit and format the chart.

Resizing and moving charts
- To resize the chart, click the chart and use the place holder on the edge to drag the chat to size
- To move the chart, click inside the chart area then drag to desired position

Labelling data values
- Each representation of data in the chart can either be labelled by a value or text label
- To label the chart, On the Chart Toolbar, in the Chat Layout group, click the Quick Layout command and select the layout that has data labels, then edit the chart tittle as appropriate.

Inserting tittles
- Each chart must have a heading showing clearly wat it represents. Also include axis. To include axis, proceed as follows:
- On the Chart Toolbar in the Chart Layout group click Add Chart Element then select Chart Tittle. Select *Above Chart* or **Centered overlay** as below:
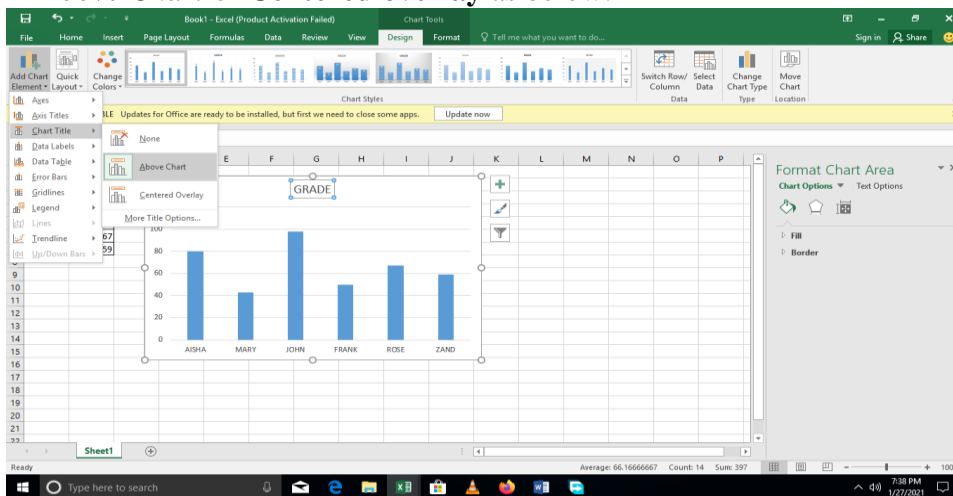
Inserting a legend
➢ A legend is equivalent to a key used to manually drawn charts.
➢ It shows what each colour or pattern of data series represents, for example green representing boys and pink representing girls.
➢ Without legends, it would be difficult to know how to differentiate the data series represented by ant chart
➢ *To create legend*
  • On the Chart Toolbar, in Chart Layout group, click Add Chart Element and then click legend.
  • Select the appropriate position as shown below:
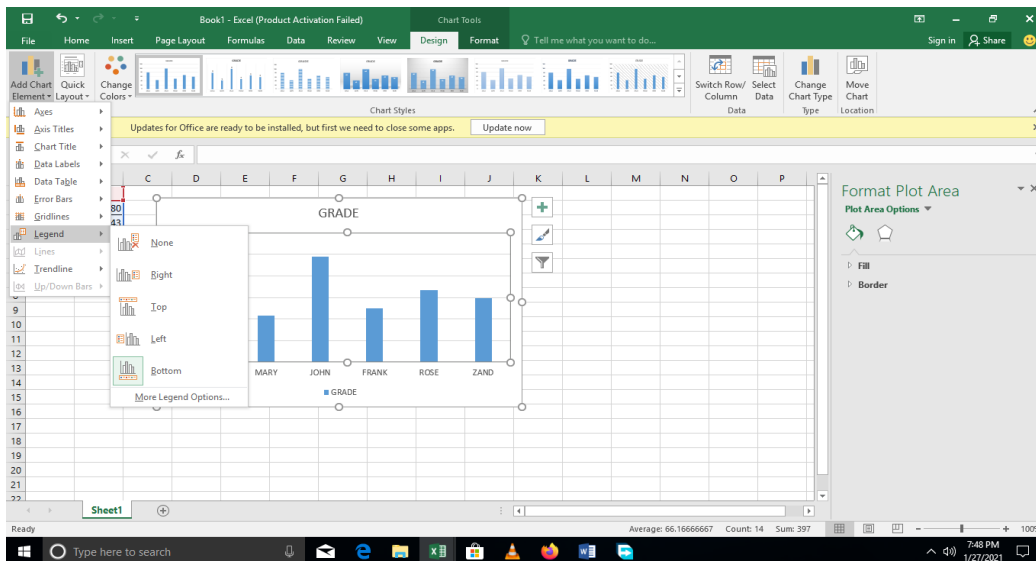
Changing the chart location

➢ Right click the chart then select Move Chart command from the shortcut menu that appears

➢ In the move chart dialog box, specify where to embed the chart into the current worksheet or new worksheet then click OK

Page setup for printing

➢ Page setup refers to the way page margins, orientation, size and other page orientated features are applied to the page.

Margins

➢ Margin control the extent to which content can be placed on the page and print area. Margins include:

1. Left, top, right or bottom margins
2. Gutter: these is the extra space usually added to the left margin of the page to give allowance for binding the printed pages.

➢ To setup margin, On the Page Layout tab in the Page Setup group, click margin then select custom margin, click the margin tab and adjust as appropriate.

Page size, orientation and scaling

➢ In the Page setup dialog box, click the Pages tab

➢ Select the page orientation, size and scaling

i. Orientation determine whether the page will be portrait or Landscape

ii. Size can be A4, Letter A1 etc

iii. Scaling is used to fit the virtual page on the screen to the real page in the printer

iv. Print quality determine print resolution in dots per inch (dpi)
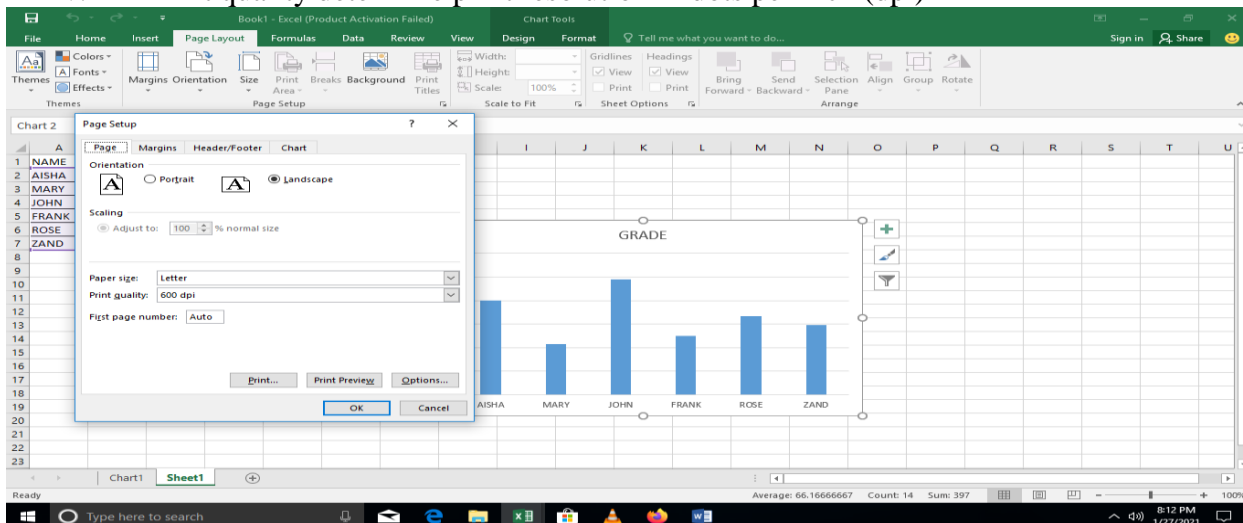
Headers and footers
- A header is a repeating text that is printed at the top of every page while a footer is printed at the bottom of the page
- To insert the header, click the Header/Footer tab then type the appropriate word in the spaces provided.

Specifying titles and the print area
- On the sheet tab, you can specify the rows and columns that have tittles that you want to repeat on each worksheet as you print in case your worksheet spans more than one page.
- You can also specify if you want to print:
    1. Gridlines: check the gridlines box
    2. Black and white

Importing and liking files
Importing files
- It is possible to create a document in a word processor and then import it into Excel.
- The text that is in the document maps directly into the Excel cells.
- There are **two** ways of achieving this:
1. Creating delimited text file (.txt) in which fields are separated by pressing the Tab key.
2. Use the comma separated values(csv) files. The comma (,) separates the fields in the file.

Importing delimited text file (.txt)
1. Open your word processor and type the following text

THE HOUR HAS COME

FIRST NAME	SECOND NAME	SCORE
Joseph	chesule	60
Virginia	Kwanyera	80
Seth	Linje	90
Stephan	Maluwa	75

The space between the fields should be created by pressing the Tab key
2. Save the file as text file (.txt) and close it
3. In excel, click the file command and then select Open command. Browse to the folder you saved he file then click it. Select the view files of .txt format
4. Select the file and import then click Open button. Follow the few prompts and you will finally get the imported file in excel

Importing using comma separated value file (csv)
- The process is the same as to that of delimited file only that instead of pressing the tab key to mark the fields, we use commas (,) then save the file as .csv file.

Liking files
- Sometimes it becomes necessary to have spreadsheet that reference other spreadsheet file.
- For example, in retail stores you can maintain a master spreadsheet having all prices of the goods. A sales spreadsheet can reference this information through links when recording transaction.
- A link is a type of formula that fetches its data from anther worksheet or spreadsheet file into the current spreadsheet file
- When you start the spreadsheet that linked to external one, it checks for the update in the external files as it starts updating its data in the process.
- To link spreadsheet:
1. Open the workbook you want to link
2. In the source worksheet, highlight the cells you wish to link to and then click the Copy command
3. Switch focus to the destination workbook, click the upper left corner of the range where you wish the links to be.
4. On the Home tab, click the Paste drop down and then click the paste special command. In the Paste Special dialog box, click paste Link option then Ok command

TOPIC 2: USING DATABASE

INTRODUCTION

➢ Managing data as a resource is an important task in any organization today.
➢ This is because data within organization and its environment forms part of the strategic, tactical, operational management and decision making
➢ In order to enhance convenient and easy storage and retrieval of data, we use database
➢ A database is a collection of related data items organized so as to provide consistent and controlled access to the items.

TYPES OF DATABASE

➢ There are **two** main types of database; namely **Manual** and **electronic** or **computerized** database

Manual database

➢ A manual database consists of a collection of repository files and folders each properly tagged and kept in a proper sequence in a cabinet.
➢ For example, in a school the admission office stores all students' files identified using unique student numbers such as 201/2014, 202/2014 etc.
➢ However, as organization data and information data grows, manual organization becomes difficult and time consuming resulting in the following problems:
1. *Redundancy*: redundancy refers t unnecessary duplication of data in multiple files
2. *Lack of flexibility*: it is difficult to search for a requested file or record
3. *Lack of integrity*: poor storage and maintenance of data may lead to unreliable and misleading reports.
4. *Lack of data sharing*: Data or information in different manual files may not be available to other users

Electronic database

➢ Electronic database refers to the use of electronic devices such as computers to stress and organize files for easy access
➢ For example, in Microsoft, files are stored under one folder on a storage media
➢ An advantage of electronic database over manual filling is that the operating system and electronic database system provide users with tools for easy storage and access of data and information

Database management systems (DBMS)

➢ To create and manipulate database, we use a software referred to as Database Management System (DBMS)
➢ The DBMS provide tools for creating, storing, searching and manipulating databases.
➢ Some examples of DBMS are:
1. Microsoft Access
2. OpenOffice Database
3. Microsoft SQL Server
4. Oracle
5. FoxPro
6. DbaseIV
7. Lotus Approach
8. Oracle's MYSQL Server

Benefits of using DBMS

➢ Some of benefits of using Database Management System include:
1. Allow authorized users to add or delete records
2. Allow users to update or modify existing records
3. Interface between database files and other application programs
4. Organize files and records for easy access, retrieval and sharing
5. Ensure security and integrity of data by safeguarding it against unauthorized access and modification

6. Keep statistics of data in a database

Common features of DBMS
- Most DBMS consist of objects or features used for creating and manipulating database. Some of the objects available in most DBMS include.
1. *Tables*: A table is a database structure used to hold related records. Tables are organized into rows and columns with each row representing a record while each column representing fields in each record.
2. *Queries*: A database query is a statement used to request for information from a database. In most DBMS software, query statements are written using a language known as *structured query language (SQL)*
3. *Forms*: a form is a graphical interface that resembles an ordinary paper form. It is mostky used for entering or viewing data from the database table or query.
4. *Reports*: Most database management system provide users with tools for creating reports that displays data from a database in a more professional appearance. It is report generator that provides the user with means to specify what to be printed on a report and the layout which the report takes.

Database model
- A database model is a logical structure that determine how data is stored, organized and manipulated by DBMS software.
- Five common types of database models are:
    1. Hierarchical model
    2. Network model
    3. Relational model
    4. Object/relational model
    5. Object oriented model
- The most popular model is **relational model**

Hierarchical model
- In hierarchical model, files are arranged in top-down structure that resemble a tree.
- The top file is called a root, the bottom files are called leaves and intermediate files have one [aren't file and one or several children files
- For example, in the figure 1 below, to access level one data, the user has to access the root first and follow the path to the level.
- A specific path leads to each item at the lower level
- Hierarchical model is rarely used in modern database system, hence absolute
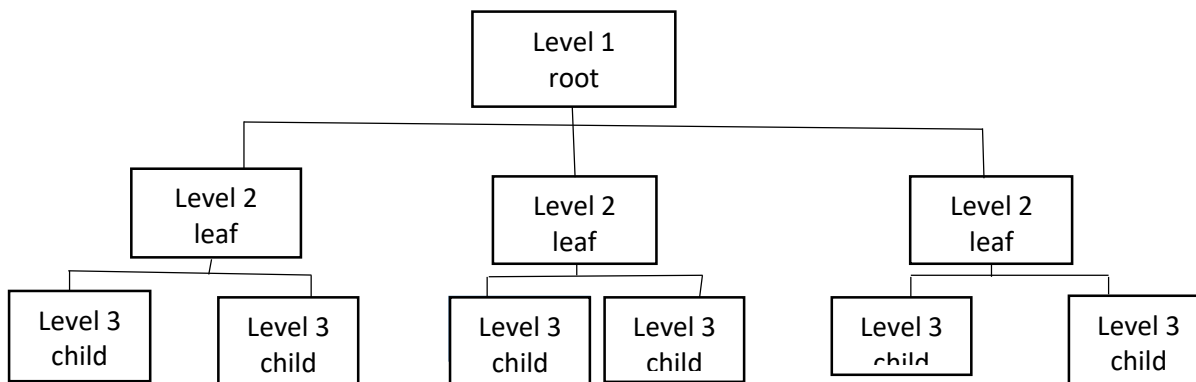
Network model
- Unlike hierarchical structure where one or more records have one parent record, the network model allows each record to have multiple parents and child records.
- In network model, access to a record can be through multiple paths and from any record.
- This type of record is what is referred to as "Many-to-many" relationship
- Network model are still popular in powerful mainframe computers

Network database model
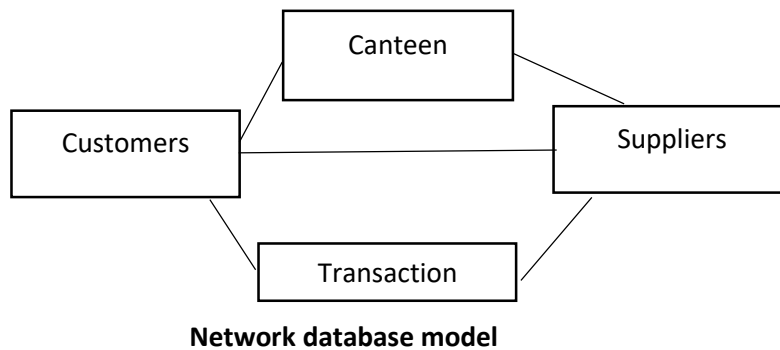
Relational model

➢ In relational database model (RDBMS), data is organized into records that are stored in related tables or files.
➢ A table is a collection of related records each record containing related fields
➢ The reason why it is called relational model is because two tables can be linked together such that a record from one table references to a record or records in another table.
➢ For example, table 2.1 and 2.2 below shows Customers table and Orders table that are related to each other through *customer number* and *customer ID.*
➢ In this case, the Orders table shows that customer number 450 (Bat Masamba) has three orders in Orders table.

Table 2.1: Customer

Customer number	Name	Telephone number
900	Mary Njemile	0884173918
230	Peter Onani	0994270554
450	Bat Masamba	0883466365

Table 2.2: Order

Customer ID	Order ID	Date	Amount (k)
900	380	12/12/2014	90,000
450	811	13/1/2014	78,00
450	234	2/5/2014	75,000
450	567	3/8/2014	12,000

Object-oriented model

➢ Object-oriented model purely supports storage, access and manipulation of objects
➢ Although currently not popular in the market, object-oriented database management systems (OODBMS) provides unification of application and database development

Object-relational model

➢ In software development, there is a shift from structured programming to object-oriented programming.
➢ This shift raised a need for a database model that stores and manipulates objects
➢ Therefore, object-relational is an evolutionary hybrid model that has capabilities to handle both relational and object-oriented and manipulation of data

Database structure

➢ For easy retrieval and manipulation, Relational database organize data into a structure called a schema.
➢ A schema is an organization structure made up of fields at the lower level and database at the highest level

1. **Field**: is a set of character that define single data value. For example, each column like Surname, Firstname, gender, sex, in a table represents a fields.
2. **Record**: a record is a collection of related fields that represents a single data items. An example of a record is a row in student examination report that may contain students' name, admission number. Grades.
3. **Table**: a database table contains a set of related records. For example, in a school database, a table may contain names of all students in the school and another table may contain names of all teachers in the school, different tables are stored in the same database.
4. **Database**: a database is a collection of related tables and each table consists of related records made up of fields.

A database schema may look like the one below:
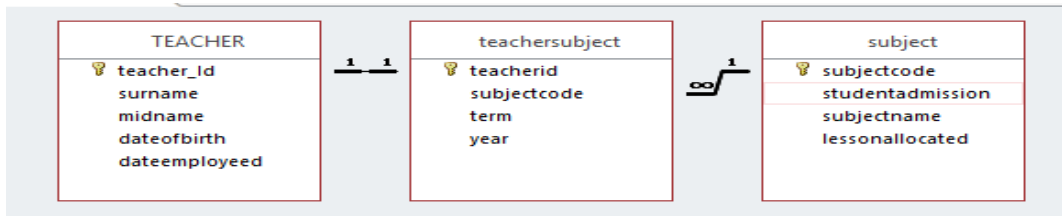
Creating database

➢ Before you begin creating database, you need to design it first. This is because a design results to better storage, access and maintenance of a database.
➢ The following are the consideration before creating a database

1. Estimate the amount of data expected to be stored in the database. This is important to determine the number of tables to be created.
2. Study the requirements of the user carefully in order to define all the inputs, outputs and relationships required to create database
3. Design prototype database preferably on the paper to determine fields and tables required to implement the database.
4. Normalize the fields into separate tables to allows flexibility in database manipulation. This process of decomposing fields into separate but related tables is referred to as *normalization*.
5. Identify a field in each table that will be used to identify each record uniquely. Such field is referred to as a *primary key.*
6. Give the most important fields first priority when designing a table structure. These fields are those mostly used to sort and search for records in a database.
7. Design sample data forms and reports needed for interaction between the user and the database system.

Creating database

➢ To create a database, proceed as follows:
1. Click start and open Microsoft Office, then click Access
2. Click the Blank database

3. Type the name for the database and specify the storage location. The database is saved as **.accdb** file extension which stands for access database
4. Click **Create** tab and the blank database with the default *Table 1* will be created as shown in the figure below:
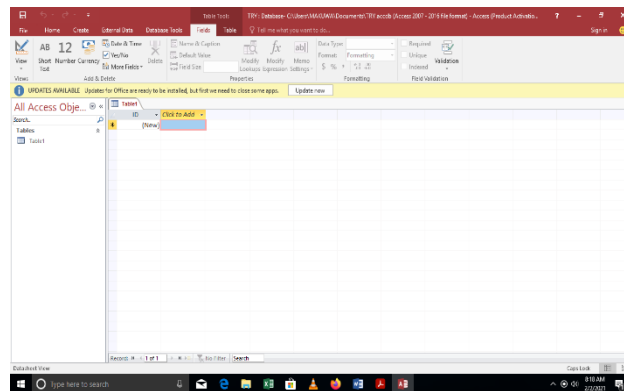
Creating a database table

➢ When Access if first launched, it creates a default Table 1. This table can be customized as follows:
1. On the Home tab, click the **View** tab and then click **Design View**. Save As dialog box pops up that requires you to save the table. Save the table with a name e.g. *Register*.
2. Using the table grid displayed, enter unique name for each field. A field name start with a letter can be up to 64 characters including letters, numbers, spaces and punctuations.
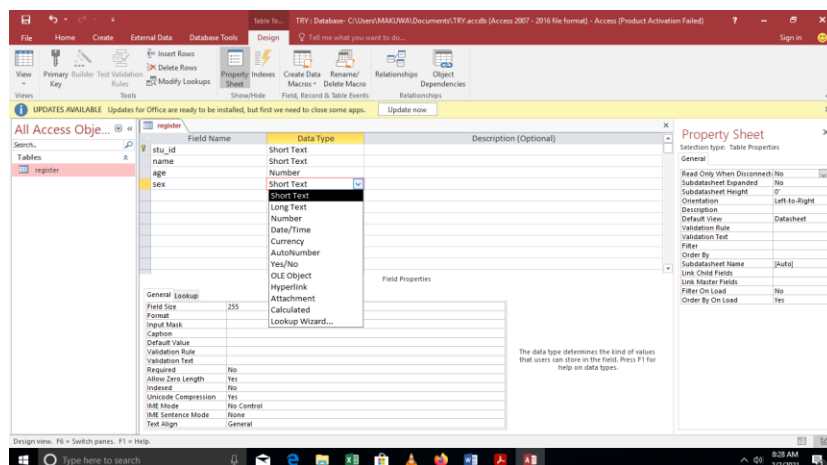

3. Choose appropriate data type before adding another field. Access starts with Short text as default data type
4. To save changes, click save button
5. Access will prompt whether you want to create primary key click YES

Setting primary key and indexes

➢ An index is used to speed up searching and sorting of records in a table while a primary key is an index that uniquely identifies each record stored in a table
➢ A primary key prevents the user from making duplicate entries into a table.
➢ Therefore, a primary key has two functions:
1. To order records
2. To control redundancy (i.e. prevent users from making duplicate entries into a table)
➢ Once a field is set as a primary key, the datasheet is automatically indexed or sorted using the primary key.
➢ To set the primary key, proceed as follows:
1. Open the table in Design View then click Design tab

2. Select the field you wish to set as primary key by clicking in the row header on the left of the Field Name
3. Click the Primary key button on the Design toolbar
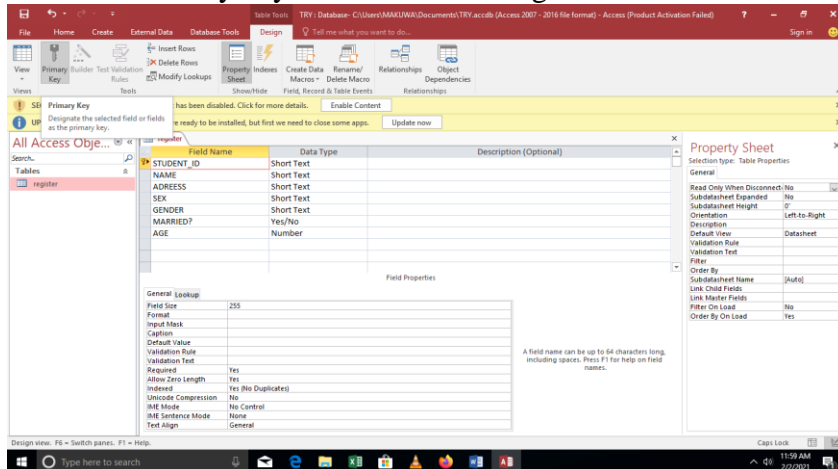
To set another field as an index or secondary key, proceed as follows
1. Open the table in Design View
2. On Design tab, click indexes button in Show/Hide group. The index regidter is displayed on the screen as shown below:
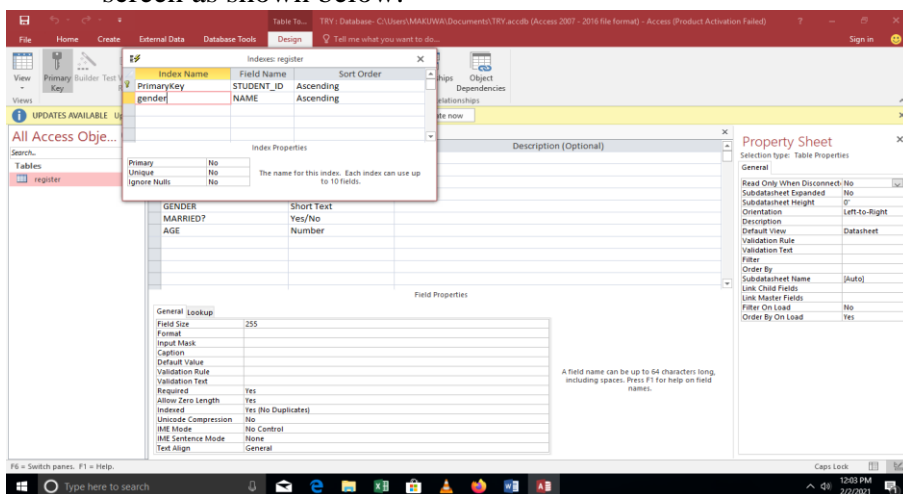
3. In the Field Name column, select the field you wish to set as a secondary index other than the primary key
4. In the Index Name, type the name of the index
5. In the sort order column, select the ascending of descending then close the window

Field Data Types

➢ The type of data to be used in a database must be clearly defined for the purpose of manipulation and storage.
➢ For example, if a filed is to be used for calculation, it must be defined as a number
➢ The following data types are allowed in Access:
1. *Short Text*
➢ This type includes alphabetic letters, numbers, spaces and punctuations. Use this data type for fields that do not need to be used for calculations such as Names, places.
➢ This type of filed accommodates a maximum of **255** characters
2. *Long Text*
➢ Unlike short text data types that takes up to 255 characters, long Text takes up to 65,535 characters.
3. *Number*

➢ This type is made up of numeric numbers 0 to 9 that are to be manipulated mathematically.
4. *Calculated*
➢ This is used to store data created from a formula. This is important particularly if a value will be used in queries, forms and reports.
5. *Date/Time*
➢ Used to identify a field as either date or time field. This is because date in a database can be manipulated mathematically, for example you can calculate age of a person by given date of birth and current date
6. *Currency*
➢ Used to identify numeric values that have decimals or fractions. Use this data type when dealing with monetary values such as fees balance
7. *AutoNumber*
➢ This is a numeric data type used if you wish Access to automatically increment the value by one. The field is incremented by one each time you enter a new value
8. *Yes/No*
➢ This is a logical data type that is either *yes* or *no* or *true* or *false*. For example, fields that requires you to answer whether you are married or not.
9. *OLE object*
➢ The term OLE stands for Object Linking and Embedding.
➢ This data type is mostly used for storing graphical objects such as pictures, drawings, charts, among others.
10. *Attachment*
➢ This data type is used to store one or more files containing pictures, sound, video or word document.

Field properties

➢ As you create more and more complex tables, you may need to use field properties to specify details related to each filed in the table.
➢ The properties depend on the type of field selected.
➢ Click the field and then click General as below:
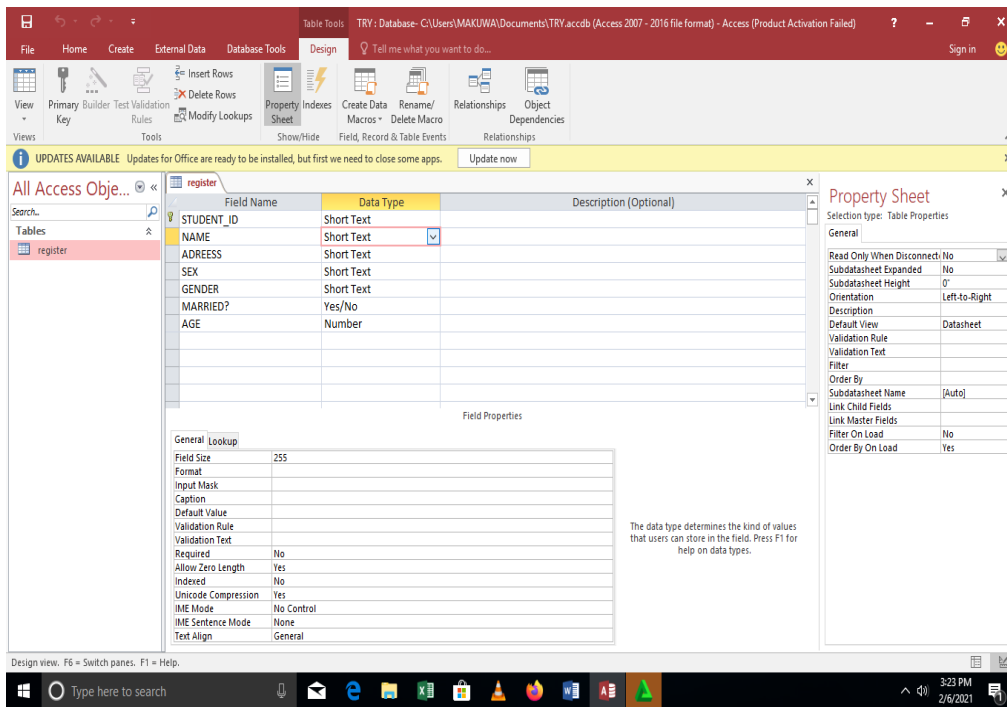
1. **Field Size**:
   ➢ Field size allow the user to set the number of characters in a field instead of the default 255 for short text field. For numeric field, you can set the field size as an *integer, Byte, Single, Double* or *Decimal*
   ➢ Integer and long integer: accept number with no decimals
   ➢ *Byte*: can only accept a number between 1 and 255
   ➢ *Single*, *double* and *decimal*: Accept number with decimals. (single precision accommodates up to 38 decimal places while double precision accommodates up to 308 decimal places)
2. **Format**:
   ➢ Determine how information appears on the screen o when printed. For example, you can format the numeric value as scientific, currency, percentage or general.
3. **Precision**:
   ➢ This property is used to specify the total number of digits that can be stored bot to the left and right of the decimal point.
4. **Decimal places**:
   ➢ This property applies to number and currency type.
5. **Input mask**:
   ➢ Input mask is used to format a field into a specific format. For example, if you enter a number such as 02000100409874 and the input mask is set as 000-(00000)-000000, it is formatted and displayed as 020-(00100)-409874. This property is mostly used to format phone numbers and address entry.
6. **Caption**:
   ➢ A caption is a more descriptive name for a field to be used in the table or a form display. For example, the caption for *stuName* could be *Student Name*
7. **Default value**:
   ➢ This is a value that will appear automatically in the datasheet or form if nothing is entered by the user. For example, Date() automatically displays the current date in the date field
8. **Validation Rule**:
   ➢ A validation rule may be an expression that restrict the values to be entered in a field. For example, if you want to restrict the marks entered in a field to values between 0 and 100, type **>=0 And <=100** in the validation rule box.
9. **Validation Text**:

➢ This is a custom message that appears once the validation rule is violated. For example, you may specify a validation text for the above validation rule to display "*Enter a number between 0 and 100*" whenever a user enters a value outside this range.

10. **Required**:
➢ This is a validation property that ensures an entry is made in the field before proceeding to the next filed or record. For example, if surname is required, you must enter it before ypu proceed.

11. **Allow zero Length**:
➢ This is also a validation property that allows the user to proceed without making any entry in the field set as *Zero* length.

12. **Indexed**:
➢ An index is a field that is used to speed up searching and sorting of records in a table. It may also be used as a validation key to prohibit duplicate values in the field. Therefore, we use index properties on specific fields such as Admission number to index records for easy access and search.

DATA ENTRY AND MANIPULATION

Manipulating records

➢ Manipulating a database is a process of appending (adding) new records, editing records, modifying the table structure.

Appending records

➢ There many ways of entering new records into a database table such as
1. Typing direct into the table in the datasheet view
2. Using a form
3. Import data from other applications such as spreadsheet

Typing direct in the Datasheet View

➢ To enter records by typing direct into database table, proceed as follows:
1. Double click the table you want to enter record OR click the table then click View then select Datasheet View
2. Click the first row in the table and make entries. The following symbols appear:
➢ *An arrowhead*: Indicates that there is no new data entry or edit is pending
➢ *Pencil*: means that the current record entry is not yet saved
➢ *Asterisk*: Marks a blank record below the current entry
➢ *Record locked*: Indicate that the current record is being edited by another user in a multi-user or networked environment.

Deleting records: To delete a record, point the arrow then *Right click* and finally click *Delete Record*

Editing record: To edit content field, click inside the cell and then type the new record

Searching for records: To find and replace a field, click *Find* or Press *Ctrl + F* then type what you search to search.

Copying and moving records: Select the record you want tom copy or move, click *COPY/CUT*, open the target datasheet and click Paste

Sorting and filtering records

2. Sorting refers to arranging records in ascending or descending order numerically or alphabetically.
3. On the other hand, filtering refers to extracting records from a table that meets given criteria.

To sort records: In the Datasheet View, select the records to be sorted, On the Home tab click either Sort icon for Ascending or Descending order.

To filter records:

There are **four** ways of filtering records and these are:

1. Common filter
2. Filter by selection
3. Filter by form
4. Advanced filter

To filter records

1. Open the table in Datasheet View, then select the record to be filtered
2. On the Home tab, click Filter icon that looks like a Funnel.
3. Use the checkbox to specify values by checking the field
4. To remove the filter, click Toggle filter

Modifying a Database

➢ You can modify the table datasheet structure,
➢ Import a table from another database
➢ Export tables to another database

Adjusting column size: Point the column between the column header then drag to resize it

To adjust row height: Point the border between the row header ad drag to required row height

Reordering table fields

➢ You can rearrange the fields by switching their positions. For example, instead of starting with Firstname followed by Midname then Surname, we can change the order to start with Surname, Firstname and then midname.
➢ **To reorder fields**: Select the column you wish to move by pointing to its header then drag the column right or left on the top of filed where you want your field to appear and drop.

CREATING RELATED TABLES

- One of the technical part in design of a relational database is to link tables using a foreign key that references a primary key of another table
- A foreign key is a field in a database table that matches the primary column of another table.
- There are **three** types of relationships between two tables, each named according to number of records that may be involved in the relationship and these are:
1. **One-to-one relationship**
- This is a type of relationship   where the primary (reference) table has only one related record in the related (child) table and vice versa.
- For example, in a Christian marriage, a man can only marry one wife and a wife is only married to one husband. In this case, there is only one record with that person I husband table related to only one record in wife table. Figure below shows how to present one-to-one relationship using an Entity Relationship Diagram (ERD)

Husband	Wife

Most one-to-one relationship are forced by rule and don't floe naturally as such you can just combine both tables into one table
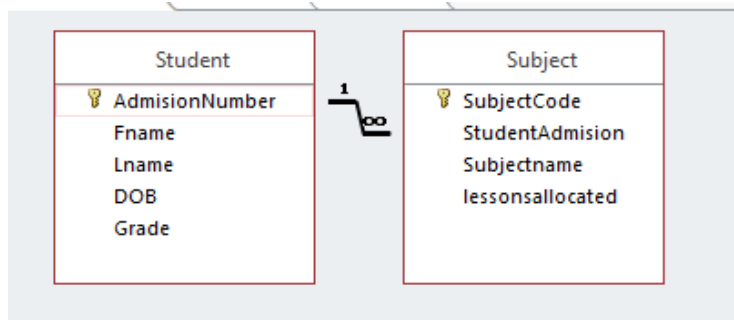
2. **One-to-many relationship**
- This is the most common type of relationship.
- In one-to-many relationship, one record from primary table correspond to one or more related records in the child table but each record in the child table is related to one record in the primary table
- For example, a student may take one or more subjects. In this case, there is only one record with that student in S*tudent table*, yet there are several subjects related to the same student in *Subject table.*
- Figure below shows how one-to-many relationship is represented using ERD
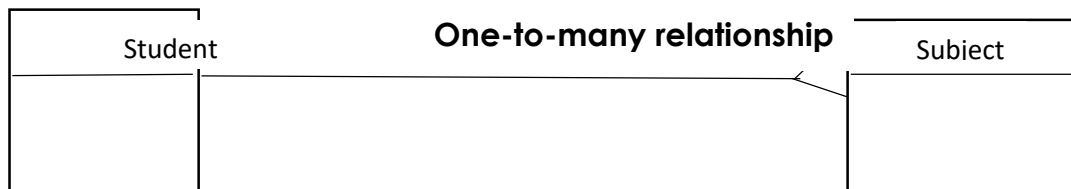
Creating one-to-many relationship

- Create one-to-many relationship using the tables below
- Note that primary key of Student table, AdmisionNumber is included in the Subject table as a foreign key named StudentAdmision.


To create one-to-many relationship using Student table and Subject table above, proceed as follows:
1. Create *two* tables, one named Student and the other one named Subject with the following fields as shown from the diagram
   Student: (**AdmisionNumber**, Fname, Lname, DOB, Grade)
   Subject: (**SubjectCode**, *StudentAdmision*, Subjectname, lessonsallocated)
2. Click the Database Tool tab, then click Relationship button as shown below
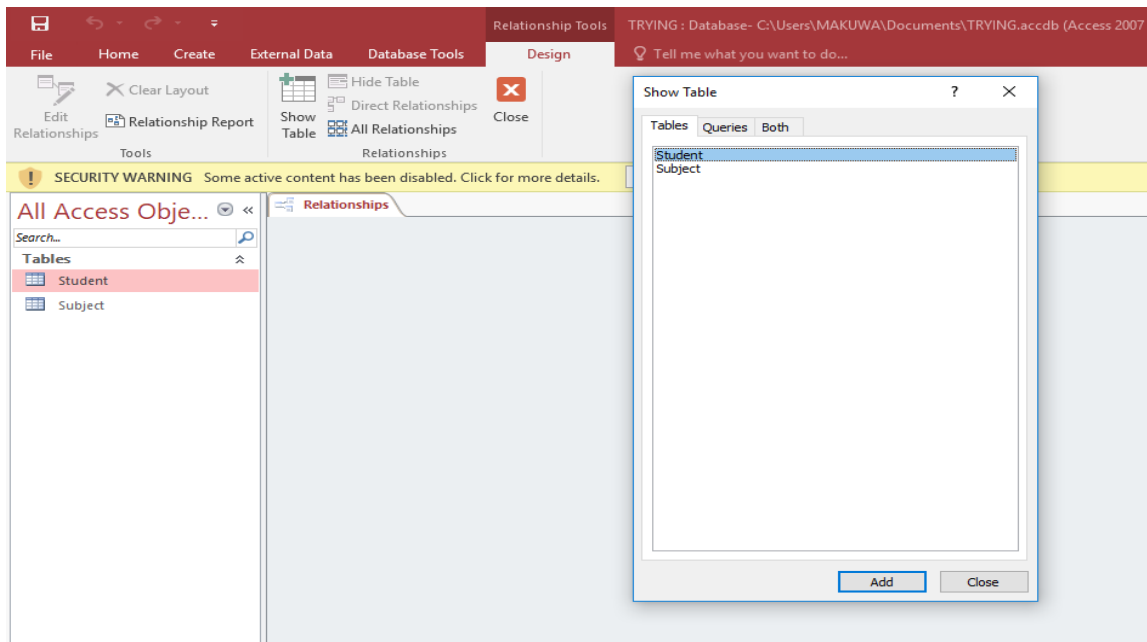
3. In the Show table dialog box, select the Student table then click Add and then click Subject table and click Add. The tables are displayed in the relationship window as shown below:
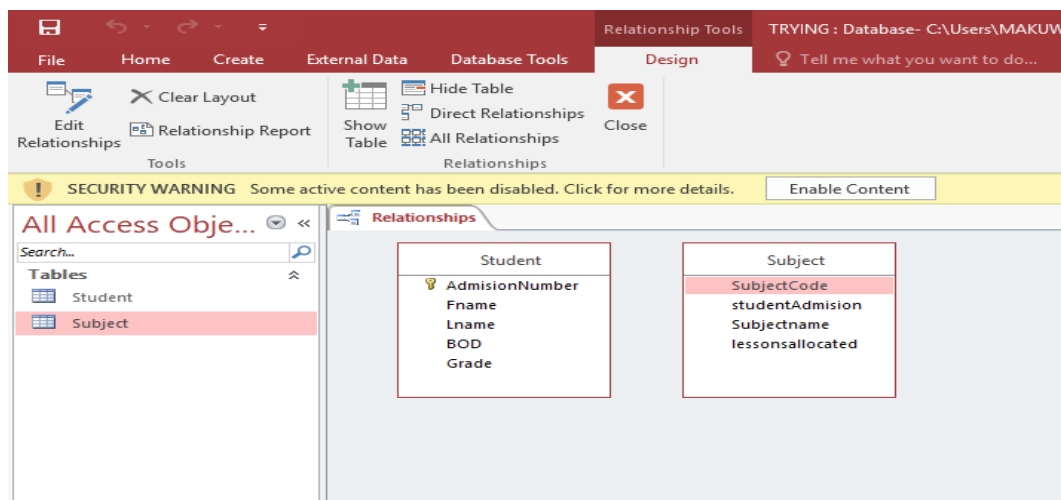

4. Drag *AdmisionNumber* primary key on the Student table and drop it into the *StudentAdmision* foreign key on the subject table. In the Edit relationship that appears, click Create Button to establish the relationship shown below.
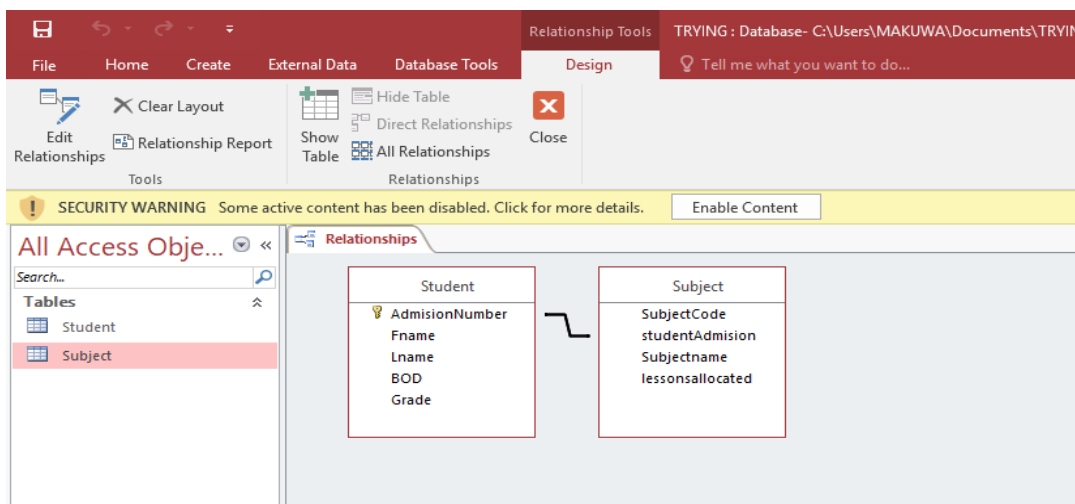
Enforcing referential integrity

- Referential integrity is a relational database integrity rule that ensures that every record entered in the child table has a related record in the primary table.
- For example, if we do not have a student with AdmissionNumber M11 in the Student table, we cannot enter subjects for her in the Subject table.
- To enforce referential integrity, proceed as follows:
1. Open the database and then display the relationship window in the Database Tool tab
2. Right click the link joining the two tables then click *Edit Relationship* (or just double click it)
3. In the Edit relationship dialog box, select *Enforce Referential Integrity* check box
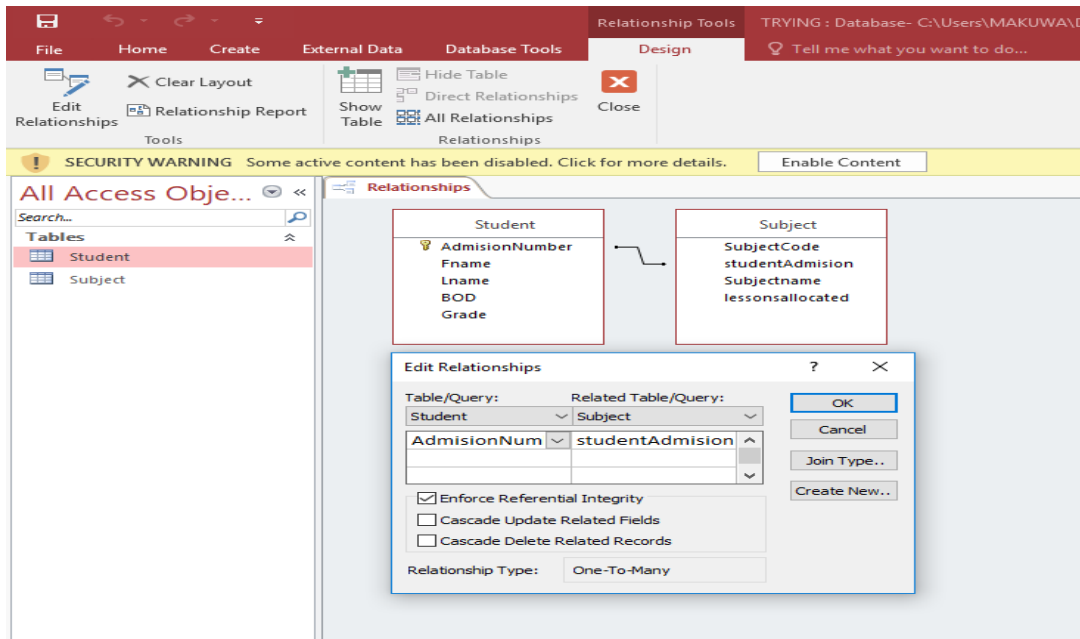

4. Click **Ok** to close the diagram

The relationship will look like below
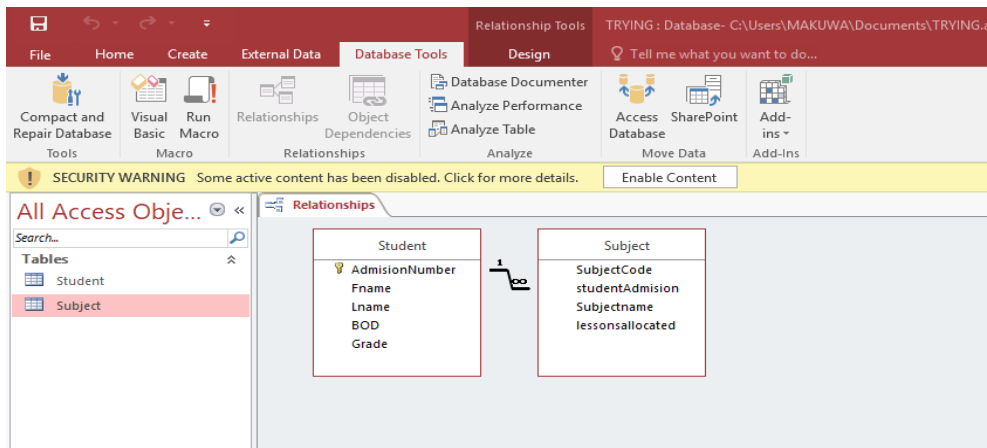
Many-to-many relationship

- Many-to-many relationship also called non-specific relationship occurs when each record in the primary table correspond to one or more records in the child table.
- For example, a teacher may teach more than one subject while one subject may be taught by one more teachers.
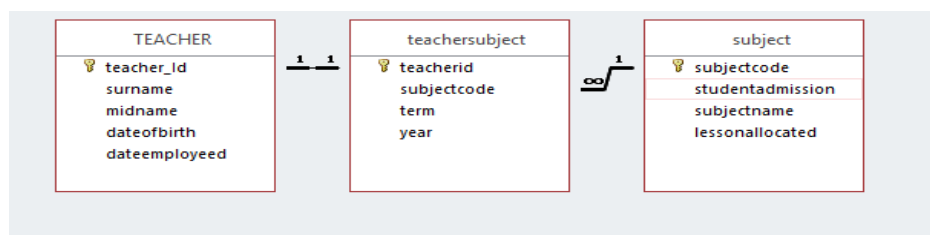
- Figure below shows representation of many-to-many relationship using ERD

Many-many relationship
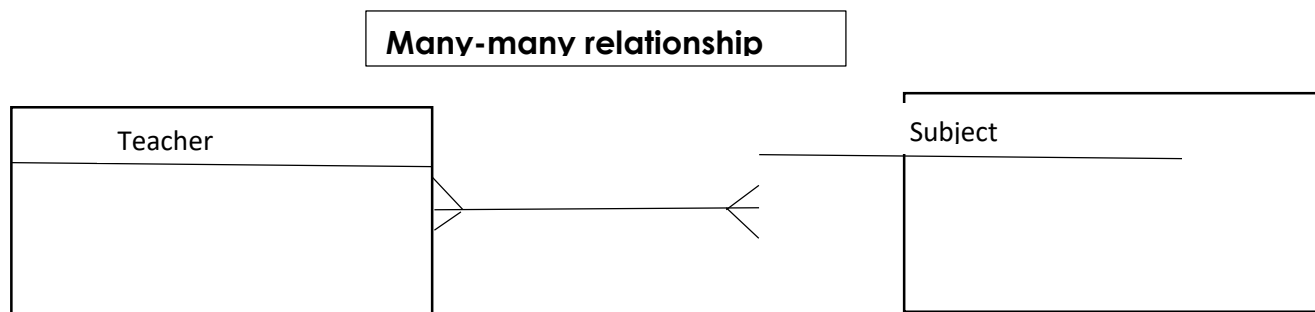
- As demonstrated earlier, many-to-many relationship requires a third table known as *Association table* that convert the relationship to **two** one-to-many relationships. This is so because relational databases do not handle many-to-many relationship

Creating Many-to-many relationship

- As discussed earlier, a third table called associated table is created that links the two tables
- Note that the primary key of **Techers** and **Subjects** tables are included in the third associated table named **TeacherSucbject** as shown below.

To create many-to-many relationship, proceed as follows:

1. Create three tables namely Teachers, Subject and teacherSubject with the following fields
   Teachers: (**Teacher_ID**, Suname, FirstName, Gender)
   TeacherSubject: (**Teacher_ID, SubjectCode**, Term, Year)
   Subject: (**SubjectCode**, SubjectName, Lessonallocate)

NB: The primary key of *TeacherSubject* table is composite (two-in-one) primary key borrowed from the two tables. According to normalization rule, Terms and Year in the TeacherSubject table will depend on the composite primary key named Teacher_ID and SubjectCode

2. To create composite primary key, hold down the SHIFT key as you click the primary key button on both Teacher_ID and Subject_Code.
3. Click the Database Tool tab then click *Relationship* button
4. In the Show dialog box, Select *Teacher* table then click **Add button**. Do the same with *Subjects* and *TeacherSubject* as shown below:
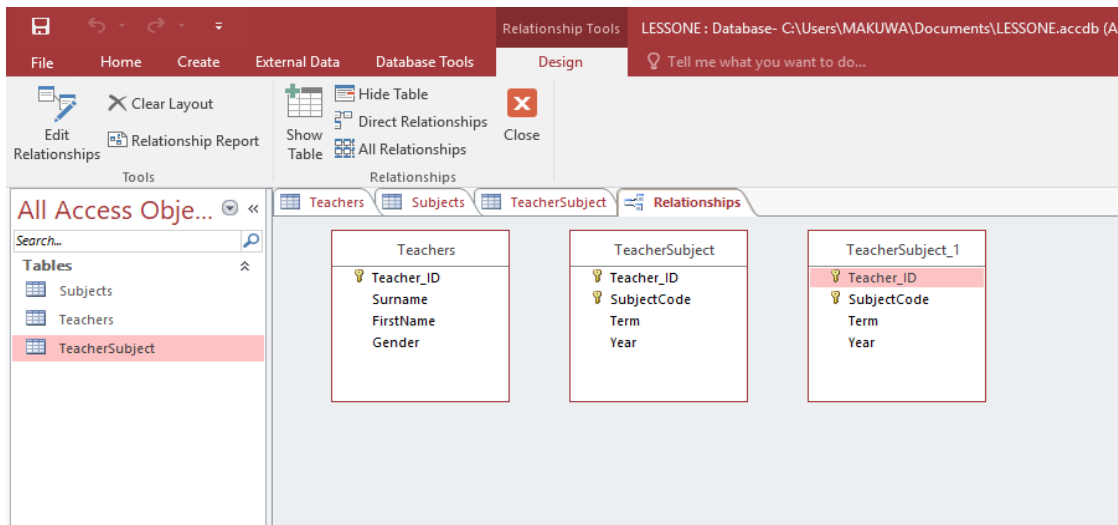
5. Drag the Teacher_ID primary key on the Teachers table and drop it into the Teacher_ID in the TeacherSubject table. Next, drag SubjectCode on the subject table and drop it in the SubjectCode in the TeacherSubject table. In the Edit relationship that appears, Enforce the referential integrity and click **Create** button
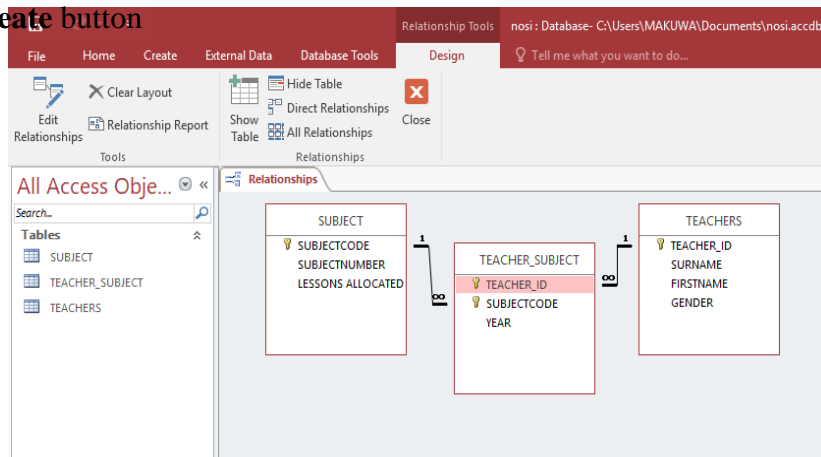
CREATING DATA FORMS

- A form is a graphical interface that enables the user to easily view and make data entrued into an underlying table or query.
- In Microsoft Access, a form is designed using the form object and field *controls*
- A control is an object such as a text box, check box, command button or labels that you place on a form design to display data or perform actions.
- These controls are found on a form Design Tools ribbon that appear once the form design is displayed.
- There are **two** types of controls you can place on the grid:
    1. Bound controls
    2. Unbound controls
- A bound control is one whose source of data is a field in a table or query while unbound control is a control whose source of data is not related to any data source
- You design or modify a form by placing these controls on the required position.

Designing a form

- There are **two** ways of designing a form
1. Using form Wizard
2. Using Design View

Designing form using Form Wizard

- A form can be designed using form wizard that takes you through a series of steps to select the fields and layout. Examples of layout are:
    1. Columnar form: The field or each record are displayed down a column on a separate line with field labels to the left
   2. Tabular form: Records are displayed from left to right across the page and labels appear at the top of each column and each row represents a new record
    3. Datasheet form: The form resembles a table in a datasheet view
    4. Justified form: One record occupies the whole form.

- To create a form using the Wizard, proceed as follows:
    1. On the **Create** tab, click **Form wizard**
    2. In the form Wizard dialog box that appear, select the *table* you want to create form for and the *fields* you want in the form and click *Next*
    3. Select the layout of the form (columnar, tabular, datasheet, justified) and click Next
    4. Type the Name of the Form
    5. Click **Finish.** The form will look like below:
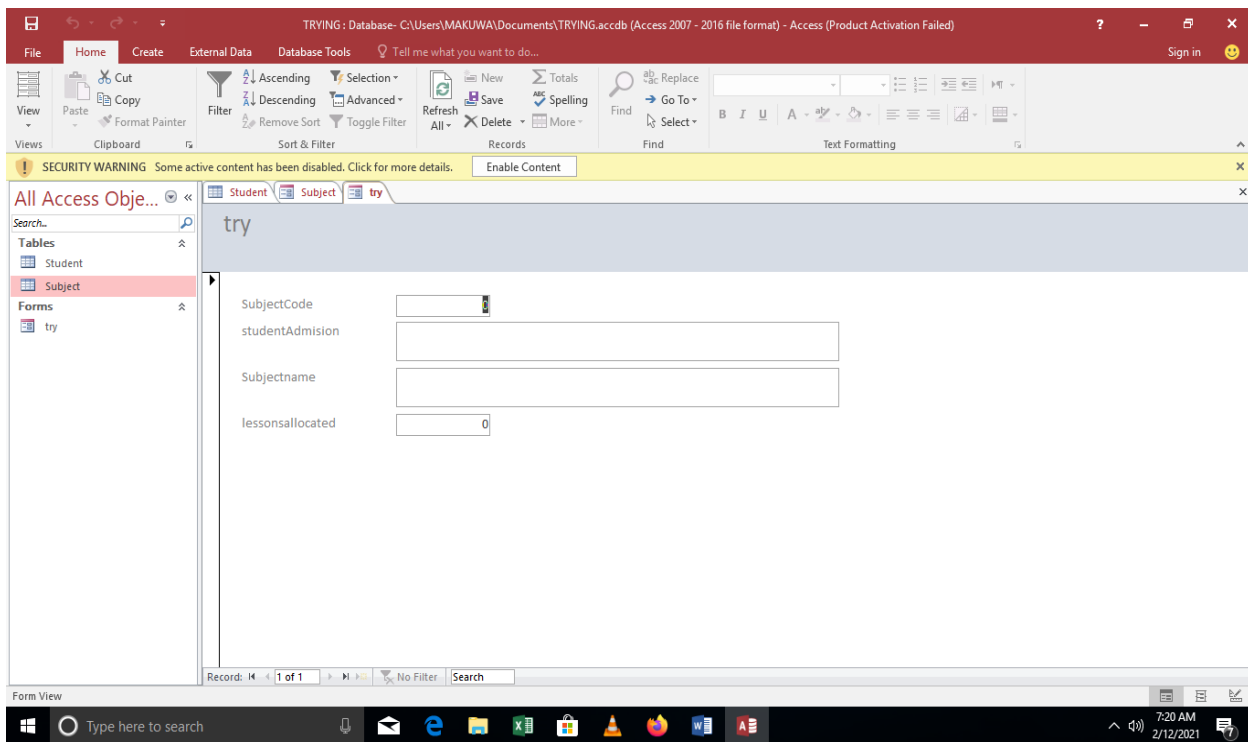
CREATING FORM IN DESIGN VIEW

- Instead of using Form Wizard, you may create a form from scratch using Design grid. Proceed as follows:
    1. Open the database you want to create from
    2. On the Create tab, click Form design. A design grid shown below will appear.
    3. On the right of the design grid is a Field List Pane. Under the Pane, expand the field list
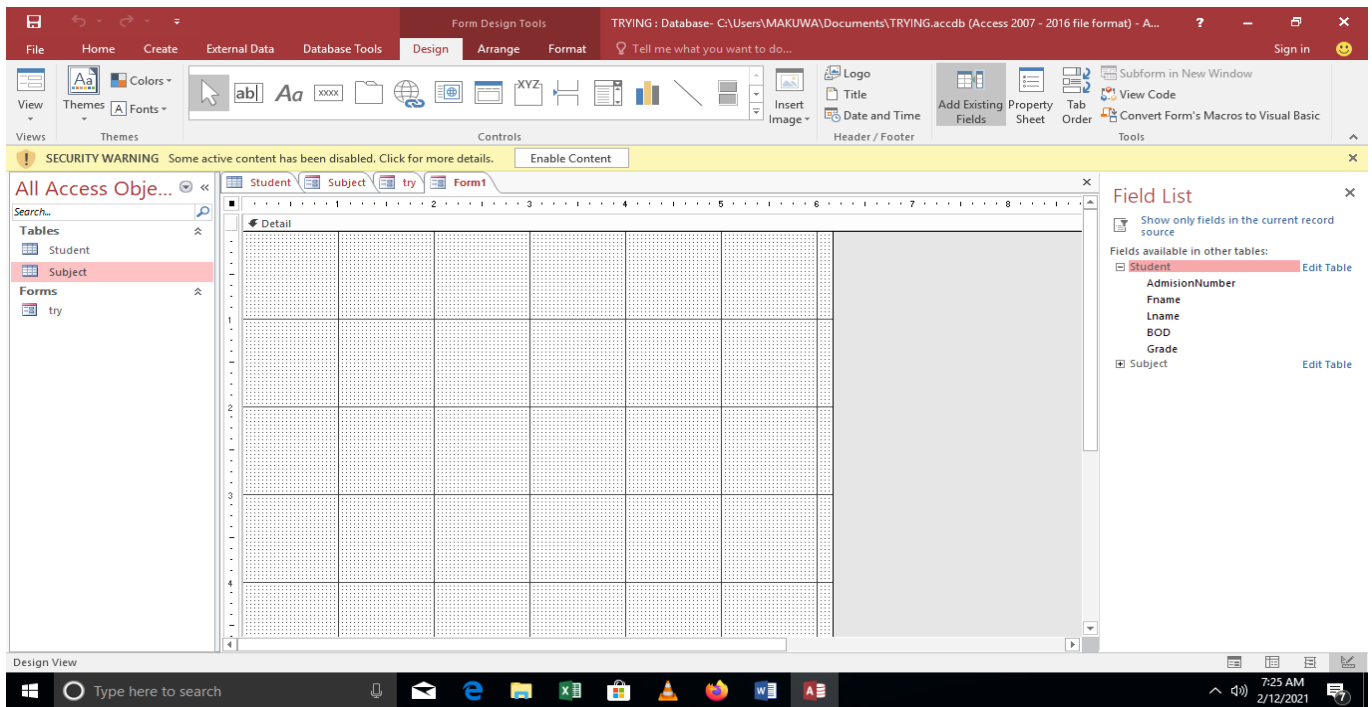
4. Drag and drop the field list on the design grid
5. Display the form on the form view to see how the controls appear in the form
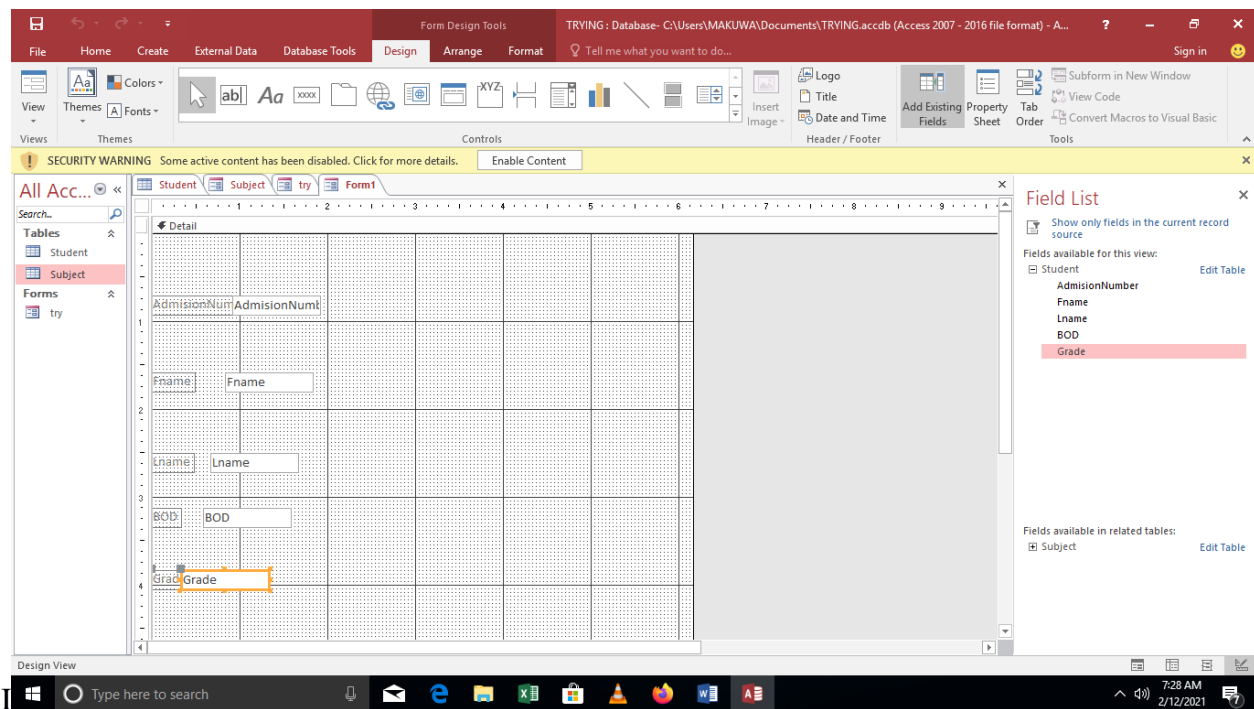
This is in design view. In a form View, it will look like below
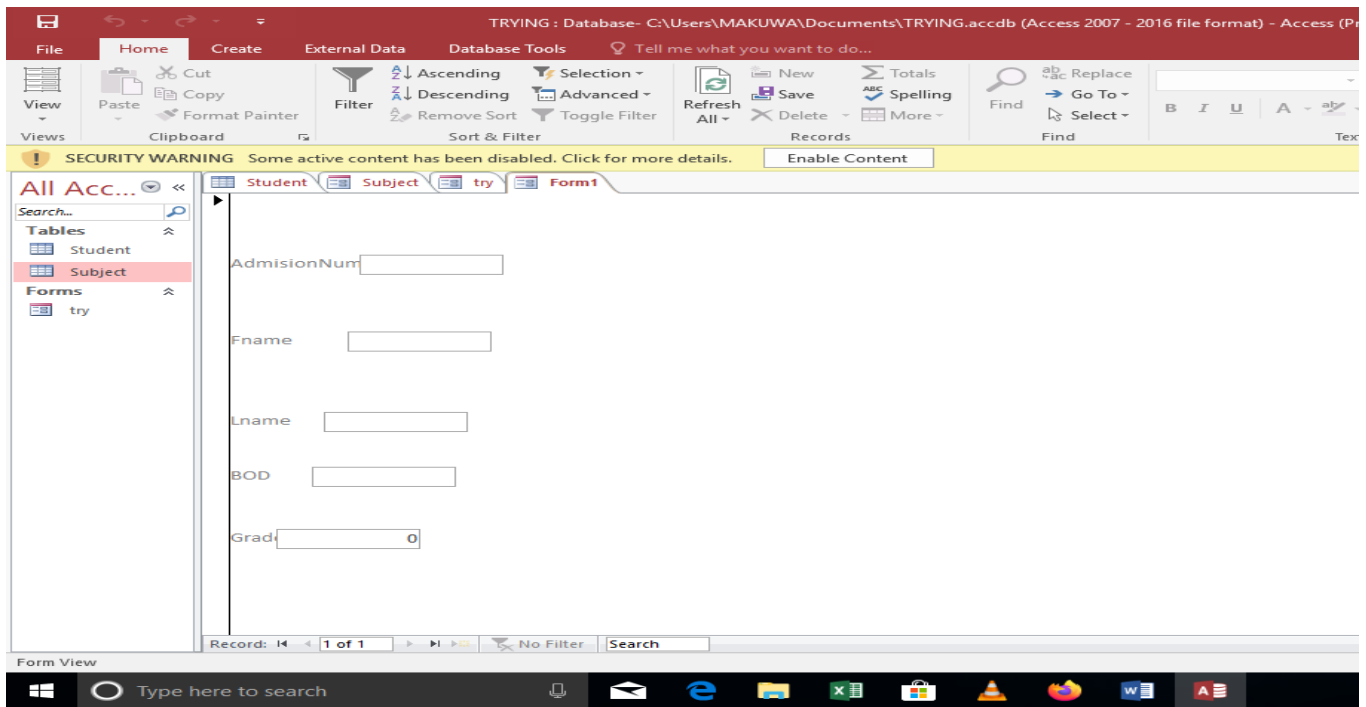
To change to Form View, click View then click Form View

Form Navigation

Once the form is displayed, you will notice a navigation bar at the bottom as shown below
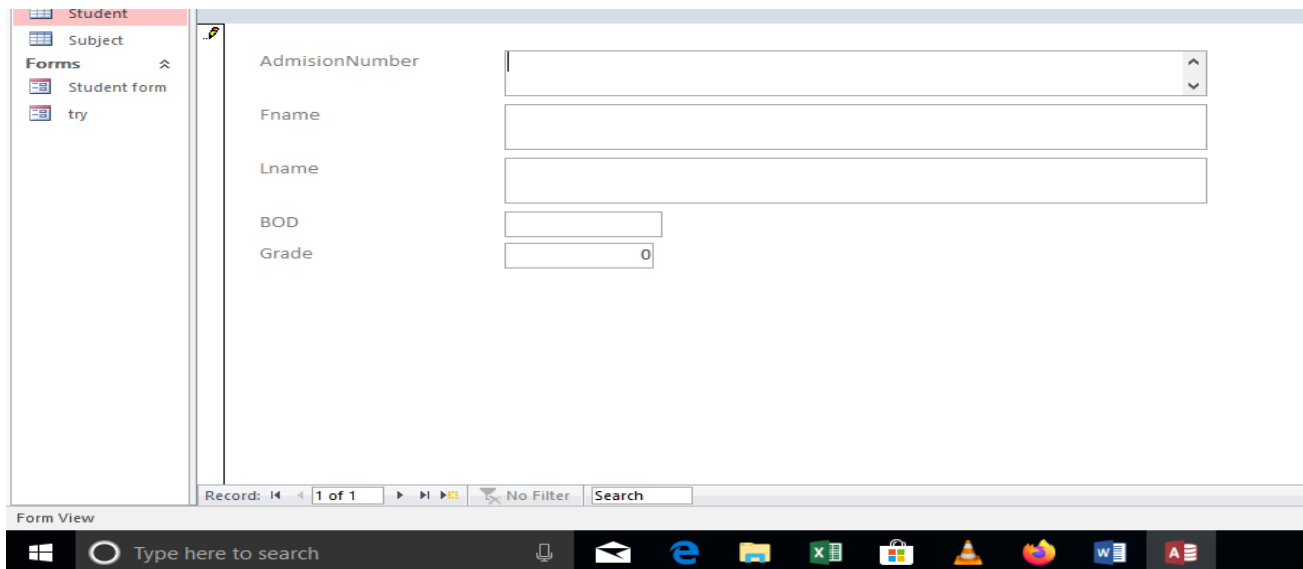
We use Navigation bar located at the bottom of the form to do the following

1. Display the first record in the table using ▮◀

2. Display the previous record using ◀

3. Display the next record using ▶

4. Display the last record using ▶▮

5. Add a New record using ▶

Modifying form

To format Field controls on a form, proceed as follows
1. Open the form in Design view
2. To resize the control, click the control and resize to the required position
3. To move control, click the control and position the pointer onto he place holder or inside the drag to the required location

Printing the form

A form can be printed either in design View or form View
1. Click the form tap to make it current
2. Select either design View or Form View
3. Click the Print menu

CREATING QUERIES

- The term query means a question.
- In database content, the term query refers to a question used to instruct a database to retrieve data or perform operations
- The operations performed may be insert, update and deletion of data in a table
- The language used to query a database on behalf of the user is referred to as Structured Query Language (SQL)

TYPES OF QUERIES

In relational database, queries are classified into **two** types
1. *Select query*
- This is the most common type of query used for searching and retrieving data from one or more tables.
- A select query lets the user specify the search criteria and the records that meets the criteria are displayed in a query data sheet called dynaset
2. *Action query*
- These queries are used to make changes to records in a table.
- An action query may be used to delete, update, add a group of records from one table to another or create a table from another table
- There are **four** types of Action query and these are;
    1. Update: Updates data in a table
    2. Append query: Adds data in a table from one or more tables
    3. Make table query: Creates a new table from a dynaset
    4. Delete query: Deletes specified records from one or more tables

Creating queries

- In Ms. Access, you can create a query in two ways
1. By using query Wizard
2. By creating query in Design View

Creating query using Query Wizard
- To create select query using query wizard, proceed as follows
1. Ensure that the database you want to create a query for is open
2. Click the Create tab, then Query Wizard Command
3. In the New query dialog box, choose Simple Query Wizard and click Ok
4. Select the table/Query to create the query from and the fields then click Next
5. Select whether to be Detailed or summery then click Next
6. Type the name of the query and click Finish

Creating Queries in design View
1. On the Create tab, click Query design
2. Select the table or tables you want to create query from and click Add as shown below:
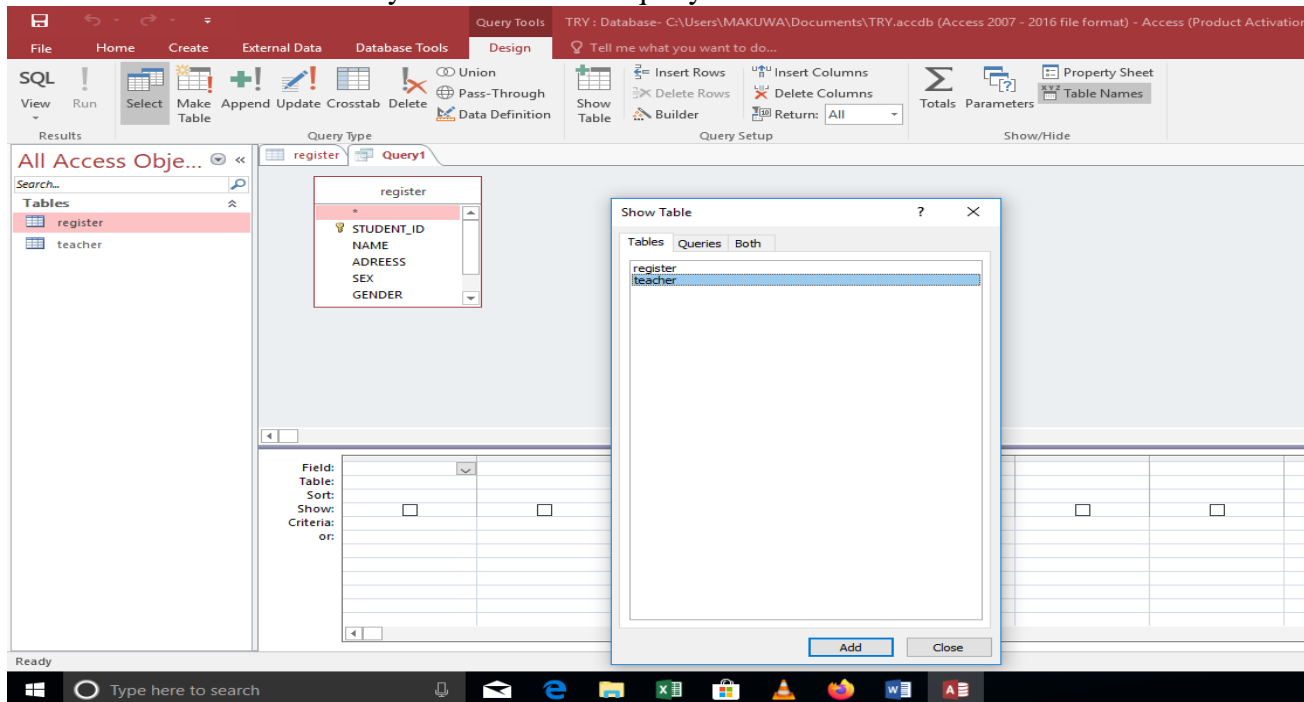
3. Drag each field or selected fields from the table into the field row
4. Type the criteria in the criteria row;

- The following are the important sections of a query design grid that are used to specify the field and criteria to be used to display the dynaset:
    1. *Field row*: Fields from a table or tables to be used are displayed in this row. Each field occupy its column
    2. *Table row*: Indicate the table providing the fields.
    3. Sort row: By clicking the down row in the sort row, you can specify the sort order, that is ascending or descending order.
    4. *Show row*: by clicking the show row, you specify whether to display the field in the query results. When the box is not clicked, the field will not be displayed.
    5. *Criteria row*: This I where you enter condition or expression that will be used by the query to display specified records.
    6. *Or row*: Used to specified an alternative condition.

Specifying query criteria
- In order to search for a particular record, you have to enter a conditional statement in the criteria row.
- For example, if you want to display list of employees who earn salary less than 5000, then you have to type <5000 in the criteria row under salary column.
- Other logical operators are: >, >=, <=, <> (not equal to), =
- You can also create compound expression using logical operators like AND, OR and NO, for example:
    ➢ Use **AND** to display values in specific range, for example type >5000 AND <8000in criteria row will display list of people whose salary is between 5000 and 8000
    ➢ Use **OR** if you e=want either one or both
    ➢ If you want data in particular range, use the word **BETWEEN**. For example, instead of *typing >4000 AND <6000 type BETWEEN 4000 AND 6000*
    ➢ If u want list of records except those you do not want, then use NOT. For example, NOT 6000 will display the whole list except 6000

➤ To display list that you are not sure of but you can only remember certain letters, use LIKE and wildcard. Wildcards are special symbols used in place of other characters... for example, LIKE Sm?

Saving and running a query
- ❖ To save a query, click file then Save
- ❖ To run a query, click *Run* button on the *Design* tab

Crating query from multiple tables
- - When you use fields from more than one table, there should be a relationship between the tables. To create query based on related tables, proceed as follows
- ✓ Start the database window and click Create tab
- ✓ Click Query Design and on the Show Tables, choose the tables and click Add.
- ✓ Add the fields from the tales into QBE grid
- ✓ Save and run the query

Sorting queries
- - In query Design view, go to sort
- - Specify the sort order
- - Display the Dynaset

Modifying queries
- ▪ You can modify the query by removing some fields, resizing columns, changing the criteria and fields to be displayed.
- ▪ All these can be done by opening the query in Design View and do the needful

Printing tables, forms and queries
1. Open the database window
2. Select the table, or form or query you want to print
3. Click File then Print

GENERATING DATABASE REPORT
- - Reports are used to summarize and present information from a database while labels are used for identity purpose.
- - Report can also be designed using two way
  1. Using report Wizard
  2. Using Design View

Generating report using Wizard
- - Just like a form wizard, a report wizard also takes a user through a number of steps by answering a few questions. Proceed as follows:
1. Ensure that the database is open
2. Click the Create tab, then Report Wizard
3. On the report wizard dialog box, select a table or a query and the fields to be added to the report the click Next
4. Choose if you want to add Grouping. Grouping is used to classify records using a particular field. Click Next
5. Select the sort option if you want and click Next
6. In the layout box, select the type of layout and as well the orientation and click Next
7. In the style screen, select a report style either bold, casual or any other
8. Finally enter the name of the report
9. Click Finish

Creating report in design view
1. Click the Create tab the select Report Design. A blank report design is displayed
2. To select the table or query, click Property Sheet in Tools group of design ribbon
3. On the displayed Property sheet, click the data tab and then specify the query or table name in the record source.
4. Click filed list button in the same group
5. Drag the each filed from the field list into the layout grid and drop it where you want it to appear

6. Once you finish placing controls, click save icon
7. Enter the name of the report
8. To view the report, click he print preview button. The design will look like the one below
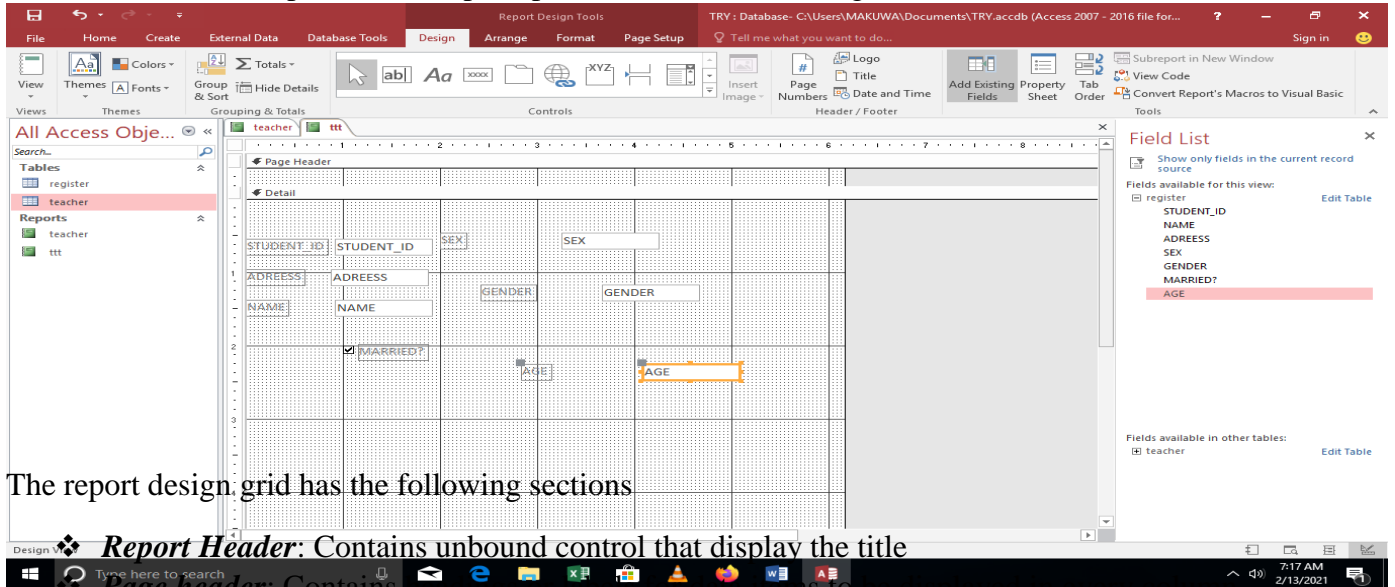
The report design grid has the following sections

❖ **Report Header**: Contains unbound control that display the title
❖ **Page header**: Contains headings or labels for data items to be displayed in every column
❖ **Detail section**: Hold bound controls that display data items for a table or query it was created from
❖ **Page footer**: Hold a control that will be displayed on every page such as page number and date, for example =Now(), displays current date and time
❖ **Report footer**: Used to display summery information from a report such as totals

Modifying report design

- To modify the report, open the report in design View and make necessary changes then save it.

Sorting and grouping

- Sorting arranges records in ascending or descending order based on specified field while grouping keeps records together based on one or more fields in the table.
- When using the report wizard, you have the opportunity to group add grouping levels. For example, if you select to group records using Student ID, all the records of a particular students are grouped together on the report

To group and sort records, proceed as follows:

1. Open the report in design View
2. Click design tab then click Group and Sort
3. Click the field by which to group or sort. You can click the More button to add other grouping and sorting options
4. Click the Close button to view the report

Printing reports

- You can print the report by:
1. Open the database
2. Select the report
3. Click File then Print
4. Set the print option
5. Click the Print option

GENERATING LABELS

- A label is a tag placed ion an item for easy identification.
- Examples of labels include: tags, mailing labels, bottle stickers.
- To generate labels using report wizard, proceed as follows
1. Open the database
2. Click Create tab then Label button in the Report group
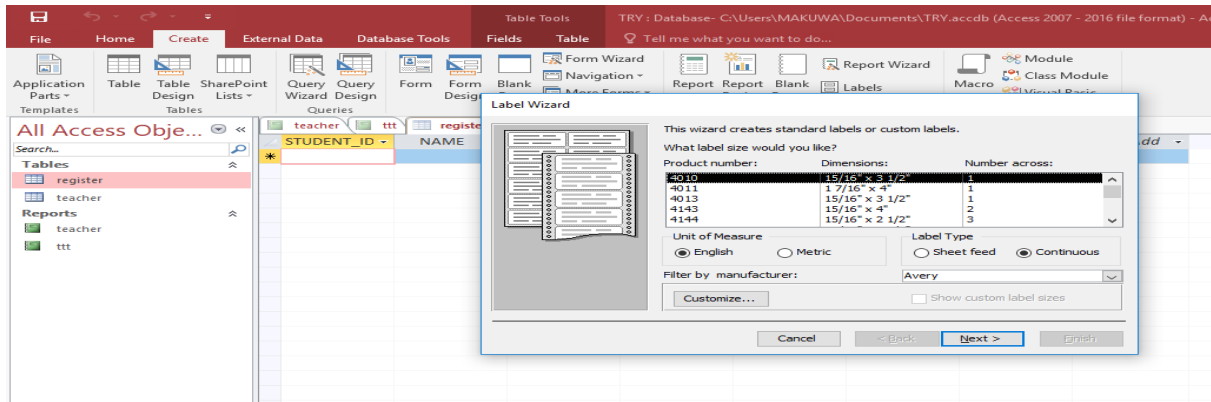
3. From the dialog boxes, specify the label size, font, fields to be included in the label, whether to sort the label, the name of the label the click Finish

Modifying the label

- You can modify the label by manipulating the layout controls. You can do all these by opening the label in a Design View

Database security

- Microsoft Access provides the user with data security features such as
    1. Encryption
    2. Password protection
    3. Hiding database object
    4. Providing user-level security
- A password protected database displays a dialog box that requests the password for opening.
1. Open the database in exclusive mode
2. On the Database Tools tab, point to Encrypt with password
3. On the Set Database Password dialog box that appears, type the password
4. Re-enter the password in the verify text box then click OK

To open the database in exclusive mode, proceed as follows:

1. Open Ms. Access and click Open Other File and then click Browse
2. Select the database file
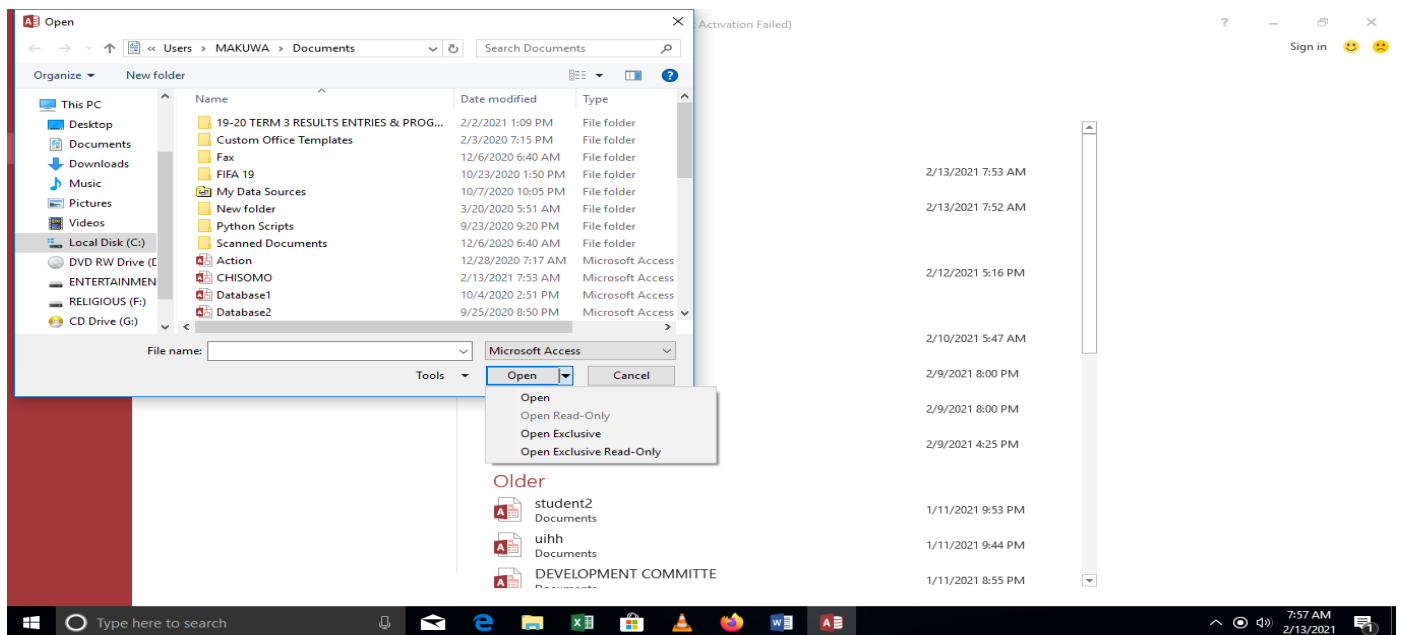
3. Click Open arrow then select Open Exclusive
4. Click File tab then click Encrypt with Password
5. Type the password then click **OK**

TOPIC 3: INTRODUCTION TO COMPUTER NETWORKS

- In book 3, you learnt about basic principles of data communication networks.
- You were introduced to networking, network devices and communication media.
- In this book, you shall learn the following:
  1. Types of networks
  2. Network topologies
  3. Reference models
  4. Internet protocol addressing system

TYPES OF NETWORKS

- A network is defined as a collection of independent entities that are arranged in such a manner to exchange data, information or resources.
- This definition is broad and covers both computer networks and non-computer network
- Examples of non-computer networks are: road network, telephone networks, nervous system etc.
- Computer networks ca be classified using several aspects but the most common classification is according to size
- Currently, there are several types but the most common are the following five
  1. Local Area Network (LAN)
  2. Metropolitan Area Network (MAN)
  3. Wide Area Network (WAN)
  4. Storage Area Network (SAN)
  5. Personal Area Network (PAN)

Local Area Network

- This is a computer network that span a relatively small geographical area like in one bulding or a school.
- It is usually owned by one organization. However, two LAN can be connected via data transmission lines or electromagnetic waves.
- Most Local area network connect PC and server computer on a small network. A server is a computer dedicated to servicing requests for resources from other computers on a network.
- LAN enable many users to share devices like laser printers as well as data. They also allow users to communicate by sending messages or engaging in chart sessions.
- LAN transmit data at a very faster rate

Metropolitan Area Network (MAN)

- This network covers a metropolitan area like a town or city.
- It covers a radius of 5 to 50km
- Metropolitan network may be owned by a single company that has offices across a metropolitan area or a service provider who provide network services to a subscriber in the area.
- Metropolitan network is made up of many local area network in a metropolitan area

Wide Area Network

- This network is larger than metropolitan area network and covers large geographical; area such as a country, a continent or the whole world.
- When it covers the whole world such as internet, it is called Global Area Network
- It consists of many local area network and metropolitan area network

Storage Area Network (SAN)

- This is a type of network where all data is stored in one powerful computer and be accessed by users using their PCs, mobile phones, smartphones, tablet, laptops etc
- This powerful computer has powerful processor and huge memory and data storage capacity. This forms what is called cloud computing.
- In cloud computing, processing power, data and programs can be located somewhere on a network of powerful computer and simply accessed by users
- An example of SAN is Data center

Personal Area Network (PAN)

- This is a type of network setup at home which allows users to share data using personal devices like phones, laptops, tablets etc which has technology that enable them to interconnect such as Bluetooth technology.
- This network is also called Home Area Network (HAN)

NETWORK TOPOLOGIES

- The term network topology refers to the way in which computers and other devices have been arranged or how data is passed from one computer to another in a network.
- Therefore, a network topology can be viewed in two ways
    1. Logical topology
    2. Physical topology

Logical topology

-Logical topology also called signal topology refers to the way data passes from one device to another on a network.

-Two types of logical topology are:
1. Ethernet
2. Token ring

Ethernet topology

- In Ethernet topology, all computers listen to the network media and can only send data when no other computer is sending.
- Sending of the data is through broadcasting technology i.e. placing the data on a common bus and all computers connected to the bus can 'see' it. However, the data has the address of the recipient and only this computer picks the message from the bus.

Token ring topology

- In token ring topology, a special package for data called a token goes around the network I a unidirectional manner.
- The token van only be taken up by the computer whose address is on the data held in the token. After taking it, the computer reads the data and ten release the token. The token then be captured by another computer which needs to transmit data.

Physical topology

- Physical topology refers to the physical layout or arrangements of computers on the network.
- Examples of physical topology include:
1. Start topology
2. Bus topology
3. Ring topology
4. Mesh topology
5. Tree/hierarchical topology

Star topology

- In star topology, all devices are connected to a central hub. Nodes communicate across the network by passing data through the hub.
- When the hub receives the data from a transmitting computer, it broadcast the message to all other nodes on the network.
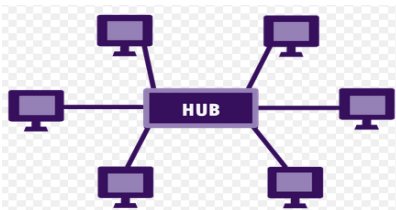
Advantages of star topology

1. It allows centralization of key networking resources like concentrators and servers
2. It gives the network administrator a focal point of network management. When the network goes wrong, it is easy for administrator to trace the problem
3. Star topology are easy to configure

Disadvantages of star topology

1. It is costly because it requires one complete cable per computer.
2. If the central hub fails, the entire network will be down
3. Installation is time consuming because each node forms a segment of its own

Bus topology

➢ In this topology, all devices are connected to central cable called bus or backbone.
➢ This topology has a problem that the cable can only carry one message at a time and each workstation on the network must be capable of knowing when it can send message and when it cannot transmit.
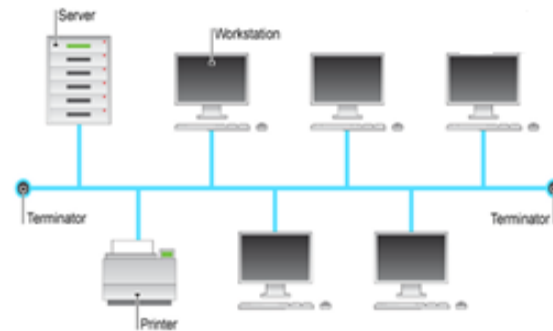
➢ A *terminator* is attached at each end of the cable to avoid signals from bouncing back and forth on the cable causing signal distortion.
➢ As the data passes through the cable, each workstation checks whether the data is addressed to it. If the address matches the machine address, it receives the data otherwise it rejects it.
➢ A network address of a computer on a local area network is called the *Medium Access Control* (MAC) address.

Advantages of bus topology

1. Easy to install
2. It is less costly. Does not require complete cable per computer

Disadvantages of bus topology

1. A cable break in any section brings down the whole network
2. Troubleshooting a cable fault is difficult because the fault could be anywhere on the cable
3. The bus topology limits the number of computers that can be connected to the cable because each computer is listening to the cable in order to transmit. This means that increase in number of computers result in an increase collision as machine compete for transmission.

Ring topology

- In a ring topology, all devices are connected to one another in a shape of a closed loop.
- Each station is responsible for regenerating and retransmitting signals around the network to its neighbour.
- A token is used to exchange data from one station to another.
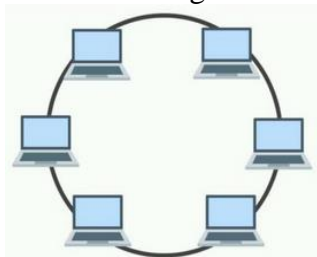
Advantages of ring topology

1. They use short length cable
2. Easy to install

Disadvantages of ring topology

1. Modification may be difficult because adding or removing a device can disrupt the entire network
2. Troubleshooting can be difficult
3. One device or media breakdown may affect the entire network. However, this is not the case with *IBM token ring* where a device called *multistation Access Unit* (MSAU) is used in the event a station fails.

Mesh topology

- This is the most common type of topology used in wide area network where there are many paths between different location.
- Devices are connected with many redundant interconnections between the node
- Every node has a connection to very other node in the network
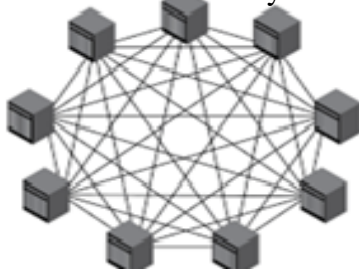
Advantages of mesh topology

1. The network can still operate even when a node breaks down or a connection breaks
2. The network is reliable
3. Point to point connections optimize throuput of data

Disadvantages of mesh topology

1. It is expensive on cable due to redundant links
2. Administration of the network is difficult because of the peer to peer connections

Tree/hierarchical topology

- This is hybrid topology.
- Groups of star-configured networks ae connected to a linear bus backbone.
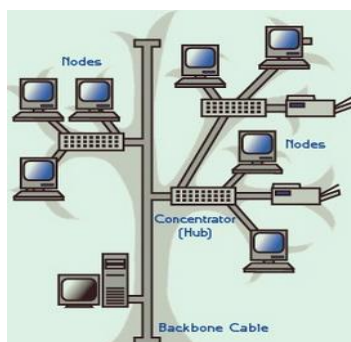
Network software

- Network software is the software that helps to efficiently utilize network resources.
- Network software is classified into two categories:
    1. Network operating system
    2. Network protocols

Network operating system

- These are operating systems specifically designed to optimize networked computers ability to respond to service requests.
- Servers run on network operating system.
- In additional to normal operating system, network operating system performs the following related functions:
    1. Provide access to network resources e.g. printers and folders
    2. Enable nodes on the network to communicate with each other more efficiently
    3. Support interprocess communications i.e. enable the various processes on the network to communicate with each other
    4. Respond to requests form application programs running on the network
    5. Supporting network services like network card drivers and protocols
    6. Implementing network security features

NB: Internetworking devices such as routers have their own operating system and hence can be managed and configured for optimum performance

Network protocols
- Protocols are set of rules and procedures that govern communication between two different devices or people.
- Therefore, network protocol refers to the rules and technical procedures that govern communication between different computers.
- The data transmission process over the network has to be broken down into discrete systematic steps. At each step, a certain action takes place. Each step has its own rules and procedures as defined by the network protocols.
- The work of these protocols must be coordinated so that there are no conflicts or incomplete operations. This co-ordination is achieved through protocol layering.
- In a world that is full of innovation from different people, it is difficult to dictate uniformity on how protocols are developed.
- To avoid protocols that conflict, a reference model for all developers was developed to give guidance to all developers worldwide.
- Two reference models were developed
    1. Open System Interconnection (OSI) reference model
    2. TCP/IP reference model

OSI reference model

- This protocol was developed by International Standard Organization(ISO)
- OSI model is not a protocol but a reference point, a standard guidelines or blueprint for hig quality protocol development.
- OSI reference model has seven layers each performing distinct function as shown in the table below:

	LAYER	FUNCTION
7	Application layer	User application runs here and generate request for data transmission or open received information
6	Presentation layer	Format data for transmission e.g. ASCII, .tif etc

		Encrypt or decrypt data
5	Session layer	Set up transmission session between communicating devices for synchronized data exchange
4	Transport layer	Manage data transfer over a network to ensure reliability
3	Network layer	Address information is added to the packet and internetwork routing to destination
2	Data link layer	Packs data into frames, add error checking information, sends to physical network. All this is called Data Link control (DLC)
1	Physical layer	Data encoding, attach to physical medium, transmit bits in voltage level format

Difference between Network and Internetwork

- The following points differentiate network and internet:
    1. A network is a local area network that has homogeneous (similar) protocols while internetwork is a network of networks that span a larger geographical area and have different protocols
    2. Network only relies on MAC address that comes with every network interface card to exchange data while internetwork requires routing address such as IP address to exchange data.
  - Form the differences above, networking devices can be divided into two:
    1. Networking devices
    2. Internetworking devices
  - Similarly, protocols can be divided into **two**
    1. Networking protocols
    2. Internetworking protocols
  - All protocols that are designed to work at level 1 and 2 of OSI model are networking protocols and they can be installed and used in networking devices.
  - Similarly, protocols designed to work from level 3 to 7 are internetworking protocols and can be installed to run on internetworking devices.
  - A device operating at a particular level means it has capability to operate all protocols in the lower levels.
  - **Figure** below classifies the networking and internetworking devices based on the OSI model

OSI	LEVEL OF OPERATION	
7	Gateway	
6		
5		Internetworking devices
4		
3	Router	
2	Switch, Bridge, NIC card	Networking devices
1	Repeater, Hub	

Repeater: Extend the length of a network by receiving weak corrupted signals, regenerating them then sending them to the other part of the network. It works at physical layer

Hub: A hub simply provides connectivity at the physical layer too. It has no packet filtering or data addressing capabilities

Switch: It works at data link layer. It has to know the MAC address of the source and destination of data for effective switching

Bridge: It works at data link layer. It has to know the MAC address of the data in order to perform packet filtering on network segment

NIC card: It works at data link layer too since it has to know and send data to the right MAC address on the network

Router: A router is an internetworking device. It operates at the network layer and runs routing protocols like Internet protocol which enable routing of data beyond the local area network

Gateway: It is the most powerful internetworking device. It operates at all levels of the OSI model and has capability tom perform interprotocol conversion.

OSI LAYERS AND DATA TRANSFER ON NETWORKS

- The ISO OSI model can be used to describe how two devices attached to a network communicate with one another. The following explanation highlight this process:
1. The user creates a message to be sent on the network using an application program running at level 7(application layer) of the OSI model e.g. email application. Immediately the user presses the SEND button, the message is passed to the application layer whose protocols affix an application header (AH) in the message
2. The message is passed down the stack all the way to the physical layer. Each layer affixes its header to the message. The message then I sent bon the network
3. At the receiving end, the message undergoes a reverse process i.e. each layer rips off its header. For example, if the message was encrypted at the presentation layer, it is now decrypted at that layer. As the message goes up the stack, all the headers will be removed until the original message is presented to the receiving user application. The figure below illustrates this process.
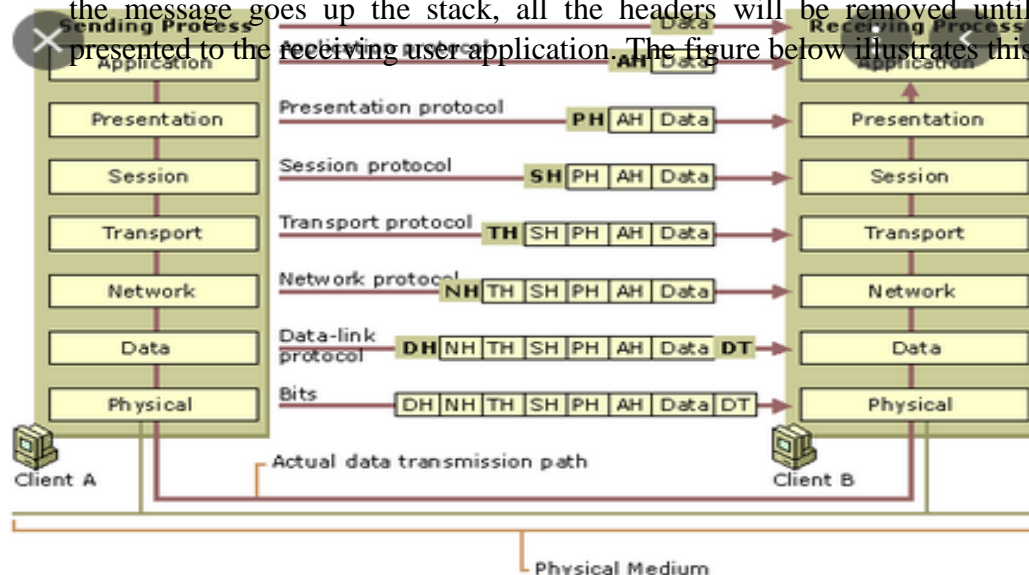
Examples of protocols at each layer of OSI
Level 7: Application layer: Simple Mail Transfer Protocol (SMTP), File Transfer Protocol (FTP)
Level 6: Presentation layer: ASCII/EBCDIC/JPEG/TIF/GIF/MPEG/PKI etc. These protocols format the data ready for transmission
Level 5: Session layer: Remote Procedure Call (RPC), Point to Point Tunneling Protocol (PPTP), OSI Session Layer protocol (OSI-SP), SQL.
Level 4: Transport layer: Transport Control Protocol (TCP), User datagram Protocol (UDP), Sequenced Packet Exchange (SPX)

Level 3: Network layer: Internet Protocol (IP), Internetwork Packet Exchange (IPX), Internet Control Message Protocol (ICMP), Open Shortest Path First (OSPF)

Level 2: Datalink layer: Ethernet, Token Ring, Point to Point Protocol (PPP), Wireless Access Protocol (WAP), Serial Line Internet Protocol (SLIP)

Level 1: Physical layer: No protocol just encoding techniques, bit streaming, transmission technique e.g. baseband or broadband etc

- There are many other protocols at each layer which have not been mentioned here. Below is the brief explanation of the most important protocols at our level

Application protocols work at highest level of the OSI model

1. **SMTP**: The Simple Mail Transfer Protocol is internet standard for electronic mail
2. **FTP**: The File Transfer Protocol enables a person to transfer files on the internet

Transport protocols work at the transport layer

3. **TCP**: The Transport Control Protocol ensures reliable transfer of data from source to destination. It breaks down the data into packets and assigns them with sequence numbers so that the message can be reconstructed at the destination
4. **UDP**: The User Datagram Protocol is unreliable data transfer protocol and is used to transfer non-user data like signals etc.
5. **SPX**: Sequential Packet Exchange (SPX) is part of Novell's internetwork packet exchange/sequential packet exchange (IPX/SPX) for sequential data
6. **NETBEUL**: Initially, we had Network Basic Input Output System (NetBIOS). This was exchanged by IBM to create a local area network protocol which was adopted by Microsoft for its Windows NT platform and renamed NetBIOS Extended User Interface (NetBEUI)

➢ Network protocols provide routing service. They handle addressing and routing information, error checking and retransmission of requests. Some of examples of network layer protocols are:

7. **IP**: Internet protocol does packet forwarding and routing using he addressing system on the internetworks known as IP addresses. Each network on the internet has a unique IP addresses.
8. **OSPF**: The Open Shortest Path First protocol helps in efficient routing of data on internetwork i.e. it analyses all the next available routes or hops and chooses the one with the least cost to transfer the packet.

THE TCP/IP PROTOCOL MODEL

- The model was developed in 1978 long before OSI reference model
- It was developed to enable internetworking on the internet
- It combines the Transport Control Protocol (TCP) and Internet protocol (IP)into one.
- Its layered structure is similar to OSI only that it has four layers instead of seven.
- TCP/IP has the following structure:
   1. The application layer
   2. The transport layer
   3. The internet layer
   4. The network interface layer
- Note that TCP/IP does not have presentation, session and data link layers like OSI model
- The function of the missing OSI layers have been amalgamated in the four layers of TCP/IP

ISO OSI	TCP/IP	TCP/IP protocols			
Application	Application layer	SMTP	FTP	TELNET	
Presentation layer					
Session layer					
Transport layer	Transport layer	TCP UDP			

Network layer	Internet layer	IP IDMP etc.
Data link layer	Network interface layer	Ethernet, Token Ring etc.
Physical layer		

Comparing OSI model and TCP/IP protocols
Similarities
1. They have similar architecture i.e. they both have layered design
2. They share a common application layer
3. The network layer in OSI and internet layer of TCP/IP perform same functions
4. Both model support packet switching and routing on networks

Differences
1. OSI has seven layers while TCP/IP has four layers
2. The session layer, presentation layer and data link layers present in OSI are missing in TCP/IP although they are amalgamated in the four somehow

THE INTERNET AND INTRANET
- As discussed earlier on, the internet is a global network of computer networks interconnected using TCP/IP protocols while the intranet on the other hand is a restricted network belonging to an organization or agency interconnected using TCP/IP protocol

Differences between internet and intranet

1. Internet is accessible to every user worldwide while intranet is specific to few computers within an organization
2. Internet has a wide access and provide a better access to website to a large population while intranet provide a better access to website to a small population
3. Intranet is safe because it can be privatized as per need while internet cannot be privatized so is not safe

However, internet and intranet have the following similarities

1. They both use internet protocols such as TCP/IP
2. Thy are both accessible via web browsers
3. Both can use instant messaging such as yahoo messengers or google talk

Methods of Internet Access

- The internet can be accessed in various ways using phones, laptops, computer, tablets etc.
- The internet is accessed using a special software called browser.
- The following methods are used to access internet

1. Connecting via telephone lines
- The physical telephone line has been the most widely used method of connecting a network or computer to the internet. This is done using the following two ways:
  a. *Dial up connections*: This used analog telephone line. A modem (modulation – demodulation) was placed between the computer and the line. When the computer wants to send data, the modulator enveloped the digital signal in an analog carrier, a process called modulation. At the receiving side, another modem removes the envelop or analog carrier wave, a process called demodulation.

Dial-up Internet Connection
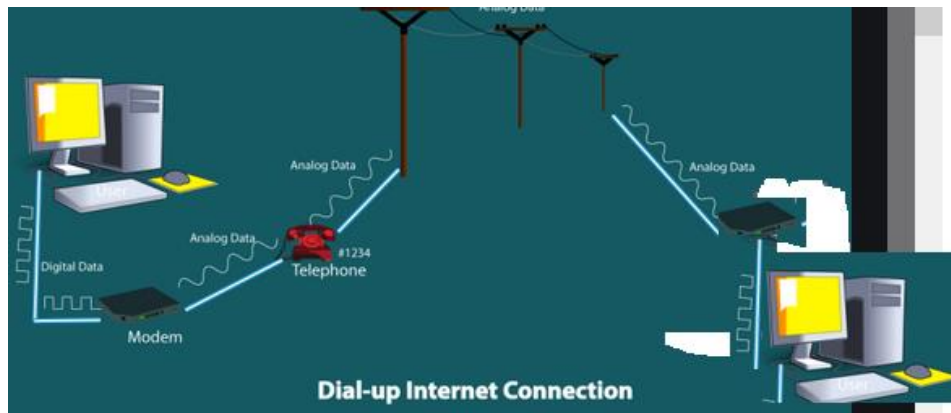
b. *Digital leased lines*: Since the line is digital, no need for a modem but just a codec to control how bits are sent/received by the computer. The connection is always up, no need to dial up for connection.

2. Connecting via mobile telephone networks
- The mobile network is capable of carrying both voice and data
- People are able to access internet via their mobile phone.
- There are currently **two** types of mobile networks

i. Global System for Mobile Communication (GSM)
-GSM networks have been evolving over time starting with 1st generation, 2nd, 3rd to currently to 4th generation. (Global System for Mobile communication) is a standard that forms the basis for 2G. GSM mobile phones are divided into a handset and a removable **SIM** (Subscriber Identity Module) card. SIM contain all the information about the user of it. You can fix this remove able SIM in another handset to activate it using the same identity.

GENERATION	TECHNOLOGY	INDICATIVE SPEED
2G	General Packet Radio Service (GPRS)	71 kbits/s
2.5G	Enhanced Data rates for GSM Evolution (EDGE)	384 kbits/s
3G	Universal Mobile Telecomm. System (UMTS)	2 Mbits/s
3.5G	High Speed Downlink Packet Access (HSDPA)	10 mbits/s
4G	Long term evolution	299 mbits/s

NB: speed indicated here are design speeds, actual may vary depending on other factors

ii. Code Division Multiple Access (CDMA) network
- This has also evolved through stages too and the highest speed on 3G is known as Evolution Data (EV DO) with speed up to 2 mbits/s'
- **CDMA** (Code Division Multiple Access) is a technology that forms the basis of 3G mobile phones. In CDMA there is no removable SIM. The entire information about the user and the account is stored in the internal memory of the device or handset

- **Figure** below shows some examples of wireless modems that can be used on computers to access the internet. A SIM card is installed in the devices.

Key Differences Between GSM and CDMA

a) The basic difference between GSM and CDMA is that the GSM is a SIM specific (i.e. a mobile phone is identified in the network by the removable SIM inserted in that phone) while CDMA is handset specific (i.e. the network identifies a handset by the information stored in the internal memory and hence.
b) The technology used in GSM to identify multiple callers in a channel is TDM and FDM. On the other hand, the in CDMA, multiple callers in a channel is separated by the code (CDM).
c) The network tower serves all the mobile phone in a network cell in GSM. While in CDMA there is a physical channel and a dedicated code for each cell in the network.
d) In GSM voice and data can be transmitted simultaneously whereas, CDMA can not
e) GSM roaming is worldwide while CDMA roaming is limited

3. Accessing the internet via fiber links
- One of the latest and fastest methods of accessing the internet is via fiber optic cables
- A subscriber simply applies to a service provider who comes and connect his/her premise to the fiber network
- Although the initial expenses are high, the long run costs are cheaper

4.Wireless access using WiMax and Wi-Fi
WiMaX
- WiMax stands for Worldwide Interoperability for Microwave.
- Small microwave transceivers are used to transmit and receive data signals both at the service providers end and the customer across distances up to 30-50km
- Figure below shows a sample of WiMax transceiver

Wi-Fi

- Wi-Fi on the other hand is a wireless radio technology that is used to provide access to the internet for computers and mobile devices like smartphones and tablets that have internal wireless modem
- The access is usually via the wireless access point which create a radius of access called Wi-Fi hotspot that covers a small radius like a bus, hall, airport etc.
- Wi-Fi that have Wi-Fi activated automatically detect and connect to Wi-Fi hotspot hence to the internet whenever they are within range.
- Figure below depict Wi-Fi hotspot

ADDRESSING SYSTEM ON COMPUTER NETWORK

> - All networks that are connected to the internet have a unique network number called *IP number*.
> - As a rule, every organization that has a network that is connected to the internet is allocated only one IP address

Difference between IP address and MAC address

1. MAC address is a hardware address used to identify a device on the network while IP address is used to identify a device on the internet
2. MAC address works at data link layer while IP address works at network layer
3. MAC address support hardware implementation of the network stack while IP address support software implementation on the internet
4. MAC address remains fixed and follows the network device while IP address changes as the network device moves from one network to another.
5. MAC address is assigned by the manufacturer of the device while IP address is assigned by the technician when configuring internet

- There are **two** types of IP addresses
    1. IP version 4 (IPv4)
    2. IP version 6 (IPv6)

IPv4

- This is the most common IP addressing system because it was the first to be created and adopted widely.
- Each address is made up of 32 bits. Period (.) separate the bits into groups of 8.
- Each group of 8 bits can be converted to its decimal equivalent to create a *dotted notation* that is easy to read.
- The internet address has two level structure
    1. The *network number* or *prefix*: which is the first part of the address and is unique worldwide
    2. The *host number* on the local network

There is also a *broadcast address* within the address which is used send data to all host in the network.

- Figure below shows the structure of the IP address

Network Number	Host umber

OR

Network Prefix	Host Number

Structure of an IP address

CLASSFUL IP ADDRESSING

> - Internet addresses can be divided into classes.
> - Designers of these addresses decided that for easier identification and routing, the length of a network number can be varied to differentiate them into classes.
> - Therefore, depending on the number of bits used for the network ID and the host number, the address can be classified either class A, B, C, D and E

Class A

- In class A, the first bit (highest order bit) of the address is set to 0 and network number is made up of the first 8 bits.

- This means that 24 bits are used to identify hosts on the internet.

Class B

- In class B, the first two bits start with 10
- The network number is made up of the first 16 bits and the host number is also made up of 6 bits

Class C

- In class C, the first three highest bits start with 110
- The network number is made of 24 bits and the host number is made up of 8 bits
- Figures below depicts the classes

Class A
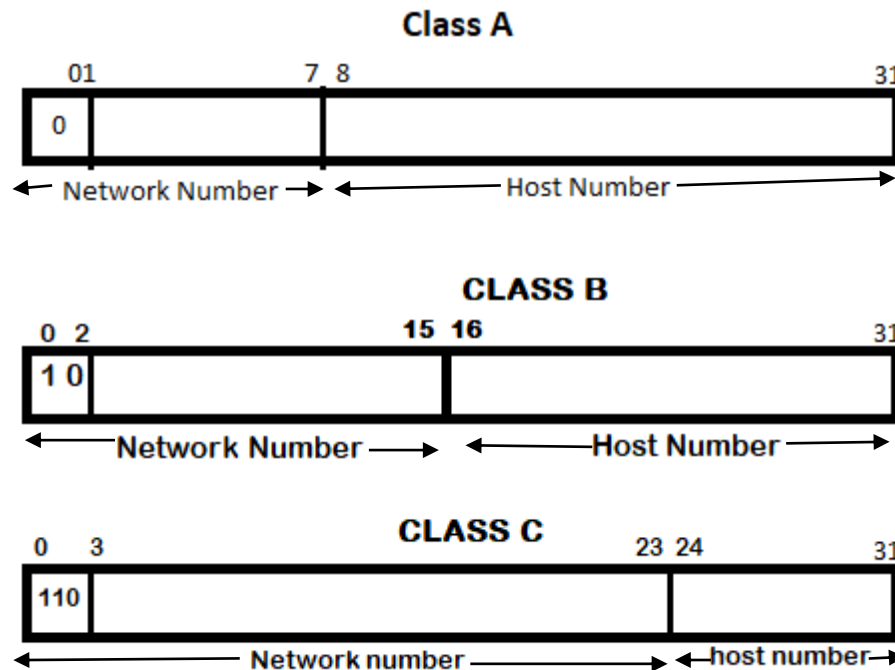
CLASS B

CLASS C

- These first three classes are called *primary classes* and are the ones in commercial use all over.
- Class D has its first four bits set as 1110 and is reserved for *IP multicasting*
- Class E has the first 5 bits set as 11111 and is reserved for *research purpose*

Interpreting IP numbers

- The lowest IP address therefor, is
- Binary notation 00000000.00000000.00000000.00000000
- Decimal notation   0 .   0   . 0   .   0

And therefore the highest would be

Binary notation   11111111.1111111.11111111.11111111

Decimal notation   255 .   255   .   255   .   255

i.e. between 00000000 and 11111111 there are 256 numbers or $2^n = 2^8 = 256$. We wrote 255 in the decimal notation because we are counting from 0 i.e. when you count from 0, it becomes $2^n - 1 = 255$.

 The all zeros and ones host addresses are reserved and never given out

- Number of networks and number of hosts per class can be calculated using this formula
    Number of network $= 2^{\text{network bits}}$
    Number of hosts $= 2^{\text{hosts bits}} - 2$

- As said earlier on, when calculating hosts IP addresses, 2 IP addresses are decreased because they cannot be assigned to hosts i.e. the first IP of a network is a network number and the last IP is reserved for Broadcast

-For example

  ➢ 192.168.1.0   is a network address
  ➢ 192.168.1.255   is broadcast address
  ➢ 192.168.1.2 – 254   are host addresses

✓ **Class A** addresses are assigned to networks with very large number of host. The first bit of the first octet is set to **0** and therefore, the first octet ranges from 1-127 i.e

$$00000000 – 01111111$$
$$1 - 127$$

✓ So the class A IP addresses starts from 1.x.x.x to 126.x.x.x, the default subnet mask is 127.x.x.x

❖ **Class B** addresses are assigned to medium to large-sized networks
❖ An IP address which belongs to class **B** has the first two bits in the first octet set to **10** i.e:

$$10000000 – 10111111$$
$$128 – 191$$

Therefore, *class B* IP addresses range from 128.0.x.x to 191.255.x.x, the default subnet mask is 255.255.x.x

➕ Class C addresses are assigned for small networks. The first bit of the first octet is set to **110** i.e:

$$11000000 – 11011111$$
$$192 – 223$$

Therefore, the IP addresses for class C range from 192.0.0.x to 223.255.255.x. the default subnet mask is 255.255.255.x

Therefore

Class A has   **number of networks = 2^{8bits} = 256**
            Number of Hosts = $2^{24\ bits}$ -2=

Class B has   **Number of networks = 2^{16} =**
            Number of Hosts = $2^{16} – 2$ =

Class C has   Number of networks $2^{24\ bits}$ =
      Number of Hosts 2^{8bits} -2=

Summary of IP in Binary

CLASS	FIRST OCTET
Class A	0
Class B	10
Class C	110
Class D	1110
Class E	1111

Summary of IP in Decimal Notation

CLASS	FIRST OCTET
Class A	0 to 127
Class B	128 to 191

Class C	192 to 223
Class D	224 to 239
Class E	240 to 255

For example,

> 128.8.74.1 is a class B

> 10.10.191.1 is class A

> 202.3.2.56 is a class C

Excise

Name the class of each of the following IP addresses:

a. 227.12.14.0
b. 193.15.45.22
c. 17.13.130.7
d. 253.5.15.111
e. 132.11.78.56

IP space Exhaustion Problem

- We have calculated that classful addressing has limited number of unique network numbers that could be generated i.e. $2^{32} = 4, 294, 967, 296$
1. Initially, it was apparent that this number of networks could exist but as the internet grew, all this space nearest exhausted and it became difficult to register a new network on the internet. As such, **two** new addressing system was developed i.e. Classless addressing and IPv6
2. In classful addressing system, small organizations were allocated class C because it has host number 8 bits which is 2^8-2, large organization were allocated class B which has 16 bits for host i.e. 2^{16} - 2 and very large organization were allocated class A which has 24 bits for host i.e. 2^{24}. Assuming an organization has **300** hosts that means it should be allocated class B, but more hosts will be wasted, so need for classless addressing system.

Classless IP addressing system

- Classless IP addressing is also called Classless Inter-Domain Routing (CIDR)
- In this addressing system, instead of having fixed boundaries between the octets, IP address can be assigned with the boundary of the network number and host number placed anywhere within the 32bits address
- Routers can be told where the network number end by including a slash (/) at the end of the IP address
- For example, 98.168.100.0/24 means the network is 24 bits and therefore, the host is 8 bits. The following gives more examples:

Address	Number of addresses per IP
192.168.10.0/24	$2^8 = 255$
192.168.10.0/22	$2^{10} = 1024$
192.168.10.0/20	$2^{12} =$
192.168.10.0/19	$2^{13} =$
192.168.10.0/18	$2^{14} =$

Difference between classful and classless addressing

1. In classful addressing, there is strict addressing layout specifications for the network number and host number for various classes while in classless, this is not so and the number of bits used for the network number and host number for an address varies according to the size of the network.
2. In classful addressing, the class of the address determines the number of bits for the network number and host number while in classless, we use front slash forward by number of bits that represent the network number e.g. /8, /24, /16 etc.
3. Classful addressing brings order in the way network numbers are allocated. Classless addressing is not as orderly because network and host bits can take an arbitrary number depending on the size of the network hence increasing routing cost.

IP version 6 (IPv6)

- This is the new generation internet addressing system architecture designed to succeed IPv4.
- It uses 128 bits addresses, so has very big space of 2^{128}
- The IPv6 address consists of 8 groups of hexadecimal digits ranging from 0-F separated by a colon for example:
  2002:2c0:2001:2:213:123:249:22
- Only leading zeros are omitted, trailing ones are not. The above address is actually
  2002:02c0:2001:0002:0213:0123:0249:0022

IPv6 address has the following characteristics
1. It uses 16 bit hexadecimal numbers
2. Numbers are separated by full colons (:)
3. Abbreviations are possible e.g. leading zeros in contiguous blocks are separated by double colons(::) e.g.
   2002:2c0:0000:0000:2:3c:3b:33 is equivalent to
   2002:2c0::2:3c:3b:33

Specifying the network and host number

- We use CIDR prefix representation i.e. a slash followed by the length of the network number written after the IPv6 umber e.g.
  2002:db6:12::/48 means the first **48** bits are for network number and therefore **80** bits are for host number. The last two colons (::) here indicates that all remaining numbers are zeroes.

Comparison between IPv4 and IPv6

1. IPv6 address consists of 128 bits while IPv4 has 32 bits
2. We use decimal notation to write IPv4 addresses and IPv6 uses hexadecimal numbers
3. IPv6 separates the hexadecimals using colons (:) while IPv4 separates the decimals using dots(.)
4. IPv6 was designed with modern internet and gargets technology in mind hence it is more flexible and extensible i.e. it caters for wired and wireless
5. IPv6 has a lot more usable space than IPv4

IP configuration on Networks

- After the computer has been connected to the internet using transmission media, it still needs to be configured in order for it to be able to communicate with other computers on the local area network and access internet
- On windows 7 computer, this is done on Network Sharing Center
- Follow the procedure below:
1. Open Control Panel

2. Click Network and Sharing Center (NSC) link
3. In the NSC dialog box, you see all the available connections for which you can configure their IP
4. On the left pane, click the Change Adapter settings link to view all available network connection whether active or not
5. Right-click the one you wish to configure then select properties command
6. In the dialog box that appear, click on Internet protocol version 4 (TCP/IPv4) and then click Properties button then click Use the following IP address option
7. Enter the IP address and the one for default Gateway

TOPIC 4: NETWORK APPLICATIONS

INTERNET AND WORLD WIDE WEB

➢ Internet refers to a global interconnection of computer networks for the purpose of communication and sharing of resources.
➢ On the other hand, World Wide Web (WWW) refers to interlinked *hypertext* documents also known as websites that are accessed using a special software called web browser.
➢ The term web in WWW is adapted from spider to refer to this interlinking of documents.
➢ The term web is a set of related *hypertext* documents on the web that contain information such as images and videos.

WEB BROWSER

➢ To view and navigate webpages and other information on the World Wide Web, a special software known as a browser is used.
➢ With a browser, one can view information on the internet which contains text, images, videos and navigate between other documents using hyperlinks.
➢ Examples of browsers are: Apple Safari, Google Chrome, Internet Explorer, Monzilla Firefox, Opera etc.
➢ The main purpose of a web browser is to connect to web servers, request web pages, and then properly format and display the documents.
➢ Each web document file is written in a language called Hypertext Markup Language (HTPM) that include text, description of the page structure, and links to other pages, images or media.
➢ **Figure** below shows a sample of a web browser known as Monzilla Firefox
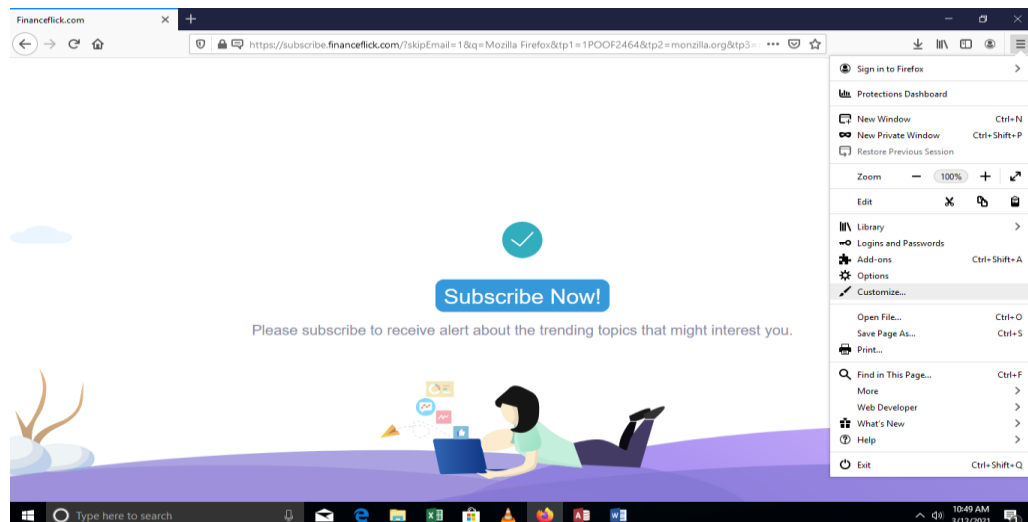
Hypertext document

➢ The term hypertext document refers to a web page that has links to the same or other pages on the web.
➢ By clicking on a link, a user is taken by the browser from the current page to other page
➢ Hypertext is structured in a way that it allows you to navigate from one page to another instead of reading in a linear way like a book.
➢ To organize hypertext document for easy access, the webpage has a unique address called Uniform Resource Locator (URL)
➢ For example, when you visit the site such as Google, you type URL written as http://www.google.co.
➢ A URL consist of three parts namely

1. Protocol: which indicate how to get information such as *http*
2. The internet hostname of the computer where the content is stored such as *google.com*
3. The directory or other locations on that site where the content is located that follows the forward slash

SEARCH ENGINES

➢ A search engine is a special site on the web that help users easily find information stored on other websites.
➢ Examples of search engines are:

- Google (www.google.com)
- Yahoo (http://search.yahoo.com)
- Lycos (http://www.lycos.com)
- Bing (www.bing.com)
- Alta vista
- Excite

➢ **Figure** below shows an example of a search engine called Google
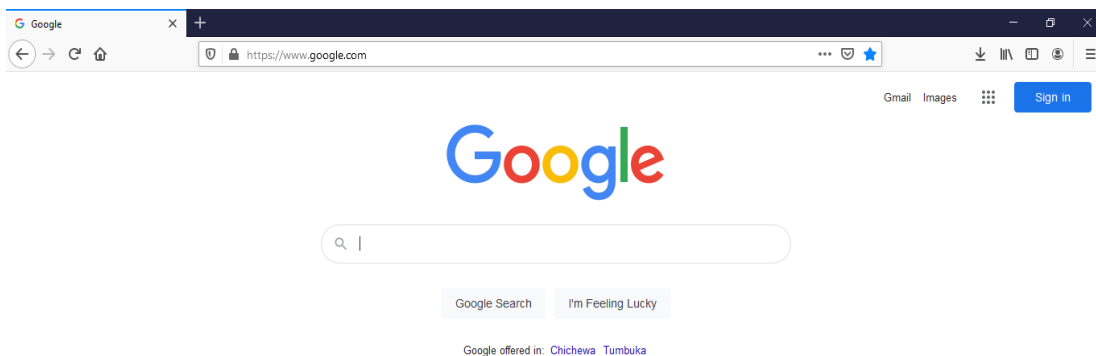
Using search engine

- As said earlier on, search engine helps internet users to search for information on the internet. Follow the steps below to search for a word
➢ Identify a search engine
➢ Enter the keyword in the search box
➢ Use quotation marks to identify the keyword
➢ From the displayed search results, identify the site that contains the information you want.

How search engine works?

➢ Search engine normally consists of three components namely
  1. Web robot or crawler
  2. Indexing database (engine)

3. Query engine
➢ The three components operate as follows:
1. Before the user invoke a search engine, a program called spider searches for new items on the web to add to the search engine index database as shown in figure below. This gathering of information before user's request make search faster.

How do Search Engines work
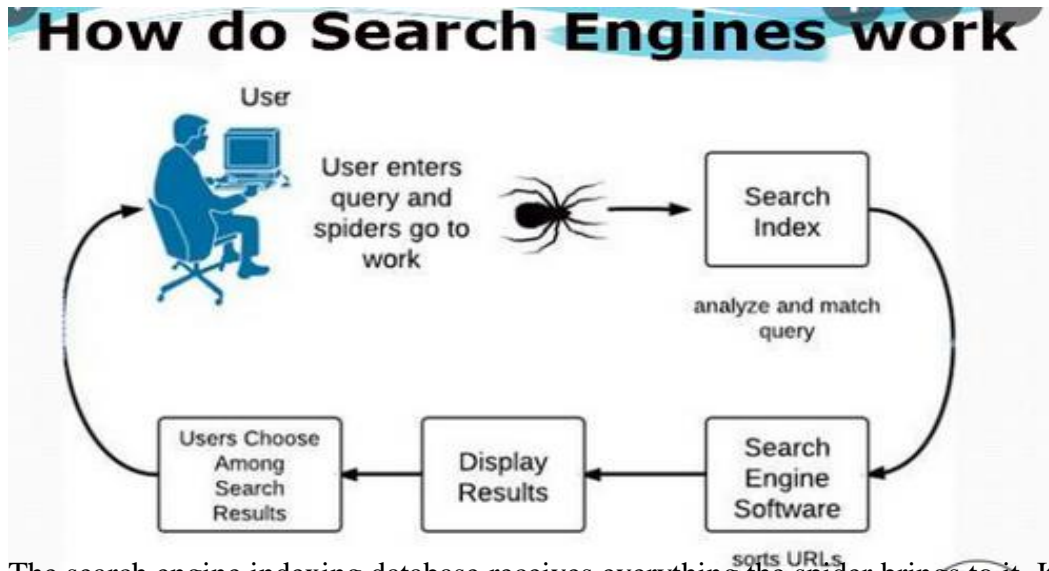
2. The search engine indexing database receives everything the spider brings to it. It scans the document for keywords and generate the indexes and then store them in an index database.
3. Once the user submits the search string (a word or phrase), the query engine receives the indexing database and process the request as follows
   - Looks the keywords specified in the user queries form the index database
   - Retrieves associated documents and rank them according to some preferences or criteria such as the most visited pages
4. The result and time taken to search for the request are displayed on the browser. If the result did not match required information, the user can refine the search words.

In summary, you need to know the meaning of the following terms and how they apply to web design

- **Website:** a collection of more webpages linked together in a meaningful way that, as a whole, describes a body of information
- **Search engine:** Special type of website that help users easily search information from other websites.
- **Web server:** A computer on internet or intranet that delivers web pages and other files in response to browser requests.
- **Web page:** Like in a book, a web page is a single document on a website containing text and any other items that are displayed within that page.
- **Home page:** The first page also known as index for a website that is loaded form which you can navigate to other pages on the same or another websites

INTERNET SERVICES

- Internet has become very popular nowadays because of the very important services that it offers to people.
- Users become addicted whenever they start using internet. Internet offers the following services:
1. **World Wide Web**

- This is a vast virtual space on the internet where information is made available. This information is made available on
  - *A website*: Is a group of related web pages or other resources located on the web server. The first page on a website is called a home page
  - *Web portals*: provide specialized services such as searching, e-mail, sports updates, financial, news and links to select website
  - *Blog*: Website that contains personal information which can be easily updated. It may be used for business, advocacy and complain
  - *Multimedia*: Sites that are meant for entertainment. It contains photos, movies, music, web TV and internet radio.

2. **Electronic mail and fax**
- An electronic mail simply refers to e-mail is a message transmitted electronically on the internet.
- What you need to send and receive e-mail is to open an e-mail account
- Other than sending e-mail, you can also use your computer to send fax messages in place of using ordinary fax machine.

3. **Instant messaging.**
- This is a messaging service that allows two or more people to communicate directly.
- To get the service, you need to first register with an instant messenger such as WhatsApp, Google+, Facebook, Yahoo Messenger, Twitter etc

4. **Electronic commerce (e-commerce)**
- This is buying and selling of goods and services on the internet.
- Companies or individuals develop websites to auction their goods and services
- **The advantages of this is that**
  - It reduces operation cost (i.e. travel expenses to meet customers or customers to meet sellers)
  - It also increases sales because you reach many customers worldwide
- **However, the disadvantage is that**
  - People deal with each other without ever meeting
  - Again there is lack of proper laws to govern the business

5. **Electronic learning (E-learning)**
- In e-learning, teaching and learning as well as learning materials and lecturers are made available over the internet.

6. **Newsgroups**
- These are organized groups of internet users who wish to share ideas and interests. Once you join the newsgroup, you can participate in the discussion forums and debates.

Browsing on the WEB

- To browse also called surfing is to explore or navigate from one website to another

Format of the web address

- The web address also referred to as Uniform Resource Locator (URL) general format is *protocol://domain-name.topleveldomain*. for example, to visit government website type http://www.malawi.gov.mw in the URL box.
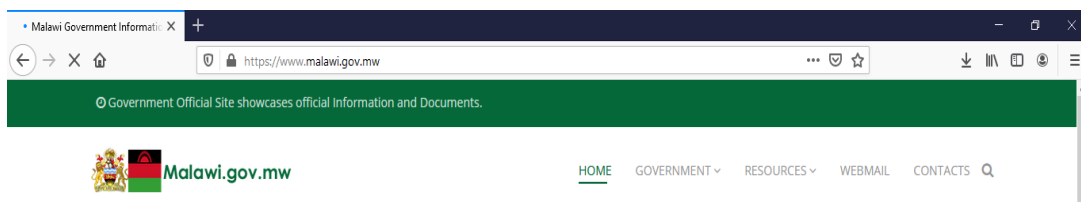
- ▪ **Protocol**: this is the rule that define how to access the content used to connect to the site or resource. **Two** common examples are:
    1. Hypertext Transfer Protocol (http://): That define standard for accessing website
    2. File Transfer Protocol (ftp://): Is used for uploading content to the webserver.
- ▪ **Domain name:** This is the name of the server where the website or resource is located. For example www.malawi is a domain name or website name located in www directory
- ▪ **Top level domain:** This represent the type of service offered by the organization. For example, .gov.mw means that a government located in Malawi. The following highlights other commonly used top level domains:

| Top level	Type
.edu	Education institution
.org	Non-profit making organization
.mil	Military organization
.com	Commercial institution
.net	An organization providing network services
.ac	An academic institution

- The top level domain may also have two letters extension added after the business domain part to indicate the country in which the business or the site is located e.g. upicasm@gmail.co.mw. This part *mw* stands for Malawi
- Other domain name could be
    - ❖ sa (South Africa)
    - ❖ ke (Kenys)
    - ❖ uk (United Kingdom)
    - ❖ us (United States)
    - ❖ ug (Uganda)
    - ❖ tz (Tanzania)
    - ❖ jp (Japan)
    - ❖ au (Australia)

Hyperlinks

- hyperlinks or links are used to navigate from one page to another. To navigate from current page to another, proceed as follows:
1. move the mouse pointer to the hyperlink until it turns to pointing finger
2. click the hyperlink once. The browser will take you to the specified page

Navigation toolbars

- The navigation toolbar consists of buttons you can easily navigate the web in Monzilla Firefox. These include Back, Forward, refresh, home, search and stop
- Figure below shows navigation toolbar
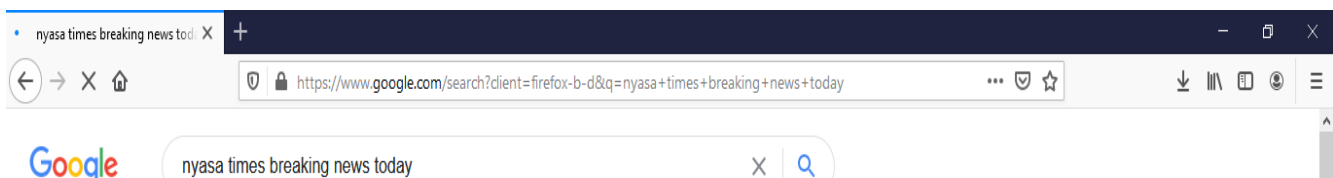
The list below highlights the function of each button on the navigation toolbar

1. *Back button*: Takes the user to the previous visited web page

2. ***Forward button***: Takes the user to visited pages after the current incase the user clicked the back button
3. ***Stop button***: Is used to stop loading the current web page
4. ***Refresh button***: This is used to reload or refresh a web page
5. ***Search box***: Where the search word is typed
6. ***Bookmarks***: Used to bookmark the page to be revisited later
7. **History**: This icon is displayed on the list of recently visited web pages
8. ***Download***: This icon is used to download the current web page
9. ***Home*** icon: The icon takes the user to the home page of the website
10. ***Menu*** icon: Clicking on this displays the main menu

Bookmarking the web page

- A bookmark is a link to a website address saved in a browser to facilitate quick access later. You can bookmark pages that are likely visited by adding them to bookmark list
- To bookmark a site
1. Identify or load the web page you would like to revisit
2. Click bookmark icon on the navigation toolbar that resemble a star
3. Use the suggested name or type a new name in the box.
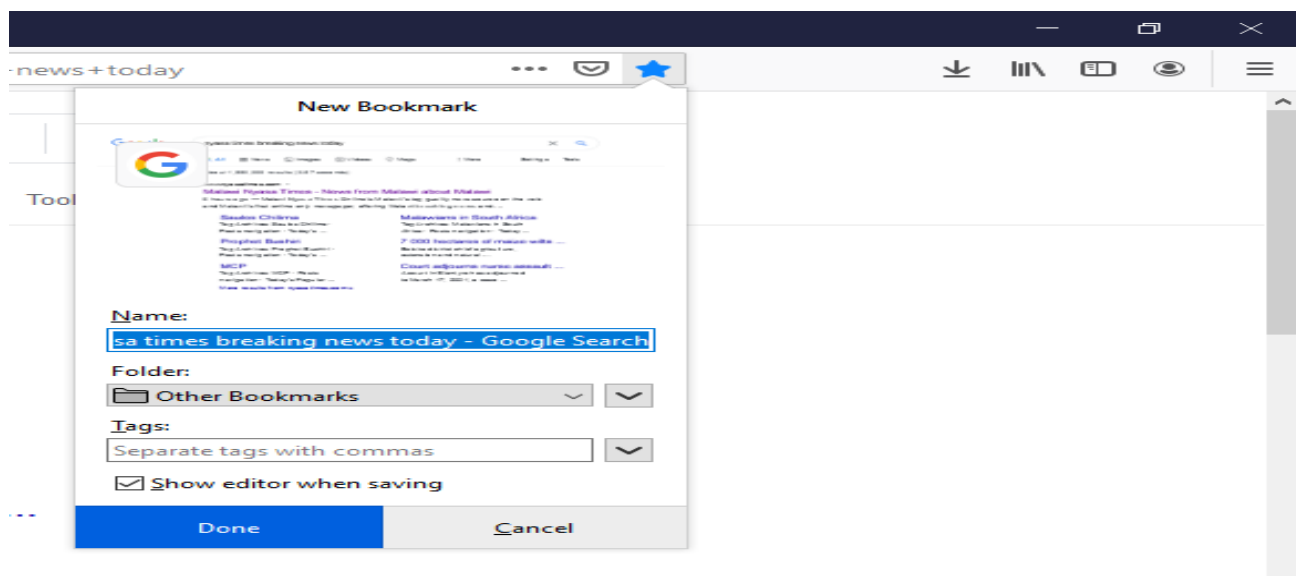
To view the bookmarks

1. Click the icon that resembles a clipboard on the navigation toolbar or press ctrl + Shift + B
2. On the pop-up list displayed, select the bookmark you wish to revisit
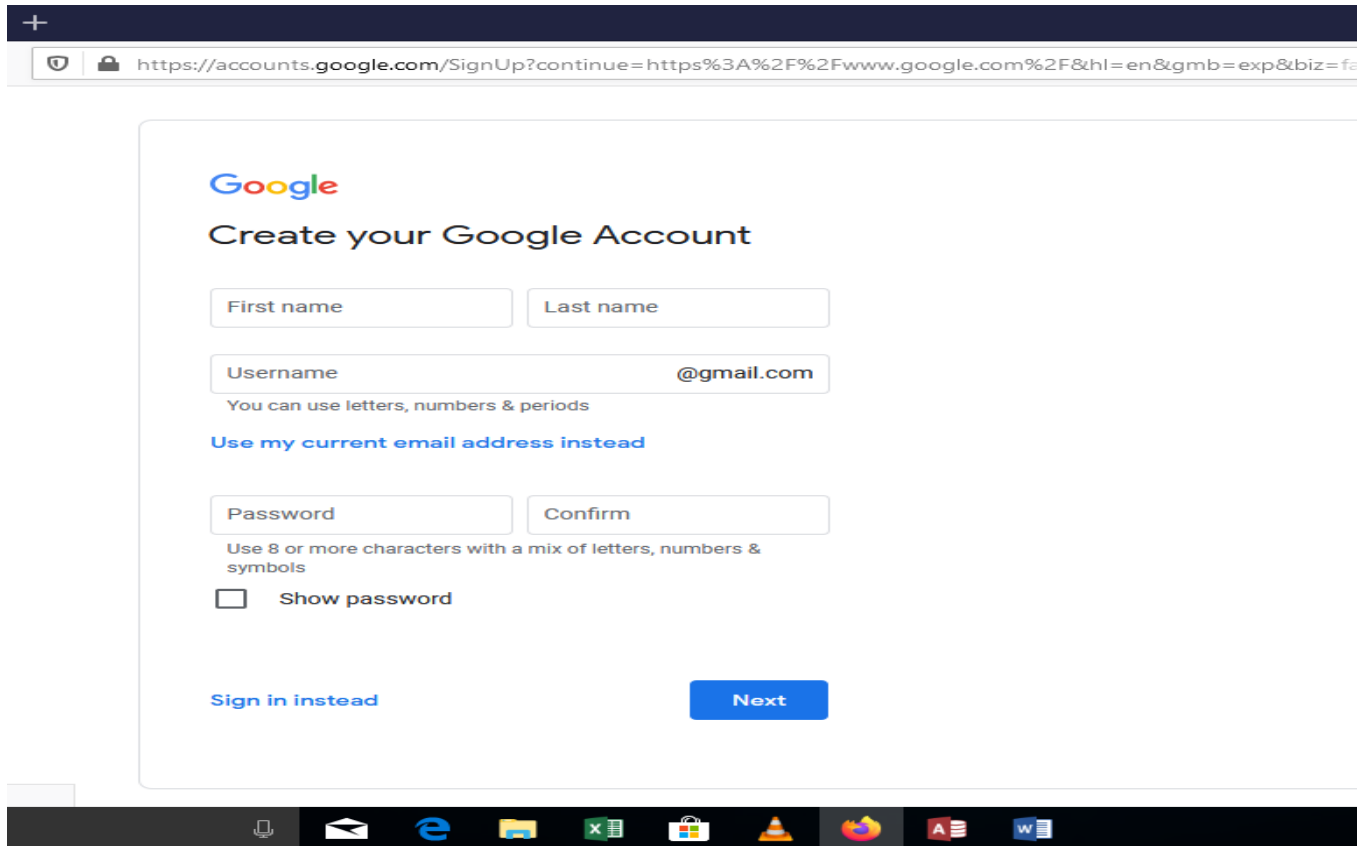
Printing the web page

1. Click File then Print
2. Set desired print properties
3. Click OK

Electronic mail (e-mail)

- To create, send and receive e-mail, an email software such as Outlook Express, Yahoo mail, Gmail, Hotmail or Eudora are required.
- To use e-mail, you need to create account with this software (Gmail, Yahoo, Hotmail etc)

Creating a new e-mail

- To create e-mail account such as Google mail, Yahoo and Hotmail requires some information about you e.g. first name, last name, date of birth and username.
- For example, to create e-mail account using Gmail, proceed as follows:
1. Launch a preferred internet browser and go to Google home by typing http://www.google.com
2. Click sign-up displayed at the top right corner or click Create account
3. In the page that appears enter your first name, last name, date of birth, gender and country and username as well as password

4. Sometimes you are provided with what is called CAPTCHA which ask you to enter letters written on it in order to prove that you are not a robot
5. Choose location and click "I agree to the terms of service"
6. In the page that appears, you may create a public profile
7. Click Continue to Gmail to proceed to your Gmail account inbox and other folders
8. Once in Gmail, you can set other option like adding photos etc.

Checking for E-mail

- To open am e-mail I Gmail
1. Load the e-mail hope page by typing www.gmail.com
2. In the login page, enter username and password
3. Click sign-in

e-mail address format

- Just like a normal postal address, an e-mail address determines the destination of an email.
- A typical email address would look like **ireenmakuwa@gmail**.com where:
1. **ireenmakuwa** is the name of the e-mail account
2. @ symbol separates the account name and the domain name
3. **Gmail.com** is the server where the email account is hosted

4. The period **"."** Is read as dot and used to separate different parts of the e-mail address
5. **Com** identifies the type of nature of business of email service provider

Creating a new e-mail message

- The standard format of an e-mail message comprises of **three** basic parts namely header information, message body and signature
- **Figure** below shows a sample of gmail account
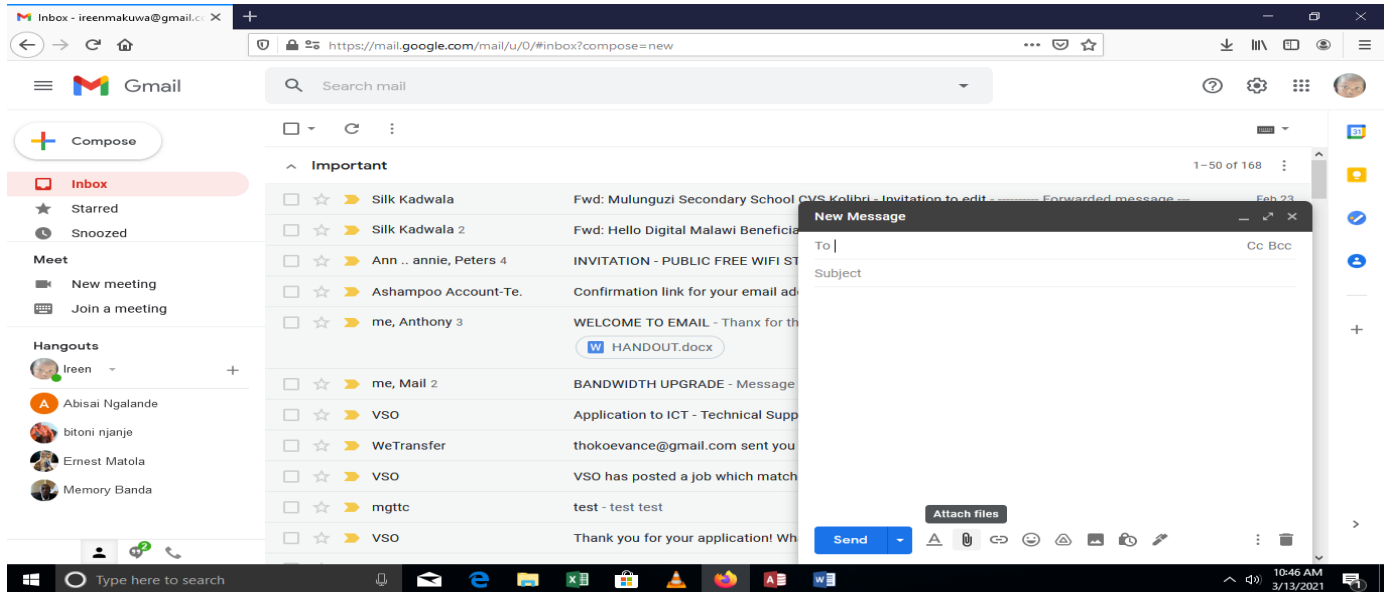
1. **Header information**: The header is made up of the following sections
   - *Address*: That's where you enter e-mail address of one or more recipients
   - *Subject*: You specify the title of the message
   - *Attachment*: You can add files such as documents, photos and videos to be sent
2. **Message body**: This is where you type the message you want to sent
3. **Signature**: The signature provides additional information about the sender as full name, address and telephone number
- **To compose an email, either in yahoo, Gmail or Outlook, proceed as follows**:
   1. Click New/Compose e-mail button
   2. Type the recipient address or get it from address book
   3. Type the subject of the message
   4. Type in the message body
   5. Click Send button

Inserting file attachments
- You can attach a file to the e-mail to be sent. The file could be picture, video or text and should not be bigger than **25MB**
- To attach such files, proceed as follows:
1. Click the **Attach File** at the bottom that resembles a paper clip
2. Select the file from your computer (if there are more files, press ctrl key as you are selecting)
3. Click Open button to attach the selected files. The attached file will appear at the bottom of the composed e-mail as shown below:
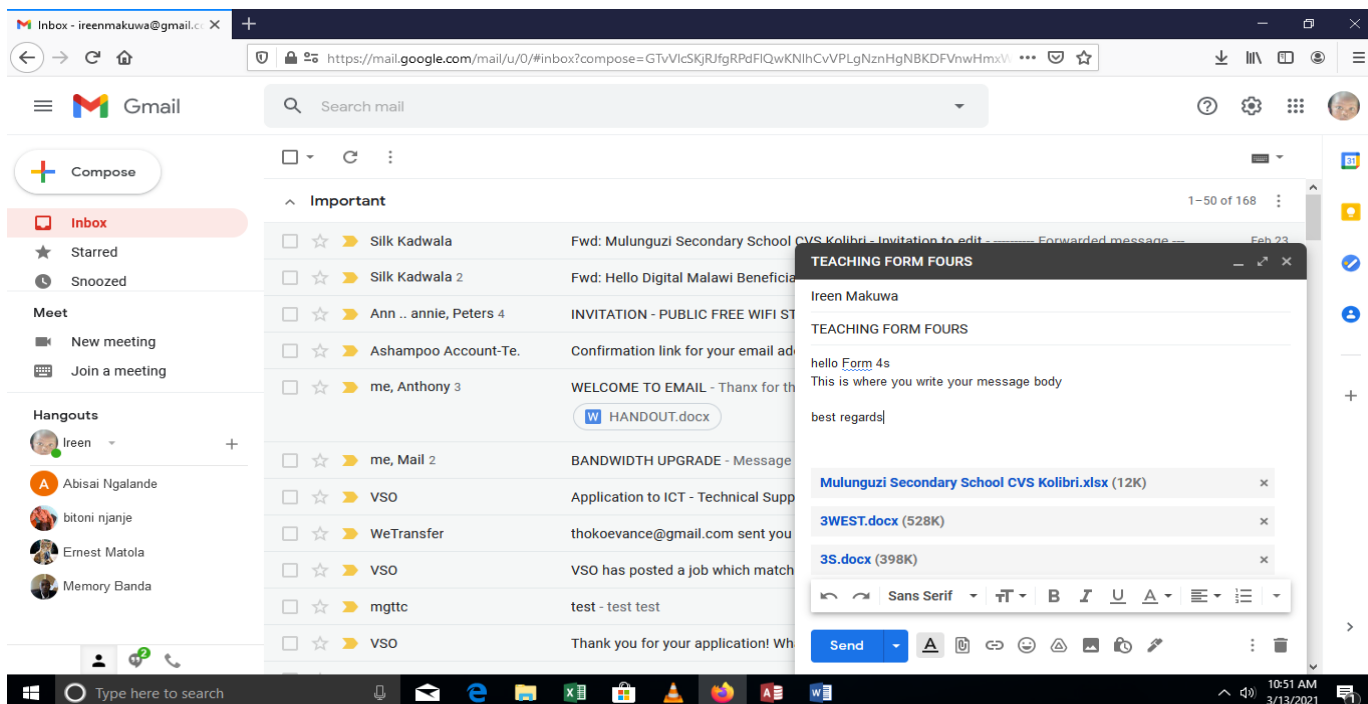
Managing contacts

- To avoid typing errors when entering e-mail addresses, add the contacts in the address book. To do this, proceed as follows
1. Switch to inbox and point to e-mail address you would like to add contact. A pop up appears such as the one below:
2. Click Add to contacts link
3. To change the contact, click the link immediately displayed to view contact details

SOCIAL NETWORKING

- There are **two** terms used in reference to social networking. These are:
  1. Social media
  2. Social networks
- Social media refers to content that you upload onto social network sites. The media content may be in form of text, videos, photos or slideshows that people can respond and comment on.
- On the other hand, Social networks are web-based sites that allow individuals to create a public profile to share information with people they share interest, activities etc. some examples of social networks are Facebook, Twitter, Linkedln, WhatsApp, Flicker, Google+, Myspace and Mxit. It has the icons below

- Therefore, social networking refers to creating social relationships to interact with other people on social networks by uploading media contents
- To interact with people, you upload pictures, texts photos and videos. Some social networks allow users to create groups to share common interests or affiliations, stream live videos and setup geosocial forums. Social networking has transformed the globe into social village

Significance of social networking

- Social networking has both advantages and disadvantages

Advantages of social networking

1. *Global connection*: Social networking helps people make new friends and stay in touch globally
2. *Marketing*: Social networking can be used to help advertise goods and services
3. *Technology use*: Social networking uses accessible technologies such as mobile phones that make it possible to motivate people towards using other ICT devices such as computers and services such as internet
4. *Social cohesion*: Social networking can be used to keep in touch with the family members in a fractured society where physical meeting may not be possible due to risks or limited infrastructure. People interact using videos and live charts.
5. *Career opportunities and employment*: Social networking can be a powerful engine for job searches.
6. *Political power*: Social networking can leverage political groups that might not otherwise have access. An example is US president Barack Obama who beat his rivals by capitalizing on use of social networks
7. *Security*: Social networking can be used to counteract terrorism and organize criminals. Security detective can sniff into media content to isolate cases of terrorism and organized crimes.
8. *Health and wellbeing*: Social networking ca be used to get help of difficult personal by tabling it into a public wall to solicit for support from friends.

Disadvantages of social networking

1. *Threat to productivity*: Social networking can be a big waste of time that has even causes job losses due to low productivity in a workplace. Some people become more addicted to social network which waste their time to do other important work.
2. *Face-to-face connection endangered*: Social networking has potentially reduced need for physical social interaction by creating a virtual society that isolate people from their physical meeting.
3. *Cyberbullying and crimes against children*: Use of social networks can expose individuals particularly children to harassment or inappropriate content. Unless parents should filter the content otherwise, children may be exposed pornography.
4. *Digital divide*: Social networking magnifies the gap between people who have access to computer technology and those that don't have access.
5. *Security and privacy*: Social networking can compromise privacy in a big way. Innocent people may upload their photos, videos etc. on social media and criminals may use this information for malicious reasons such as fraud, identity theft, terrorism and embarrassing
6. *Social networking can be used to establish government and to advance terrorism*: This has been witnessed in the recent Arab countries such as Egypt, Libya and Tunisia
7. *Corrupted language*: This is the use on non-standard or un grammatical language which makes people addicted and adopt that language to be used in day-to-day talk thereby limiting standard language development.

DISTRIBUTED SYSTEMS AND APPLICATIONS

- In distributed computing, three fundamental concepts are used: distributed systems, distributed operating systems and distributed applications
1. **Distributed system**: Distributed system refers to networks of heterogeneous (different) computers, applications and using shared resources which are geographically dispersed across networks. Figure below shows a layout of distributed system on which distributed applications are deployed:

Two examples of distributed systems are:

    a. *Internet*: A vast collection of computer networks. Most hardware and software manufacturers are competing to provide software and hardware assess through internet service referred to as "***Cloud Computing***"

    b. *Intranet*: A privately owned internet administered by an organization to provide secure access to the organization services. An example is bank intranet that provide real time access to banking services anywhere any time using computers and mobile phones

2. **Distributed operating system**: This is a special type of operating system that controls, integrates and homogenizes use of heterogamous hardware and software resources in a distributed system. Some examples are Mach, Chorus, UNIX

3. **Distributed application**: This is an application that is distributed across several servers in a distributed system. The main responsibility of a distributed server running on a distributed operating system is to coordinate and provide efficient access to information and services. Some common examples of distributed applications include:

    1) ***Online flight-reservation***: Most airlines provide online web-based or mobile applications for real-time booking and payment of flight

    2) ***Distributed cash dispensing machines***: To enhance access to withdrawal and deposit transactions, most banks distribute processes to multiple servers across their continents.

    3) ***Video conferencing applications***: Some video conferencing applications are distributed to provide quality of services in sound and video transmission even across continents

    4) ***The world wide web***: described earlier on

- It is the responsibility of distributed systems to manage these applications in order to ensure reliability of services and information even in case of partial breakdown. This is achieved through the following distributed mechanisms

    ❖ ***Hardware management and control***. The distributed system manages and coordinates allocation of hardware resources such as processors, memory and storage depending on the location of the user.

    ❖ ***Load balancing***: Distributed system may divide a processing task to available processors to optimize processing speed. This distribution of processing tasks across multiple processors is what is referred to as Load balancing

    ❖ ***Data access***: As opposed to centralized system where data access may delay due to number of users and network limitations, distributed system and applications provide convenient and efficient access

because a copy of data is accessed from nearest server. For example, when you type a search word on Google, the result is displayed instantly because the results are fetched from a nearest mirror.

❖ *Security and reliability*: Ii it responsibility of distributed system and applications to enforce security in data transmission and reliability against error in input or hardware failure.

Benefits and challenges of distributed system

- Distributed systems and deployment of distributed applications poses a number of benefits and challenges relating to heterogeneity of networks, computer hardware, operating systems, security and implementation by different programmers.

Advantages of distributed systems

- As opposed to *centralized system*, distributed applications offers the following benefits
1. *Reliability*: Due to load balancing distribution of record copied to multiple servers across to the user, distributed applications provide increased availability and shorter response time.
2. *Incremental growth*: In distributed systems and applications, scaling up the system only requires extension rather that's replacing computing devices.
3. *Shared utilization of resources*: Distributed applications enhances data sharing
4. *Communication*: Distributed applications such as social networks e.g. Facebook and e-mail applications facilitates efficient interactions spread all over the globe.

Disadvantages of distributed systems

1. *Network performance*: In places of poor connectivity, delay may occur between operations such as cash withdrawal in an ATM causing frustration or failure of transactions
2. *Poor implementations of distributed applications* expose users to more security risks due to multiple access points for intruders and possible communication with insecure systems
3. *Software complexity*: distributed system are complex to take them run on different platform making it difficult and time consuming to troubleshoot such systems in case of failure.