

# ICT IN ACCOUNTING

for Rwandan Schools

Senior

4

Student Book

For Experimental Version

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# FOREWORD

Dear Student,

Rwanda Basic Education Board (REB) is honoured to present Senior 4 ICT in Accounting book for the students of Accounting Profession Option which serves as a guide to competence-based teaching and learning to ensure consistency and coherence in the learning of the ICT in Accounting. The Rwandan educational philosophy is to ensure that you achieve full potential at every level of education which will prepare you to be well integrated in society and exploit employment opportunities.

The government of Rwanda emphasizes the importance of aligning teaching and learning materials with the syllabus to facilitate your learning process. Many factors influence what you learn, how well you learn and the competences you acquire. Those factors include the relevance of the specific content, the quality of teachers' pedagogical approaches, the assessment strategies and the instructional materials available. In this book, we paid special attention to the activities that facilitate the learning process in which you can develop your ideas and make new discoveries during concrete activities carried out individually or in groups.

In competence-based curriculum, learning is considered as a process of active building and developing knowledge and meanings by the learner where concepts are mainly introduced by an activity, situation or scenario that helps the learner to construct knowledge, develop skills and acquire positive attitudes and values.

For efficient use of this textbook, your role is to:

- Work on given activities which lead to the development of skills;
- Share relevant information with other learners through presentations, discussions, group work and other active learning techniques such as role play, case studies, investigation and research in the library, on internet or outside;
- Participate and take responsibility for your own learning;
- Draw conclusions based on the findings from the learning activities.

To facilitate you in doing activities, the content of this book is self-explanatory so that you can easily use it yourself, acquire and assess your competences. The book is made of units as presented in the syllabus. Each unit has the following structure: the unit title and key unit competence are given and they are followed by the introductory activity before the development of ICT in Accounting concepts that are connected to real world problems more especially to finance and economics.

The development of each concept has the following points:

- Learning activity which is a well set and simple activity to be done by students in order to generate the concept to be learnt;
- Main elements of the content to be emphasized;
- Worked examples; and
- Application activities to be done by the user to consolidate competences or to assess the achievement of objectives.

Even though the book has some worked examples, you will succeed on the application activities depending on your ways of reading, questioning, thinking and handling calculations problems not by searching for similar-looking worked out examples.

Furthermore, to succeed ICT in Accounting, you are asked to keep trying; sometimes you will find concepts that need to be worked at before you completely understand. The only way to really grasp such a concept is to think about it and work related problems found in other reference books.

I wish to sincerely express my appreciation to the people who contributed towards the development of this book, particularly, REB staff, development partners, Universities Lecturers and secondary school teachers for their technical support. A word of gratitude goes to Secondary Schools Head Teachers, Administration of different Universities and development partners who availed their staff for various activities.

Any comment or contribution for the improvement of this textbook for the next edition is welcome.

**Dr. MBARUSHIMANA Nelson**

Director General, REB.

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**Joan MURUNGI**

Head of CTRLR Department

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# UNIT 1

## COMPUTER SECURITY



### Introductory activity

Jane is an accountant in charge of payroll preparation in the Ministry of Finance of Rwanda. She has a computer which, two months ago was working quickly and properly. Every day she uses internet connection for operating some online transactions, she also used a flash disk to share her work with different workmates. Today her computer is no longer responding quickly as before, when connecting a flash disk on her computer some data are lost others hidden, some data are duplicated, disorganized and most of the time her computer restarts itself while she is working.

Discuss the main different causes of the above-mentioned issues of Jane's computer

Identify the risks of an unsecured computer

Describe how this computer can be secured

Describe how data stored in a computer can be protected



### Activity 1.1

What do you understand by security of the computer?

1. How a computer user can protect data and information stored in that computer?
2. What will happen if a user leaves his/her computer without switching it off?

### 1.1.1 Computer security

Computer security means techniques developed to safeguard information stored on a computer. It is also the protection of computer systems and information from harm, theft, and unauthorized use. The standard for a good security tells us that 10% of security safeguards are technical, 90% of security safeguards rely on the computer user to adhere to good computing practices.

Computer security is everyone's responsibility; this means that everyone who uses a computer or mobile device needs to understand how to keep their computers, devices and data secure.

### 1.1.2. Computer security related terms

**Security:** This is a state of feeling safe and protected. Something that provides a sense of protection against attack, harm or loss is security.

**Malware:** It is a file or code, typically delivered over a network, that infects, explores, steals or conducts virtually any behavior an attacker wants. And because malware comes in so many variants, there are numerous methods to infect computer systems.

**Spyware:** Spyware is software with malicious behavior that aims to gather information about a person or organization and send it to another entity in a way that harms the user. It installs itself on your computer and starts covertly monitoring your online behavior without your permission.

**Trojan horse :** A trojan horse, is a type of malware that conceals its true content to fool a user into thinking it's a harmless file.

**Worm:** A computer worm is a program containing malicious code that attacks host computers and spreads via a network. Network worms exploit security vulnerabilities in various applications. Due to the availability of the internet, they can spread all over the world within a few hours of their release.

**Adware :** Adware (or advertising software) is the term used for various pop-up advertisements that show up on your computer or mobile device. Adware have the potential to become malicious and harm your device by slowing it down, hijacking your browser and installing viruses and spyware.

**Authentication:** This is a process used to identify individuals based on username and password. This process establishes whether; Someone or something is in fact who or what is declared to be. Authentication ensures that the individual is who he or she claims to be but nothing about access rights of an individual.



**Authorisation:** This is permission to perform action.

**Username:** A username is a name that uniquely identifies someone on a computer system. For example, a computer may be setup with multiple accounts, with different usernames for each account.

**Password:** A Password is a word, phrase, or string of characters intended to differentiate an authorized user or process (for the purpose of permitting access) from an unauthorized user. A password is used to prove one's identity, or authorize access to a resource.



Figure 1. 1. Entry of a user name and password to protect a computer

Username is almost always paired with a password. This username/password combination is referred to as a login, and is often required for users to log in to computer or websites. For example, to access the e-mail via the Web, it is required to enter the username and password. Once, it is done the username may appear on the screen but the password is kept secret.



### Application activity 1.1

1. Explain the meaning of the term Computer security.
2. Identify consequences of security violation
3. What is the role of applying password and username to login to a page?

## 1.2 Importance of computer security

### Activity 1.2



The school accountant, wanted to make a payroll, but was unable to find the final updated list of school employees on his/her computer. He/she remembered that some days ago, she/he gave the same computer to the school secretary to write a letter.

The school accountant decided to use any list found on his/her computer.

1. Discuss the impacts that may arise when the School Accountant uses any list found on his/her computer
2. In pairs, discuss what can be the solution for the next time for not losing either the letters or the list
3. Apart from the School Accountant and Secretary, who else has the responsibility to protect the computer? Support your answer with positive impacts of protecting a computer in different ways

The importance of computer security is to protect the computer and its data as well as its user's identity. The data and information that most users store on their hard drives are often far more valuable than the computers themselves. Broadly, the importance of computer security lies in how harmful it can be if that data is lost.

Companies often store a lot of very sensitive information electronically, including trade secrets, customer lists and extensive corporate documents, both finished and those in progress. The importance of computer security is obvious in these contexts. It is perhaps less obvious for home computer users, but it is no less essential.

When computer hackers gain access to a computer, they can often see everything that is stored there. This might include **bank information, tax identification documents and sensitive health information, along with more ordinary files such as Word Processing documents and family photos**. Cyber criminals can use personally identifiable information to steal identities and perpetrate fraud.

The importance of computer security also extends to larger network security. A compromised computer can be manipulated and made into an agent of a cyber crime ring. As one example viruses and malware are often designed to hijack and exploit email address books. They can sometimes also turn home

computers into bots, which are computers that have been taken over and are made to network with others all over the world to perpetrate crime. Computers that have fallen victim to bot networks are not fully used by their owners, often they run very slowly and constantly their memory space is diverted to running malicious scripts.

Security of computer should help protect the confidential and important data stored on a hard disk storage.

### **The major importance of computer security is:**

Protect the computer

Protect data

Protect user's identification.

This is mainly because data present in the computer can be misused by unauthorised intrusions.

- Purpose of computer security is to:
- Keep your information on computer protected
- Maintain your computer's overall health
- Help prevent viruses and malware
- Help programs run more smoothly

Generally, computer security helps keep information safe



### **Application activity 1.2**

1. Give the major importance of computer security
2. Discuss different kinds of data to be protected.
3. Discuss and write a brief report on the importance of computer security at your school, in financial institutions and in education field.

## 1.3 Computer threats

### Activity 1.3



A consultant in the finance field joined her office as usual in the morning, after switching on her computer, she realized that it goes slowly, some data on the hard disk were unavailable, and faced complications of saving document on the hard disk, yet the computer was before operating properly for long time ago.

- Describe the reasons of the above issues and propose what could be the solution

### 1.3.1 Threats

A threat, in the context of computer security, refers to anything that has the potential to cause serious harm to a computer system. A threat is an activity, attack, situation that may happen, with the potential to cause serious damage. Threats can lead to attacks on computer systems, networks and more.

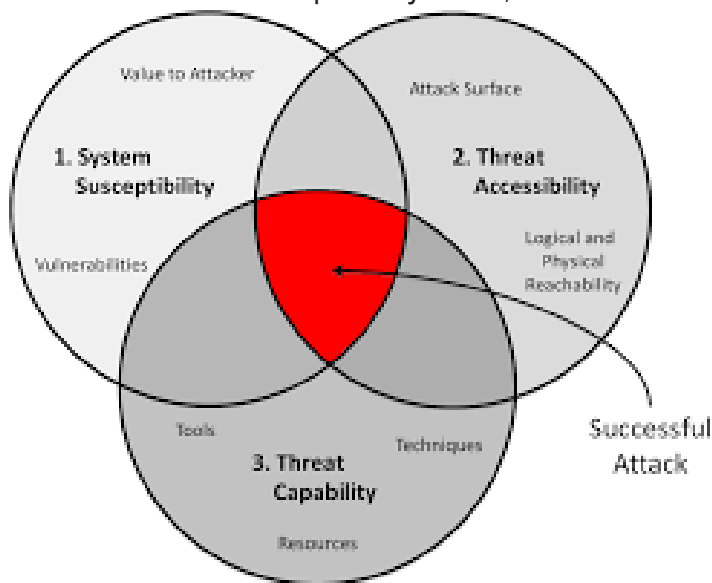


Figure 1. 2. Diagram illustrating computer threats effects

### 1.3.2 Threat categories

Knowing how to identify computer **security** threats is the first step in protecting a computer. The **threats** could be intentional, accidental or caused by natural disasters. Computer threats can be physical or logical.

- Physical threats
- Logical threats.

#### a) Physical threats

Digital storage media and hardware are subject to numerous internal and external forces that can damage or destroy their readability. Below are some cases of physical threats :

- Improper storage environment with high temperature, humidity, light, dust
- Over use mainly for physical contact media,
- Natural disaster such as fire, flood, earthquake
- Inadequate hardware maintenance,
- Hardware malfunction

#### b) Logical threats

Logical threats are events or attacks that remove, corrupt, deny access, allow access, or steal information from a computer without physical presence of somebody. These include viruses, worms, trojans, spyware, adware, SQL injection etc.

### ***1.3.3. Difference between logical threat and physical threats***

Physical threats may include theft, vandalism and environmental damage while logical threats are those that may damage your software systems, data, or network without damaging your hardware.

General threats to information systems can cause the following:

**Hardware failure:** A malfunction within the electronic circuits or electromechanical components (disks, tapes) of a computer system. **Example:** a CPU socket damaged.

**Software failure :** The inability of a program to continue processing due to erroneous logic. **Example:** A crash of a computer program.

**Electrical problems:** Are faults caused by electricity like a low-resistance connection between two points in an electric circuit through which the current tends to flow rather than along the intended path.

**User errors:** Is an error made by the human user of a computer system in interacting with it. **Example:** A system file deleted unintentionally by a user.

**Program changes ;** modifications made to program. **Example:** a simple modification in a program can affect the whole software.

**Theft of data, software, services and equipment.** When a physical or logical component of a system is stolen, the whole system stops. **Example:** A computer cannot run without a RAM or cannot run with corrupted software.



### Application activity 1.3

1. Discuss the difference between logical and physical threats
2. In the school computer lab, take one computer and remove all available RAMs in the computer. Discuss what happens to the functioning of the system.
3. Conduct a diagnostic of the school computer lab. From the diagnosis enumerate the different threats found in the computers.
4. Discuss the effect of both logical threats and physical threats

## 1.4 Computer virus



### Activity 1.4

In the school computer lab, when one student inserted a flash disk in one computer, all files are immediately deleted and the flash disk becomes empty. Another student discovers that when he/she opens a document in my Ms Word, the content is displayed in unknown characters.

In groups, discuss what should be the causes for such problems.

#### 1.4.1 Definition

Computer viruses are unwanted software programs or pieces of code that interfere with the functioning of the computer. They spread through contaminated files, data, and insecure networks. Once it enters your system, it can replicate to produce copies of itself to spread from one program to another program and from one infected computer to another computer. Viruses are self-replicating computer programs that interfere with the functioning of the computer by infecting files, data, programs, etc.

#### 1.4.2 Types of Computer Virus

##### 1. Overwrite Virus

It is the simplest computer virus that overwrites the code of the host computer system's file with its own malicious code. The content of the infected file is replaced partially or completely without changing the size of the file. Thus, it destroys the original program code by overwriting it with its defective code. The

infected files must be deleted or replaced with a new copy as this virus cannot be removed or disinfected.

## **2. Append Virus**

As the name suggests, this virus appends its malicious code to the end of the host program's file. After that, it alters the file's header in a way that the file's header is redirected to the start of the malicious code of the append virus. Thus, this code is executed each time the program runs. However, it does not destroy the host program; rather, it modifies it in a way that it holds the virus code and enables the code to run itself.

## **3. Macro Virus**

Macro virus alters or infects the macros of a document or data file. It is embedded as a macro in a document and adds its codes to the macros of the document. The virus spreads when infected documents or data files are opened in other computers.

It also spreads through software programs, which execute macros such as Ms Word, Ms Excel. Each time a document is opened using these programs, other related documents will also get infected.

The first macro virus, which was named concept, spread through emails with attached Ms Word documents. It infected MsWord 6.0 and Ms Word 95 documents, which were saved using Save as option. Fortunately, it did not cause any harm, except for displaying a message on the screen.

## **4. Boot Virus**

Boot virus or boot sector virus alters the boot sector program stored in the hard disk or any other storage device such as floppy disks. It replaces the boot sector program with its own malicious version. It infects the computer only when it is used to boot up the computer. If it enters after the boot-up process, it will not infect the computer. For example, if someone forgets to remove the infected floppy disk when the computer is turned off and then turns on this computer, it runs the infected boot sector program during the booting process.

Usually, it enters into the system through corrupt media files, infected storage devices, and insecure computer networks. The spread of this virus is very rare these days due to the decline in the use of floppy disk and use of boot-sector safeguards in the present-day operating systems.

## 5. Resident Virus

The resident virus stays permanently in the primary memory (RAM) of the computer. When the computer is turning on, this type of virus becomes active and corrupts the files and programs running on the computer.

## 6. Multipartite Virus

Multipartite virus spreads and infects in multiple ways. It infects both the boot sector and the executable files stored on the hard drive simultaneously. When the computer is turning on, the boot sector virus is triggered as it latches on to the hard drive, which has the data for starting up the computer. Once it is triggered, the program files also get infected.

## 7. File Infector Virus

It is one of the commonly found computer viruses. It mainly infects the executable files; the files with .com or .exe extensions. The virus becomes active when the infected file is executed. The active virus overwrites the file partially or completely. Thus it may destroy the original file partially or completely.

## 8. Computer Worm

Computer worm is similar to a virus but is technically different from the virus. It can replicate and spread like a virus, but unlike viruses, it does not need a host program to spread. Being able to self-replicate it can produce multiple copies of itself. It spreads through networks such as an email sent to an infected email id can infect your system with a computer worm.

## 9. Trojan Horse

Trojan horse is a malware like a virus or a worm, but it is technically different from both. It can't replicate like virus and worm. Trojan horse hides itself in a program. Once you install any such program, the trojan horse enters into your computer. It can provide unauthorized access to a computer, send files to other computers and may delete files or can make other unwanted changes in a computer.

## 10. Cavity virus

It is also known as a spacefiller virus. As the name suggests, this virus tends to install itself by occupying the empty sections of a file. It is not easy to detect this virus as it fills the empty spaces without changing the size of the file.



## **11. CMOS Virus**

It infects the CMOS, which stands for complementary metal-oxide semiconductor and is a memory chip that contains the system configuration. This virus can erase or reset the system configuration.

## **12. Companion Virus**

It resides itself in a file whose name is similar to another program file, which is executed normally. When the program file is executed, the virus gets activated and performs malicious steps such as deleting the files on a computer hard drive. Globe virus is a first known companion virus, which was found in 1992.

## **13. Encrypted Virus**

It encrypts its payload to make its detection more difficult. It comprises two parts: An encrypted virus body and a decryptor, which decrypts the virus when it is executed. After decryption, the virus can execute itself in order to replicate and become a resident. Furthermore, it is different from cryptolocker, which is a computer virus that encrypts the hard drive data and holds it for ransom.

## **14. Executable Virus**

It is a non-resident computer virus, which resides in an executable file. Whenever the infected file is executed, it infects the other files.

## **15. Polymorphic Virus**

It creates its thousands of copies itself; in each copy, it changes the sequence and byte values to evade detection by antivirus software. Even the best antiviruses may not be able to detect this virus. Polymorphic viruses affect data types and functions and generally spread through spam, infected sites, and while using other malware.

## **16. Rabbit Virus**

It is also known as wabbit, a fork bomb. It is capable of creating new processes, and each of the new process further creates new processes. This process continues until this virus utilizes all the available resources in the system and system falls short of resources. It may cause the target system to slow down and crash. For example, it is like an infinite loop that repeatedly creates processes that consume lots of CPU cycles and operating system resources.

## 17. Stealth Virus

It is a hidden computer virus, which specifically attacks operating system processes. It usually hides itself in partitions, files or boot sectors and is capable of going unnoticed during antivirus or anti-malware scans making it capable of intentionally avoiding detection.

## 18. Web Scripting Virus

The web scripting virus is a kind of computer security vulnerability through websites which breaks our web browser security. This virus allows the attackers to inject client-side scripting into the web page. It can steal our information from the web browser. This type of viruses is usually used to attack the sites with a larger population such as social networking, e-mail, etc.

### 1.4.3 Characteristics of a Virus

Following are a couple of characteristics of any virus that infects computers.

- They reside in a computer's memory and activate themselves while the program that is attached starts running. **For example:** They attach themselves to the **explorer.exe** in windows OS because it is the process that is running all the time.
- They modify themselves after the infection phase making it so hard for an antivirus to detect them.
- They always try to hide themselves in the operating systems by encrypting themselves into cryptic symbols and decrypting themselves when they replicate or execute.

### 1.4.4 Symptoms of a Computer Virus

There are many warning signs or symptoms which show that a computer is infected with a virus, some of which are as follows:

- **Slow computer performance:** The computer may work slowly. The result for this is that it will take more time to open or shut down, to open a file, a document or a computer application, etc. The operating system and internet speed may also slow down.
- **Frequent pop-ups:** A virus may cause unusual frequent window pop-ups.
- **Hard drive issue:** The hard drive may exhibit unusual high activity even when it is not in use. It may cause unwanted changes to the hard drive and may freeze or crash this device.
- **Frequent crashes :** One may experience frequent sudden system crashes while playing games, watching videos, or doing some other work using the infected system. A blue screen appears when it crashes.

- **Unknown programs:** Unwanted programs may open or start automatically when the computer is turning on. These programs are found in computer's list of active applications. Sometimes, the window shuts down unexpectedly without any reason.
- **Unusual activities:** The computer may perform differently, such as not being able to log into accounts. The hardware, software, or OS may start malfunctioning leading to crashing the system abruptly.
- **Network issue :** Sometimes, there is a high network activity even if the computer is not connected to the internet and vice versa.
- **Unnecessary advertisement:** It is normal that sometimes advertisements may come to the computer screen while browsing, but when it comes when not browsing, it may indicate a virus on that computer.
- **Affected applications :** Some viruses are developed to affect specific applications. Consequently, some applications may not work if the computer is infected.
- **Blocked by antivirus sites:** An antivirus site may deny access to a computer that is infected by a virus.
- **Dialog boxes :** Many dialog boxes keep appearing suddenly on a computer screen.
- **Printer issues :** A printer attached to an infected computer may print documents without getting any command or in an inappropriate manner.
- **Changed Homepage:** A home page may get changed without being done by the user.
- **Strange messages:** One may see strange error messages on a computer such as «cannot rename the folder as a folder with the same name already exists»

#### **1.4.5 Anti-virus installation**

- In this case Kaspersky 2017 is going to be used as an example of how to install an antivirus. Before the installation of Kaspersky 2017 on a computer, the following preparation has to be made:
- Make sure that the software is on external storage device or on another computer which is on the network;
- Check if the computer meets the requirements of Kaspersky Anti-Virus 2017;
- Make sure no antivirus software of Kaspersky Lab or other vendors is installed on your computer;
- Check if there is any incompatible software and remove it;
- Close all running applications;
- Check if it is Kaspersky Anti-Virus 2017 installation under Windows 10, then click on the Desktop tile on the start screen.

## Standard Installation:

1. Download the installation file from Kaspersky Lab website and run it. Then, the user follows the instructions given by the system.
2. If the antivirus Kaspersky installation file is saved in another computer on the same network, connect to that computer and run the executive file from it or move it using a removable storage. The instructions will be followed as in the point above
3. Insert the disc into the CD/DVD drive if it contains the Kaspersky installation file. If the installation does not start automatically, run the installation file manually. Click Install.

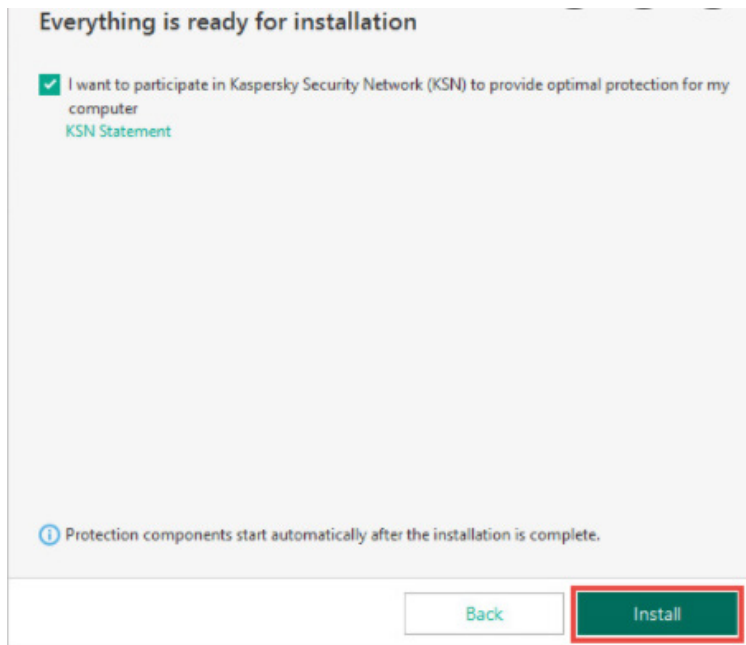


Figure 1. 3. Kaspersky antivirus installation interface

1. Read the License Agreement in the window that appear afterward by clicking on the respective link. Accept its terms to install the application. Respond to other windows that may display as the installation continues
2. Wait until the installation is complete. Make sure the Start Kaspersky Anti-Virus check box is selected, then click Finish

**Note:** A virus scan is the process of using anti-virus software to scan and identify viruses in a computing device. It is recommended to scan any external storage connected to computer before using it.



### Application activity 1.4

1. Explain clearly what will happen if a computer is infected by a virus that shows the following signs or symptoms:
  - ii) **Slow computer performance**
  - iii) **Frequent pop-ups**
  - iv) **Hard Drive issue**
  - v) **Frequent crashes**
  - vi) **Unknown programs**
2. Give the difference between resident virus and non-resident virus
3. What do you understand by executable virus?

## 1.5 Computer attacks

### Activity 1.5



One day, an ICT teacher found the messages below on some computers in computer lab.

1. Discuss which kind of messages they are
2. Explain the reason why some computers may display the above messages
3. Give the solution that can help the ICT teacher avoid those types of messages in computers

A Computer attack is any attempt to gain unauthorized access to a computer, or computing system with the intent to cause damage. Computer attacks aim to disable, disrupt, destroy or control computer systems or to alter, block, delete, manipulate or steal the data.

## **1.5.1 Ways of computer attacks**

### **1. Virus**

Viruses spread when the software or documents they get attached to are transferred from one computer to another using a network, a disk, file sharing methods, or through infected e-mail attachments. Some viruses use different stealth strategies to avoid their detection from anti-virus software.

### **2. Trojans**

A Trojan horse, or Trojan, is a type of malicious code or software that looks legitimate but can take control of your computer. A Trojan is designed to damage, disrupt, steal, or in general inflict some other harmful action on your data or network. A Trojan acts like a genuine application or file to trick you.

### **3. Worms**

A computer worm is a program containing malicious code that attacks host computers and spreads via a network. Network worms exploit security vulnerabilities in various applications. Due to the availability of the Internet, they can spread all over the world within a few hours of their release.

### **4. Website Hacking**

Attackers can run code, install malware, steal or modify data by exploiting vulnerabilities. Typically, hackers snoop around and crawl websites to identify underlying vulnerabilities and weaknesses and accordingly, orchestrate attacks and data breaches.

### **5. Cybercrime**

Hacking is identifying and exploiting weaknesses in computer systems and/or computer networks. Cybercrime is committing a crime with the aid of computers and information technology infrastructure.

### **6. Unwanted content**

Unwanted content can come in various different forms and can have a negative impact on how things are perceived. It is generally personal information that is displayed on a computer when connected to the internet without the user's consent.

## 7. Attacks through computer network

Actions taken through the use of computer networks to disrupt, deny, degrade, or destroy information resident in computers and computer networks, or the computers and networks themselves.

### Examples :

Unauthorized access.

Distributed Denial of Service (DDoS) attacks.

## 8. Attacks by means of removable media

Data can be lost or sensitive data can be leaked. In many cases this data loss comes at a high price both in reputational damage and financial loss. Another security risk in the use of removable media is the introduction of malware from one device to another.

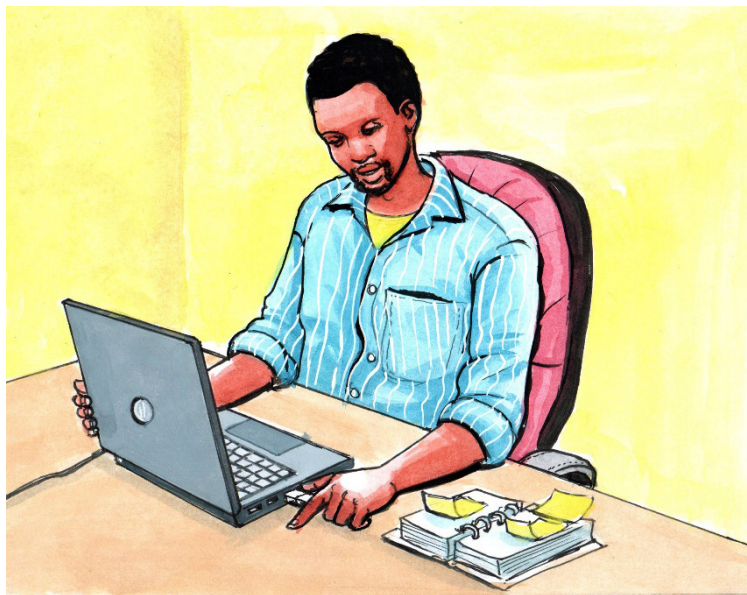


Figure 1. 4. Removable media is one way to transfer attacks agents

## Denial of Services attack

A denial-of-service attack is a cyber-attack in which the perpetrator seeks to make a computer or network resource unavailable to its intended users by temporarily or indefinitely disrupting services of a host connected to a network.



## Application activity 1.5

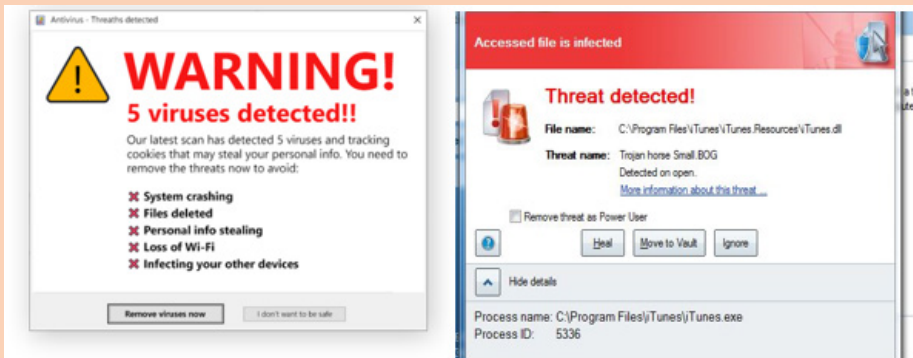
1. Explain different ways of how a computer can be attacked.
2. What is a computer attack?
3. Identify any 5 examples of computer attacks
4. Visit your school computer laboratory and detect whether there are some computers which have been attacked or not.

## 1.6 Threats protection



### Activity 1.6

A group of O'level students went to do a research in computer laboratory and found that some computers have those messages as shown on the images below. They tried to close those messages but still the computers did not work properly.



1. Explain why those messages were displayed on the computer screens.
2. Explain can be done in order to make those computers work properly

### 1.6.1 Computer antivirus

There are many antiviruses, which are programs that can help to protect a computer from viruses. It scans the system and cleans the viruses detected during the scan. Some of the popular antiviruses include Avast, Quickheal, McAfee, Kaspersky, etc



- **Basic functions of Antivirus Engines:** This is the core of any antivirus product. All antivirus engines have three components to function accordingly. It is important to understand these functions because it will help for better manual cleaning of viruses.
- **Scanning:** When a new virus is detected in the cyberspace, antivirus producers start writing programs (updates) that scans for similar signature strings.
- **Integrity checking:** This method generally checks for manipulated files in OS from the viruses.
- **Interception:** This method is used basically to detect Trojans and it checks the request made by the operating system for network access.

The following image shows the schema for an antivirus engines functionality.

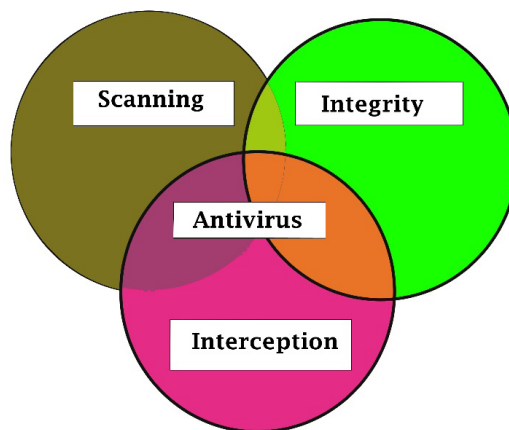


Figure 1. 5. Antivirus engine functionalities

## Types of anti virus

### 1. Free Antivirus Software

The free versions of anti-viruses have nearly identical malware detection scores to the paid versions produced by the same company, but the commercial antivirus makes a small difference in the performance of security. Examples of such antiviruses are **Avast Antivirus, AVG Antivirus, Panda Antivirus, Bitdefender Antivirus, and Microsoft Security Essentials**. When the computer to be installed is a server, there will be a need to have a commercial version.

## 2. Commercial Antivirus

These are the ones that are got after paying a fee. The buyer then gets a key that will be entered when the antivirus is being installed. Note also that all the producers of the free antiviruses offer their commercial versions. Some of the commercial antiviruses are: Kaspersky Anti-Virus, McAfee AntiVirus Plus, Webroot Secure Anywhere Antivirus, and Bitdefender Antivirus Plus These antiviruses can be downloaded as free trials from the maker's websites.

The Kaspersky Antivirus has an excellent score in anti-phishing and gives a useful bonus in security tools like credit card protection in computers. McAfee Antivirus Plus can protect all the operating systems like Windows, Mac OS, Android, and iOS devices and has very good malicious URL blocking and anti-phishing. Webroot SecureAnywhere Anti virus has features like recovery of files encrypted by ransomware, very fast scan, handles unknown malware and uses small amount of disk space.

When using the above type of antivirus, modified, replaced or deleted files and the shared libraries should also be checked. They generally infect executable program files with extension like .EXE, .DRV, .SYS, .COM, .BIN. Malwares changes extension of genuine files, for example: File.TXT to File.TXT.VBS.

For the system administrator of a webserver, be aware of another form of malware which is called **webshell**. It generally is in a .php extension but with strange file names and in an encrypted form. When those types of file are detected from any computer, they must be deleted.

- Detecting a Computer Error from a Virus Infection

This section explains how to detect a computer or OS fault from a virus because sometimes people and system administrators mix the signs.

The following events are most likely not caused by a malware:

- Error while the system is booting in bios stage, like Bios's battery cell display, timer error display.
- Hardware errors, like beeps RAM burn, HDD, etc.
- If a document fails to start normally like a corrupted file, but the other files can be opened accordingly.
- Keyboard or mouse doesn't respond to any commands
- Monitor switching on and off too often, like blinking or vibrating, this is a hardware fault.

On the other hand, the following signs in a computer system are caused by malware:

- The computer shows a pop-up or error tables.
- Freezes frequently.
- It slows down when a program or process starts.
- Third parties complain that they are receiving invitation in social media or via email by computer user.
- Files extensions changes appear or files are added to the system without computer user consent.
- Internet Explorer freezes too often even though the internet speed is very good.
- Hard disk space is full all the time, even when there seem to be few files and folders in the computer.
- Files and program sizes changes comparing to its original version.
- Installation of an antivirus

To install an antivirus program on a computer, follow the steps below:

Insert the CD or DVD into the computer's disc drive. The installation process should start automatically, with a window opening to guidance through the installation process.

- If the antivirus program is downloaded from the Internet, find the downloaded file on computer. If the downloaded file is a zip file, unzip the file to extract and access the installation files. Look for a file named setup.exe, install.exe, or something similar, then double-click that file. The installation process should start, with a window opening to help guide through the install process.

### **1.6.2 Anti-Spyware**

Anti-spyware is a type of software that is designed to detect and remove unwanted spyware programs. Spyware is a type of malware that is installed on a computer without the user's knowledge in order to collect information about them. This can pose a security risk to the user, but more frequently spyware degrades system performance by taking up processing power, installing additional software, or redirecting users' browser activity.

Anti-spyware is an antivirus software primarily utilized to **scan a hard disk for viruses, worms, and Trojan horses**, and removes, fixes, or isolates any threats that are found. Antispyware software scans the hard disk and registry for traces of spyware and adware to removes them or prompt the user to remove them.

For preventing a computer to be affected by spywares the installation of an anti spyware is needed. Such anti spyware are: TotalAV, Outbyte PC Repair, Restoro, Advanced SystemCare, Iolo System Mechanic, Malwarebytes Adwcleaner, etc

### Applying antispyware

The computer user can download and install a free or commercial AntiSpyWare then run it and scan the computer as it was done for antivirus to remove found spyware.

### 1.6.3 Firewalls

Firewall is a network security device that monitors and filters incoming and outgoing network traffic based on an organization's previously established security policies. It can be a At its most basic, a firewall is essentially the barrier that sits between a private internal network and the public internet.

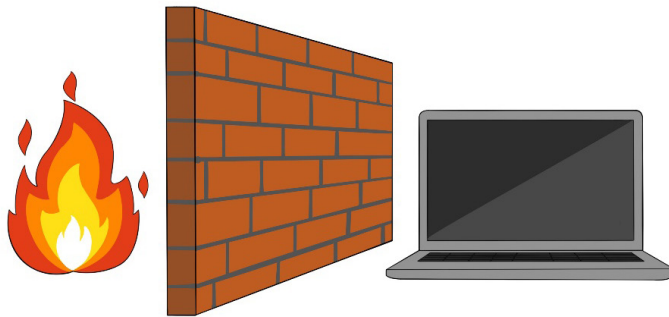


Figure 1. 6. Antivirus engine functionalities

A firewall can be a hardware or a software. A firewall can help protect a network by acting as an intermediary between the internal network and outside traffic. It monitors attempts to gain access to the operating system and blocks unwanted incoming traffic and unrecognized sources. The Benefits of a firewall include among others preventing hackers and remote access, protecting data, network monitoring, protecting against Trojan and other malicious software, etc.

Firewalls are also categorized based on how they operate. Based on their method of operation, below are different types of firewalls:

### 3. Packet Filtering Firewalls

Packet filtering firewalls are the oldest, most basic type of firewalls. Operating at the network layer, they check a data packet for its source IP and destination IP, the protocol, source port, and destination port against predefined rules to

determine whether to pass or discard the packet. Packet filtering firewalls are essentially stateless, monitoring each packet independently without any track of the established connection or the packets that have passed through that connection previously. This makes these firewalls very limited in their capacity to protect against advanced threats and attacks.

Packet filtering firewalls are fast, cheap, and effective. But the security they provide is very basic.

#### **4. Circuit level gateways**

Circuit-level gateways verify established Transmission Control Protocol (TCP) connections and keep track of the active sessions. They are quite similar to packet filtering firewalls in that they perform a single check and utilize minimal resources. Primarily, they determine the security of an established connection. When an internal device initiates a connection with a remote host, circuit-level gateways establish a virtual connection on behalf of the internal device to keep the identity of the internal user hidden.

#### **5. Stateful Inspection Firewalls**

They verify and keep track of established connections to perform packet inspection to provide better, more comprehensive security. They work by creating a kind of table with source computer addresses, destination computer address, source computer port and destination computer port once a connection is established. They create their own rules dynamically to allow expected incoming network traffic instead of relying on a static set of rules based on this information. They therefore drop data packets that do not belong to a verified active connection.

#### **6. Application level Gateways**

Also called Proxy Firewalls, application-level gateways are implemented at the application layer via a proxy device. Instead of an outsider accessing your internal network directly, the connection is established through the proxy firewall. The external client sends a request to the proxy firewall. After verifying the authenticity of the request, the proxy firewall forwards it to one of the internal devices or servers on the client's behalf. Alternatively, an internal device may request access to a webpage, and the proxy device will forward the request while hiding the identity and location of the internal devices and network.

## 1.6.4 Access control

Every computer user needs access to a password that is shared with them. The user makes a request to access the password. The request is sent to the designated administrator(s) for approval.

### 1. Main category of users

- Administrator

An administrator is someone who can make changes on a computer that will affect other users of the computer. Administrators can change security settings, install software and hardware, access all files on the computer, and make changes to other user accounts.

- Local user

Local user accounts are **stored locally on the server**. These accounts can be assigned rights and permissions on a particular server, but on that server only. Local user accounts are security principals that are used to secure and manage access to the resources on a standalone or member server for services or users.

To create a new user account in Windows 10, follow these steps:

1. Right-click the Windows Start menu button.
2. Select Control Panel
3. Select User Accounts .
4. Select Manage another account .
5. Select Add a new user in PC settings .
6. Click on “I don’t have this person’s sign-in information”
7. Click on Add a user without a Microsoft account

After following all these steps, the following window will be displayed :

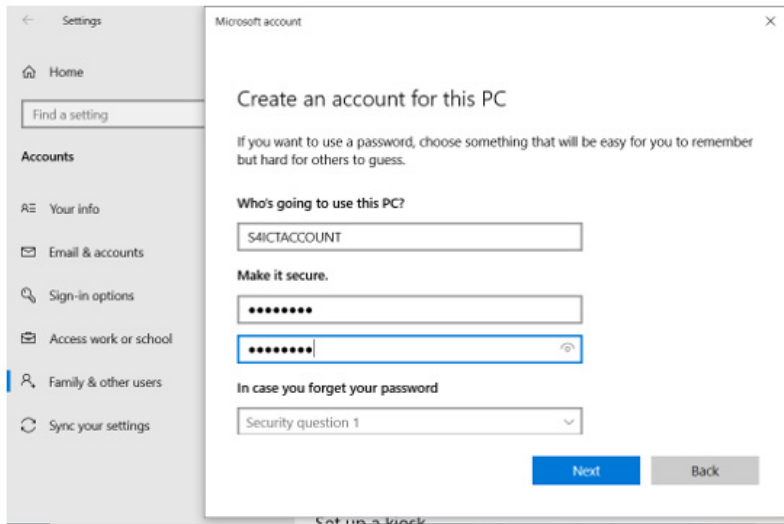


Figure 1. 7. User account creation interface

1. On the above window, enter the username and the password the new user will use to login.
2. Choose and answer the questions which help in recovering an account when the password is forgotten.
3. After clicking on Next, a new user account will be created.

**Note:** The Administrator account is the first account that is created during the Windows installation. The Administrator account has full control of the files, directories, services, and other resources on the local computer. The Administrator account can create other local users, assign user rights, and assign permissions

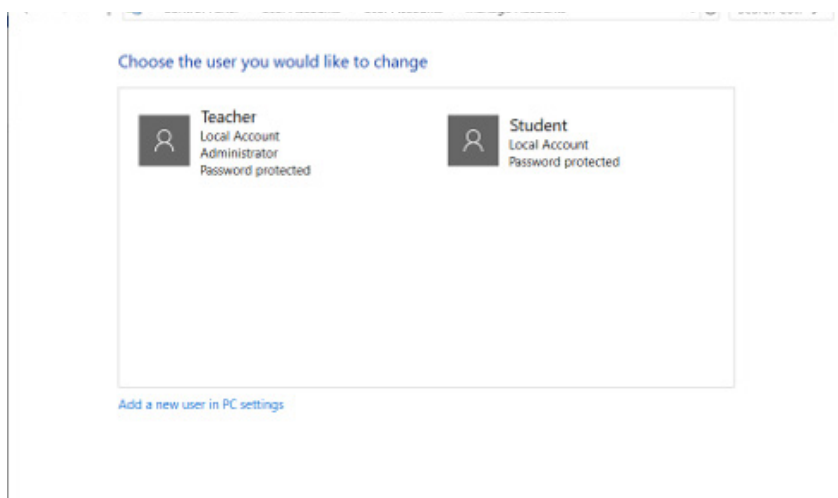


Figure 1. 8. Window showing different user accounts interface



### Application activity 1.6

1. Describe different functions of an anti virus
2. Differentiate AVG anti virus to Microsoft security essentials
3. Briefly differentiate the types of firewall
4. a) At your school, the anti-virus used or installed in computers is for how many users ?
5. b) Suppose that, the anti-virus keys are stolen by someone else to use it on network. What can be the consequences for that anti-virus users in that school ?
6. c) How the computer users can avoid that illegal action ?



### Activity 1.7

In the school computer laboratory, to enter in a secured computer with password, someone needs to be given that password. If it has been forgotten, it becomes impossible to work with that computer. Answer the following questions :

1. What is the importance of login to computer with password ?
2. List other security measures that can be used to protect a computer.
3. Explain how data stored in computer can be protected from damage ?

## 1.7 Threat prevention

Computer viruses can easily spread through the internet and email, causing potential harm to a computer's data, files and hard drive. Viruses are commonly disguised as hyperlinks, pop-ups or email attachments of images, greeting cards, audio or video files. Use the following instructions to help keep the computer safe from viruses, hackers and other malicious attacks.

### 1. Use Strong Passwords

It is very necessary to keep data safe by creating unique, complex passwords. The best passwords include a mix of numbers, letters, and symbols and are at least 8 characters long.



## **2. Keep everything up to date**

Another basic step to take is to make sure you have the latest versions of all software installed on your devices. The importance of this is because software updates include features designed to withstand the latest security threats. Microsoft, Oracle, and other makers regularly update their software to eliminate “bugs” that hackers could exploit.

If a computer has an operating a system from many years ago, it’s defenseless against any viruses or malware recently developed. Make it a habit to install all new software updates as soon as they become available.

### **1. Use Antivirus Software**

Antivirus software acts as a “vaccine” against virtual viruses. It can identify and eliminate the threat that could harm a computer.

### **2. Use a Firewall**

Using antivirus programs doesn’t automatically mean that there is a firewall in a computer. Macs computers come with pre-installed firewall software. Make sure it’s enabled to provide an extra layer of protection from viruses and malware.

### **3. Install a popup blocker**

Many attacks happen through browsers, during everyone’s daily activities. Hackers can gain access to any computer from one innocent click on the wrong ad or link. An ad or popup blocker is essential to protecting any computer’s data. It will prevent any unwanted pages from opening automatically. Never click on, open, or download anything unless its source is known.

### **4. Beware of Email Phishing Scams**

These appear in email form under the guise of a legitimate company. The goal is to get the computer user to enter his/her personal information or to click on an infected link that allows access to the computer.

Some companies will have their own domain name for emails. If an email address claims to be from Paypal or Netflix but ends with @gmail.com, it’s a scam. Other signs include misspellings, poor grammar, and suspicious attachments, buttons, or links. A legitimate company will never invite you via email to log in and provide personal or billing information.

## 5. Know the signs of infection

There are different signs which may make one think about a computer being infected such as repeated error messages, unexpected shutdowns, a sudden slowing down of a computer, a computer taking too long to shut down or restart, new unknown toolbars, etc. Any of these signs could mean that the computer is infected.

## 6. Consider additional security features

At the very least, it is better to perform weekly or even daily backups of all important data. Store it securely in the cloud or on a separate hard drive. That way, if the virus come accidentally the vital information won't be lost or compromised. For extra protection, it is good to consider advanced security measures like endpoint security. This protects not just not only the computer but also the whole network.



### Application activity 1.7

1. In group of 4 discuss the best practices that every user of the computer should apply as routine in order to keep an installed antivirus stronger.
2. Install an available antivirus in the computer lab, update it and scan the full computer then report you observed during the whole process up to the end.
3. Discuss the necessary recommendations to prevent viruses and spywares from the computer
4. Outline the signs of a computer which has been infected by virus



## End of unit assessment 1

### Part 1. Written

- a) What is computer security ?
- b) What is the purpose of computer security ?
- c) With an example, explain how you can protect a computer from physical threats ?
- d) By using examples, explain access control in authorization
- e) Which type of attack that enable a computer user to access his/her e-mail address ?
- f) Identify consequences of security violation in computer security context
- g) Discuss and write a brief report on the importance of computer security at your school, in financial institutions and in education field
- h) With an example differentiate the physical threats to logical threats
- i) Explain the term “Executable virus”
- j) It is heard that some web site become hacked by unknown people. Which strategies can be used to avoid young Rwandan programmers to engage in that action ?
- k) Using an arrow match the following in Group A with their corresponding in Group B

### Part 2. Written

In school computer lab, every student takes a computer and do the following activities :

- i) Create a user name and password to enter in that particular computer
- ii) Add a new user on the computer
- iii) Update the anti-virus found on the computers

To set a paragraph spacing follow these steps:

1.

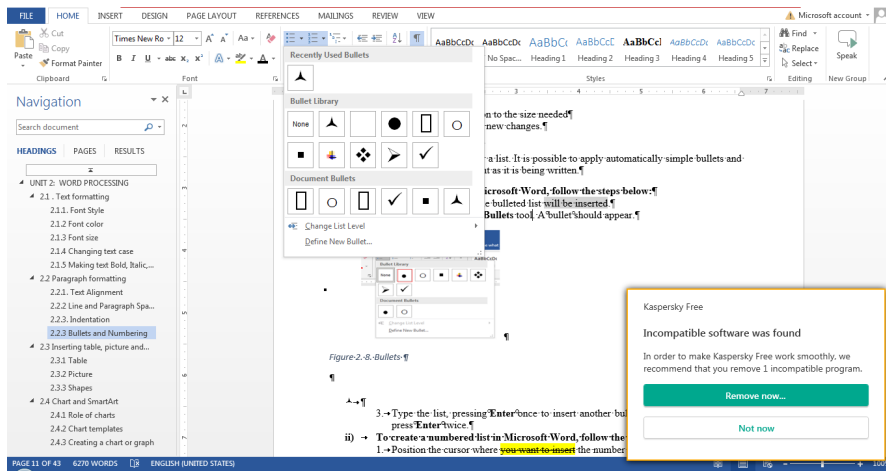


Figure 2. 10. Different bullets that can be applied in Word

2. Type the list, pressing **Enter** once to insert another bullet. When finished, simply press **Enter** twice.
- i) **To create a numbered list in Microsoft Word, follow the steps below.**
1. Position the cursor where the numbered list will be inserted.
  2. In the Home tab, click the **Numbering** tool. A number One should appear.



### Introductory activity

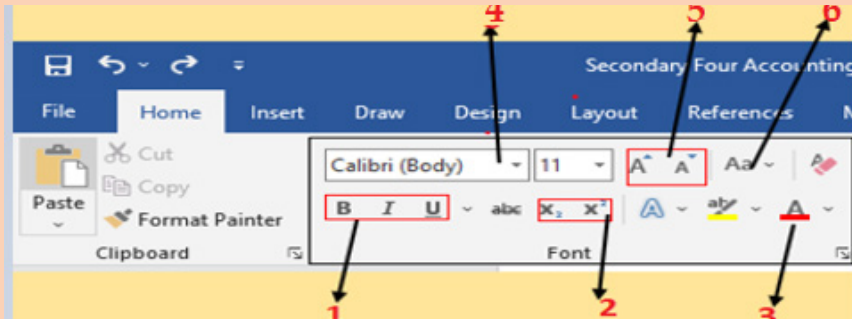
1. The head teacher of your school buys a new computer which has no software in it. He/she needs to prepare a report which to be send to the District. What are the system software and application software that the head teacher will need to achieve his purpose.
2. You are asked by your head teacher to prepare a document presenting the features of your school specifically its historical background, Vision and mission, performance, statistics about students and officers.
  - iii) Give steps used to launch application software that will be used to perform this task
  - iv) The document to be created must comply with the following:
    - v) It has titles and has highlights of words to which more attention is needed. (The highlighted word can be made as: Bold, italic, underlined depending on the preferences)
    - vi) It has attractive colors depending on school preferences
    - vii) It contains a table to present the school statistics information.
    - viii) It has a school image as the first page
    - ix) It contains the hierarchy of officers in the school which is created using smart chart
    - x) Has a header “My beautiful School” and footer as “Cantered page number”.
    - xi) Create a table of content for this document and save it on “My school” as file name.

## 2.1 Text formatting

### Activity 2.1



1. Open the new document of MS word
2. Name each icon commands by make a pointer/cursor on each icon from Font groups in home tab as shown on the below figure:



3. Write a function of each command from 1 to 6

**Formatting** is the process of enhancing the appearance of a document, making it attractive. Text formatting involves enhancement of the appearance of the text. Some of the common text formatting features includes font style, font size, font colour, underline, change case and among others.

### 2.1.1. Font Style

By default, the font type of each new document is set to Calibri. However, Ms Word provides many other fonts to use in customizing the text. To change text's font style/font face go through these steps:

1. Select the text to modify
2. On the Home tab, click the drop-down arrow next to the Font box. A menu of font styles will appear.
3. Select and click on the font type to apply. Immediately the font style changes

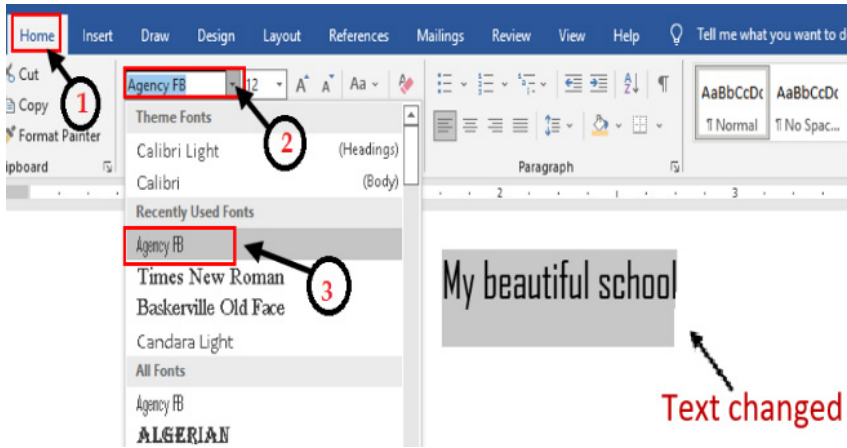


Figure 2. 1. Different font types to choose from in Word

### 2.1.2 Font color

The most common font color for word text is automatic (near black) but there are other fonts available. To change the font color:

1. Select the text to modify.
2. On the Home tab, click the Font Color drop-down arrow. The Font Color menu appears.
3. Select the font color to use. The font color will change in the document.

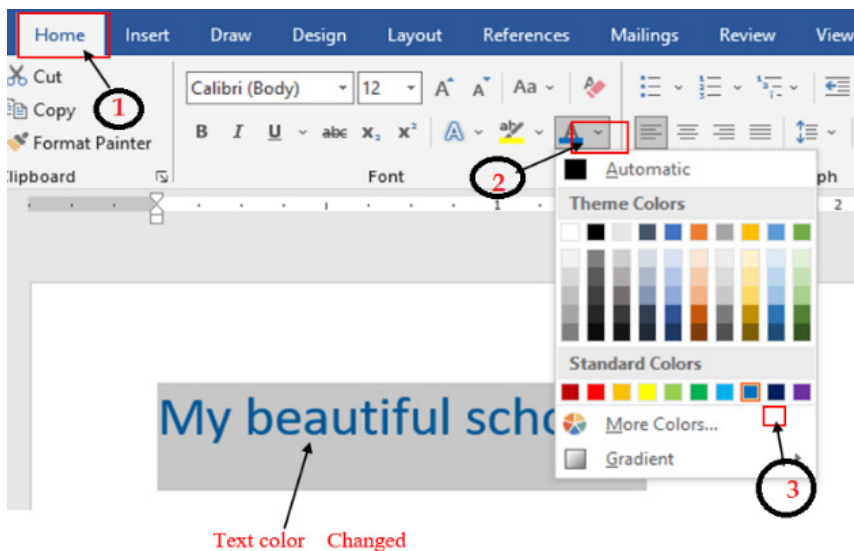


Figure 2. 2. Different font color in Word

The color to choose from are not limited to the drop-down menu that appears. Select More Colors at the bottom of the menu to access the Colors dialog box and choose one of the colors.

### 2.1.3 Font size

The most used size of word characters is 12, however character size in Word varies from 1 to 72 but can be increased even up. To change the font size go through the following steps:

1. Select the text for which the size is going to be changed. For example type and select the text “My beautiful School”.
2. Click on the **Home tab** and click the **Font size** command from the **Font group** then choose the desired size like 36. In the figure below the font size of the text is now changed to 36.

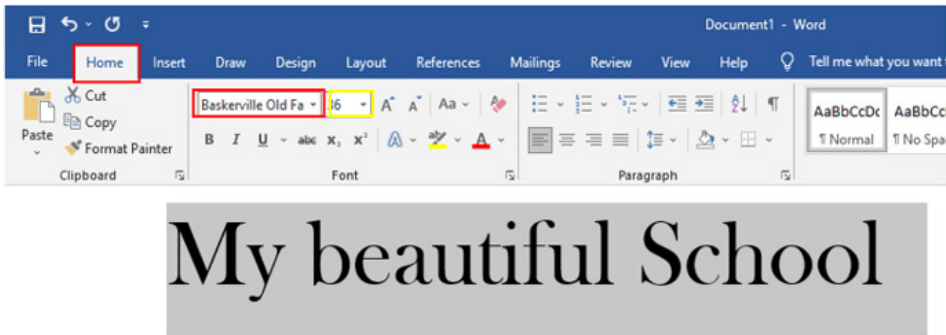


Figure 2. 3. Setting the font size in Word

**Note:** It is possible to change the font size using the **Increase Font Size** and **Decrease Font Size** commands

### 2.1.4 Changing text case

The text case is about the presentation of characters in words. The available cases are: Sentence case, Lower case, Upper case, Toggle case and Capitalize each Word. To change the case:

1. Select the text for which to change the case.
2. On the Home tab, click the Change Case command in the Font group.
3. A drop-down menu will appear. Select the desired case option from the menu



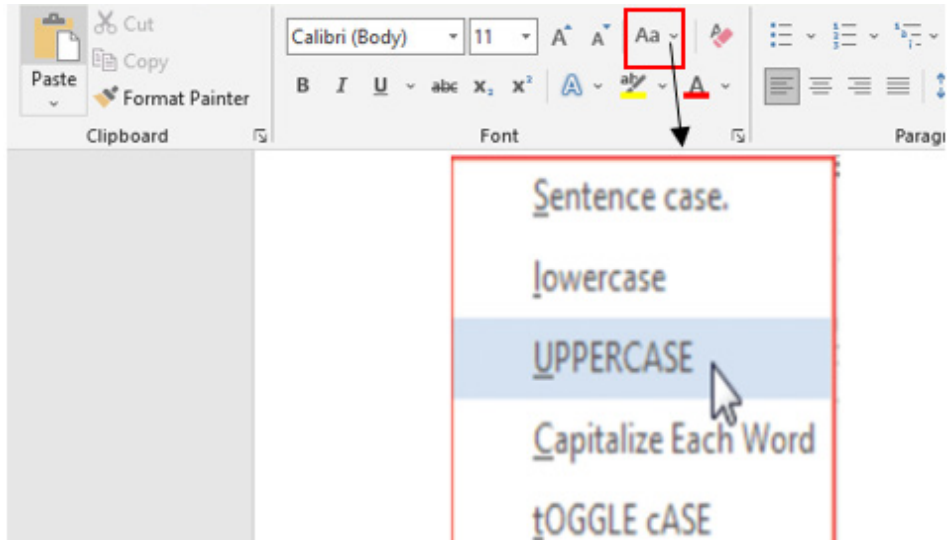


Figure 2. 4. Window used to change the text case

- **Sentence case:** It capitalizes the first letter of each sentence.
- **Uppercase:** It capitalizes all the all letters of your text.
- **Capitalize Each Word:** It capitalizes the first letter of each word.
- **Toggle Case:** It allows you to shift between two case views, e.g. to shift between Capitalize Each Word and cAPITALIZE eACH wORD .

### 2.1.5 Making text Bold, Italic, and Underlined

The Bold, Italic, and Underline commands are used to help draw attention to important words or phrases. To make text have these attributes do the following:

1. Select the text to modify.
2. On the Home tab, click the Bold (B), Italic (I), or Underline (U) commands in the Font group
3. The selected text will be modified and made bold, italic and underlined as in the next image if all the corresponding icons were clicked on as shown below.

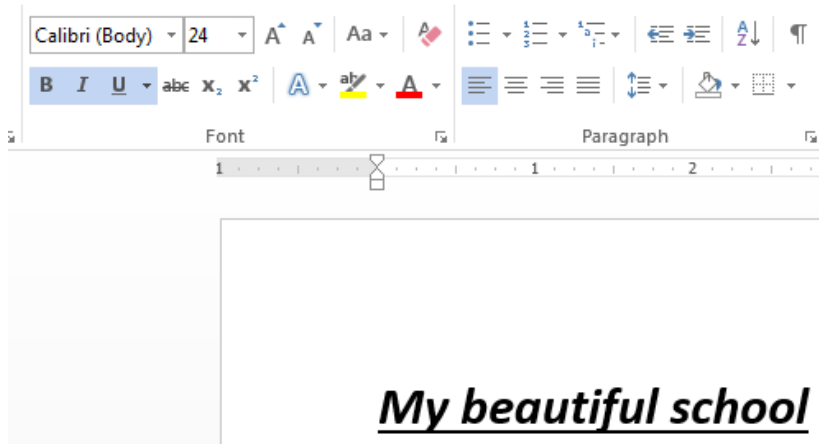


Figure 2. 5. Tools used to make text bold, underlined and italic

The functions of the used commands are given below:

- **Bold:** It allows to make the text bold
- **Italic:** It allows to italicize the text
- **Underline:** It allows to underline the text

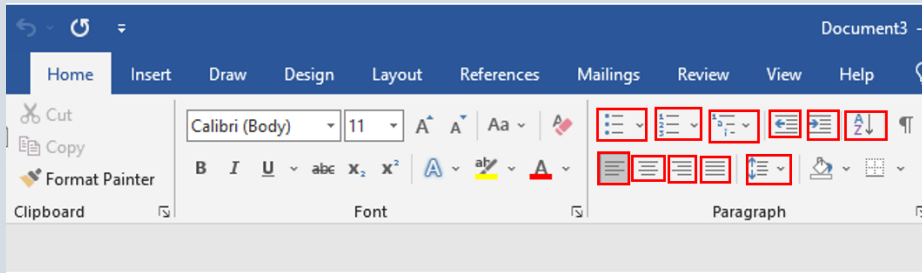


### Application activity 2.1

1. What is the function of the following command in a Word document?
  - b) (a) Font size, (b) Font color, (c) Font style, (d) Bold, (e) italic, (f) Change case
3. 2. Write at least four lines of text which describes "Your education background "and do the following:
  - iv) Change font type of the first and second sentences to "Poor Richard", font size to "14", font color to "Blue" and make the sentences italic.
  - v) Change the third and fourth sentence to the font type" Tahoma", font size "12", font color "Red" and underline those sentences.

## 2.2 Paragraph formatting

1. Open the new document of Ms word and type the descriptions of each tool commands which are highlighted in the window below



2. In Word Processing, type a text which describes the importance computer security in different fields. Apply the desire font type, font color and italic to make that document more attractiveApply on the text a line spacing of 1.0

A Paragraph format contains one or more lines with a combination of words, numbers and other characters. They are features used to improve the appearance of an entire paragraph. They include among others Text Alignments, Bullets, Numbering, Multi-Level list, Paragraph Indents, Sorting Text, Line Spacing and many others.

### 2.2.1. Text Alignment

It refers to the arrangement of text relative to the left or right margin of a page. There are four types of alignments namely: Left, Right, Centre and Justified alignments

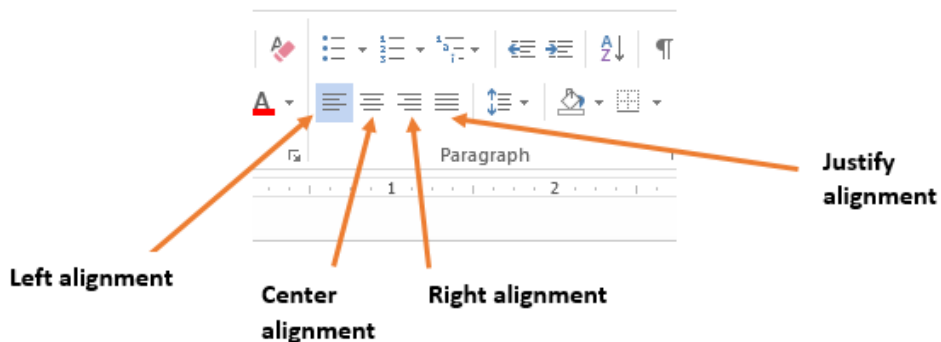


Figure 2. 6. Different alignments in Word

## Steps:

1. Select the text that needs to be aligned
2. On the **Home** tab, in the **Paragraph** group click either Align Left , Align Right, Center or Justify command

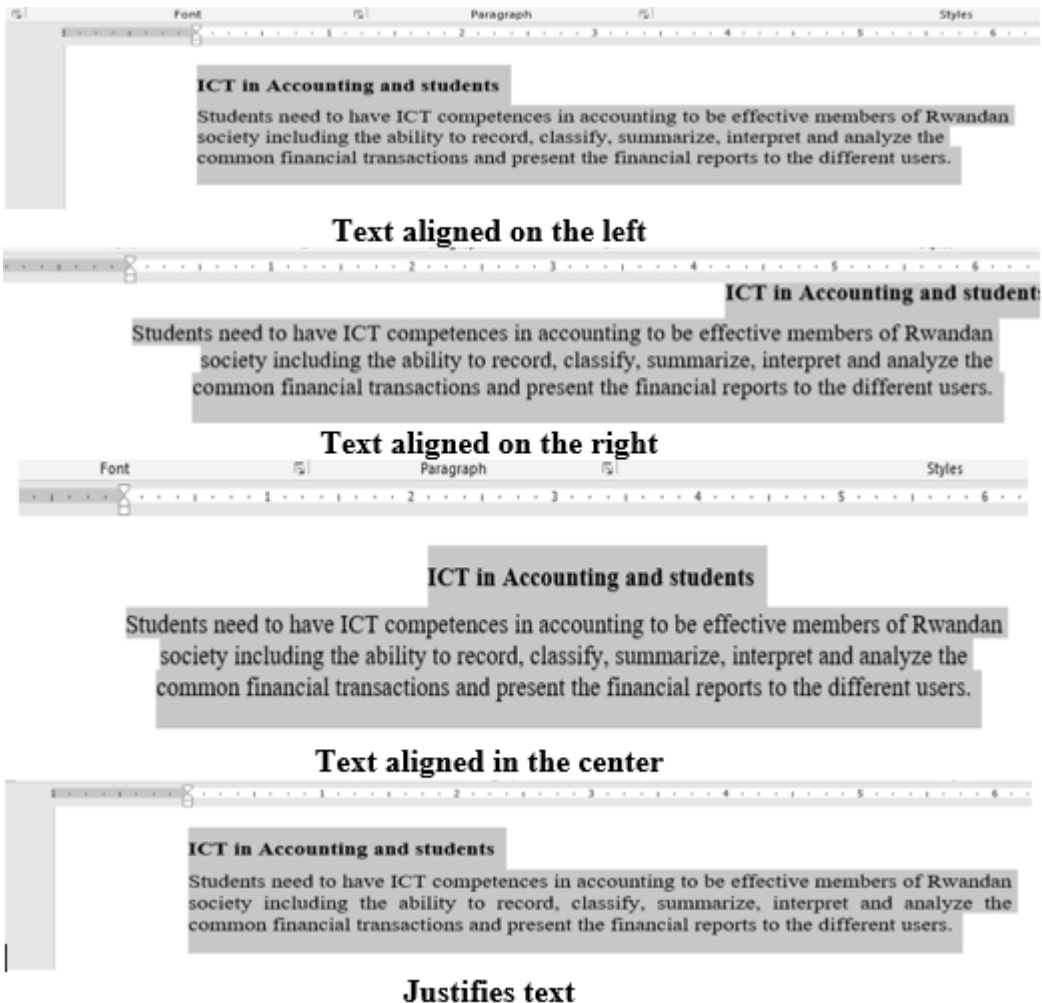


Figure 2. 7. Different alignments that can be applied in Word

## 2.2.2 Line and Paragraph Spacing

Line spacing determines the amount of vertical space between lines of text. Microsoft Word uses single line spacing by default. The selected line spacing will affect all lines of text in the selected paragraph or in the paragraph that contains the insertion point.

To set a paragraph spacing follow these steps:

- Select all of the paragraphs for which the spacing is to be changed (or

place the insertion point anywhere in a single paragraph that needs to be changed).

- On the **Home** tab, click the “**Line and Paragraph Spacing**” command.
- Choose the line spacing among the different options

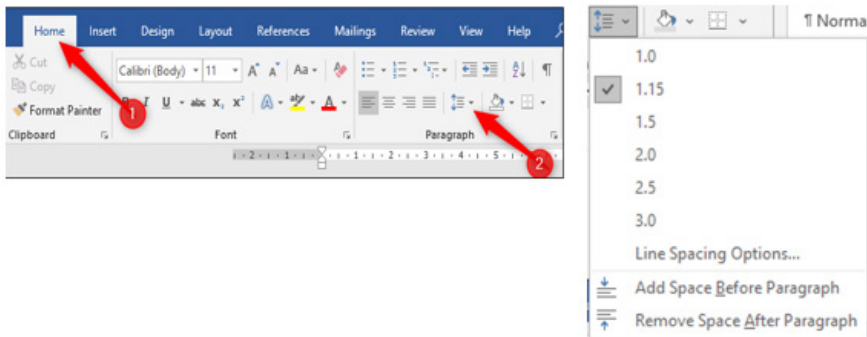


Figure 2. 8. Steps to follow to set line spacing

The line spacing is shown in multiples. “2.0” is double spacing, “3.0” is triple spacing, and so on. Select the line spacing needed and Word applies it to the selected paragraphs.

There is a way to choose another spacing, or revert to the original spacing, click the “Line and Paragraph Spacing” option again and select a different line spacing.

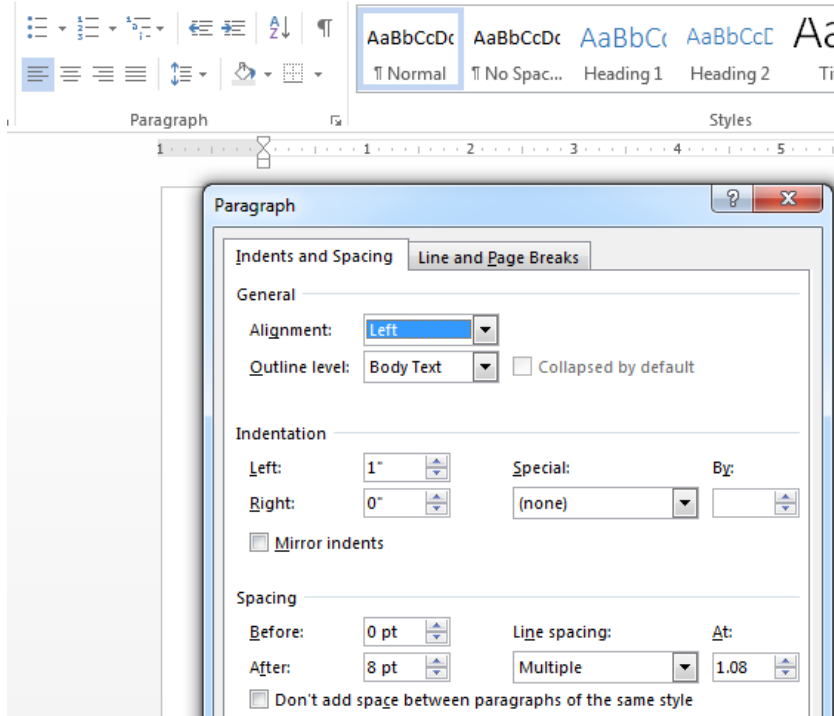
### 2.2.3. Indentation

It is the process of moving text away from the right or left margins by a given interval. There are four different types of indents that can be applied to a paragraph which are detailed in the table below:

Indent type	Results
First Line indent	Indents just the first line of a paragraph a specific amount, leaving all other lines in the paragraph alone
Left Line Indent	Indents all the lines of the paragraph a specific distance from the left margin.
Right Line Indent	Indents all the lines of the paragraph a specific distance from the right margin.
Hanging Indent	Indents all the lines of the paragraph a specific distance from the left margin except the first line

**i) To Create a Left Line Indent follow the following steps:**

- 1) Position the cursor anywhere in the first paragraph of the document
- 2) In the **Home tab**, click on the icon on the right bottom corner of the **Paragraph group (Paragraph Settings)**
- 3) In the dialog box that appears next to **Alignment** option, click on the drop down arrow and choose **Left**. The other options available when the drop down arrow is clicked are Right, Centered and Justified



*Figure 2. 9. Setting the left line indent*

- 4) In the **Indentation** options, increase the Left Indentation to 1 inch by clicking the Up-scroll arrow
- 5) In the Spacing options, select the spacing to apply
- 6) To apply the new changes click OK

Note that all the lines from the left side of the first paragraph moved over 1 inch.

**ii) To Create a Right Line Indent follow these steps**

- 1) Position the cursor anywhere in the first paragraph of the document
- 2) In the **Home tab**, click on the **Paragraph Settings** icon from **Paragraph** group

- 3) In the new dialog box, next to **Alignment** options click on the drop down arrow and choose **Right**.
- 4) Increase the indentation to the size needed
- 5) Click OK to apply the new changes.

## 2.2.3 Bullets and Numbering

Bullets or numbering are used for a list. It is possible to apply automatically simple bullets and numbering to lists in the document as it is being written.

**i) To create a bulleted list in Microsoft Word, follow the steps below:**

1. Position the cursor where the bulleted list will be inserted.
2. On the Home tab, click the **Bullets** tool. A bullet should appear.

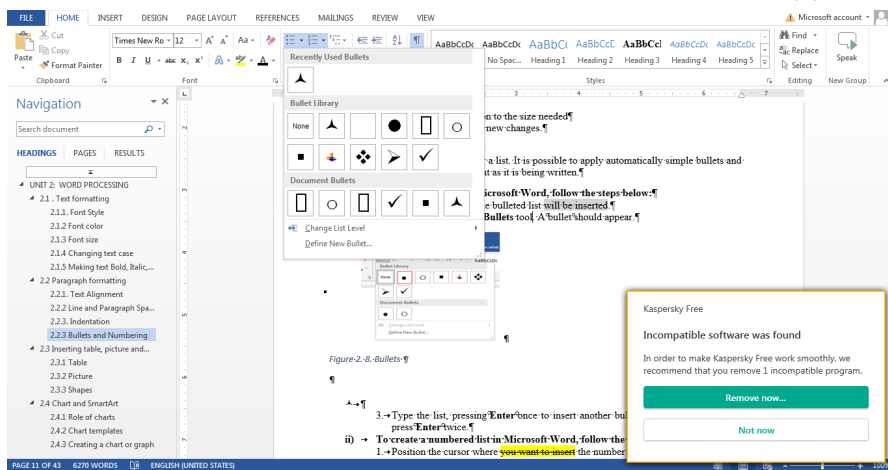


Figure 2. 10. Different bullets that can be applied in Word

3. Type the list, pressing **Enter** once to insert another bullet. When finished, simply press **Enter** twice.

**ii) To create a numbered list in Microsoft Word, follow the steps below.**

1. Position the cursor where the numbered list will be inserted.
2. In the Home tab, click the **Numbering** tool. A number One should appear.

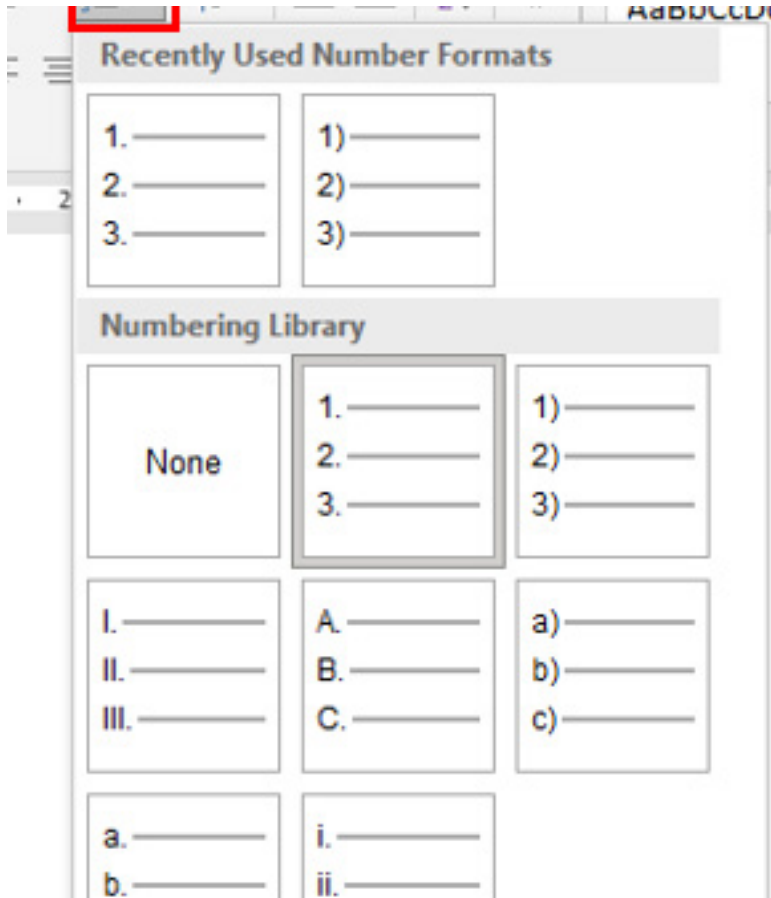


Figure 2. 11. Different numbering styles

### iii) Multilevel numbering

Multilevel numbering creates a numbering system in which some numbers are embedded among others therefore creating a logical hierarchy.

- How to set up multilevel numbering

Before applying multilevel numbering to a document, firstly apply heading style to the heading text.

1. Select the text on which the numbering is to be applied
2. In the **Home** tab, click the **Multilevel numbering** icon in the **Paragraph** group.
3. There is an option to select an existing layout from the list to use as a starting point, or create a new numbering system from scratch. As you hover over each thumbnail image, Word provides a larger image of the numbering system.



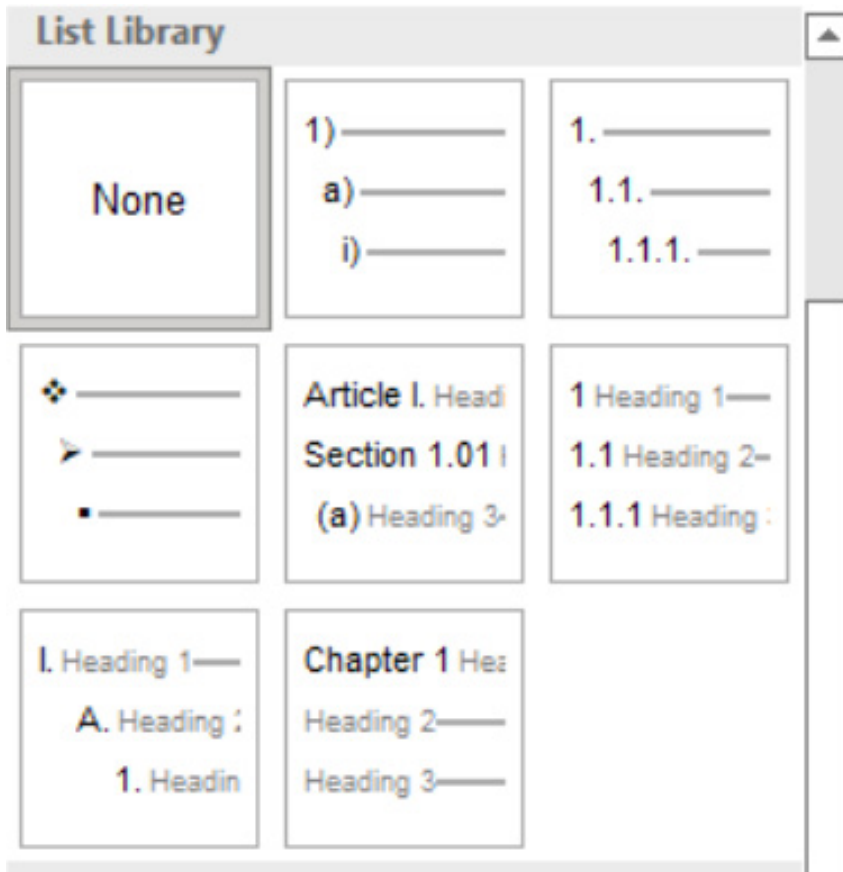


Figure 2. 12. Multi level list



## Application activity 2.2

1. Type text in word processing software which describe your school.

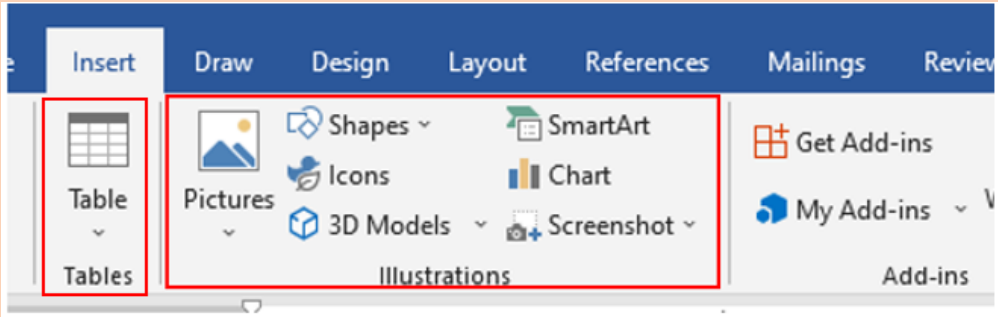
The first paragraph talks about school background, the second about school Vision and weekly school schedule Save it as “Education” and do the following

- b) Apply on the text a line spacing of 1.0
  - c) Apply Right indent to the left on your first paragraph (school background)
  - d) Apply left indent to the Right on your Second paragraph (school Vision)
  - e) Apply the numbered list for weekly school schedule paragraph
  - f) With bulleted list, retype the name of commands labeled by numbers in activity 2.1
1. Select your school background then do the following:
    - a) Indent the first sentence,
    - b) Change the font type to “Time New Roman “, size =”12”, line spacing =”2.0
    - c) Change alignment from Left to Justified alignment

## 2.3. Inserting table, picture and Shapes

### Activity 2.3

By doing a research, discuss the tools used in Word shown in the screenshot below:



MS Word allows for the insertion of many objects like Tables, Pictures, Shapes equations, Symbols, Word Art. These objects make a document more beautiful and easy to understand. Those different objects are inserted in a document by using the Insert tab.

### 2.3.1 Table

A table is a feature that is used to present information in an organized layout consisting of rows and columns which intersect to make a Cell. To create a table, first determine how many columns and rows that it will have. In Word, the tool to make a table will look like the one shown below:

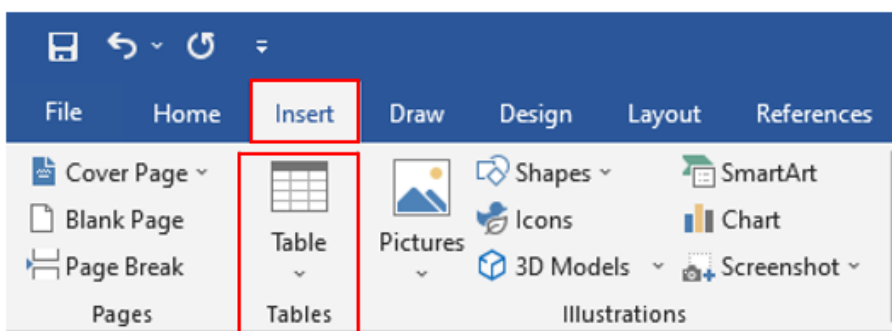


Figure 2. 13. Steps used to create a table

#### i) Inserting a table in document

There are two ways of creating a table namely: Using the Graphic Grid and Using the Insert Table feature.

### a) Using the Graphic Grid

1. Position the cursor where the table is to be inserted.
2. Click on the **Insert tab**,
3. Click the **Table tool** and select the number of rows and columns that are needed.
4. Use the grid to select how many columns and rows are needed. Choose the number of columns and rows by dragging the mouse across the grid and then clicking the left mouse button on the lowest right square.

### b) Using the Insert Table feature

- On the **Insert tab**, click the **Table** tool
- Click on **Insert Table** option
- In the dialog box that appears write the number of rows and columns and click OK

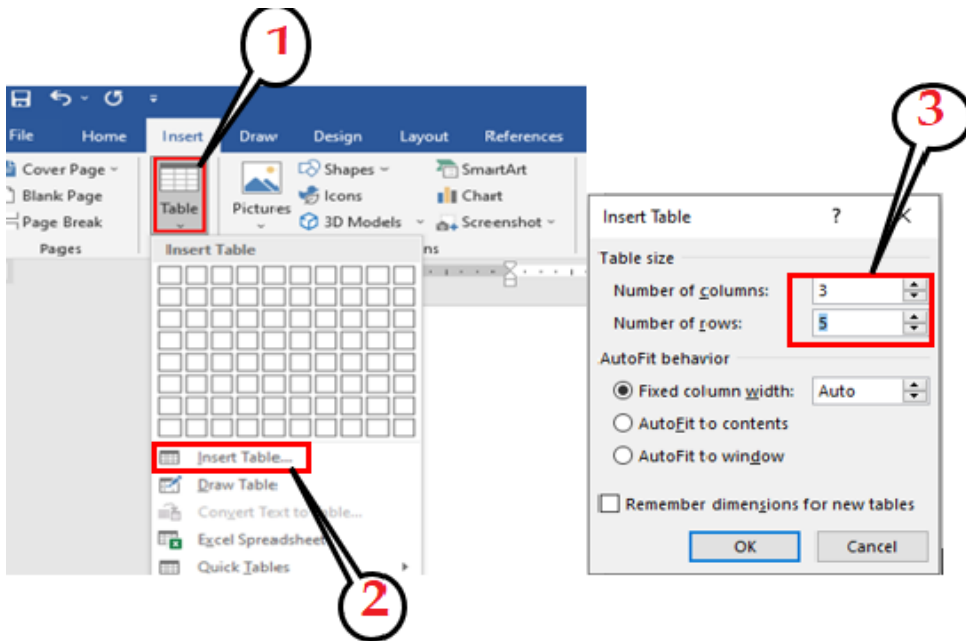


Figure 2. 14. Steps to use the Insert Table feature

### ii Add a Row or Column

To add a new column or row in an already created table do the following:

Place the cursor in any cell within the column or the cell next to which the new

1. Place the cursor in any cell within the column or the cell next to which the new column or row will be created and do a Right Click.

2. In the options that will appear click on **Insert**
3. Next to **Insert** option click on one of the insert options like Insert Columns to the Left. The Insert column/row options are shown in the window below:

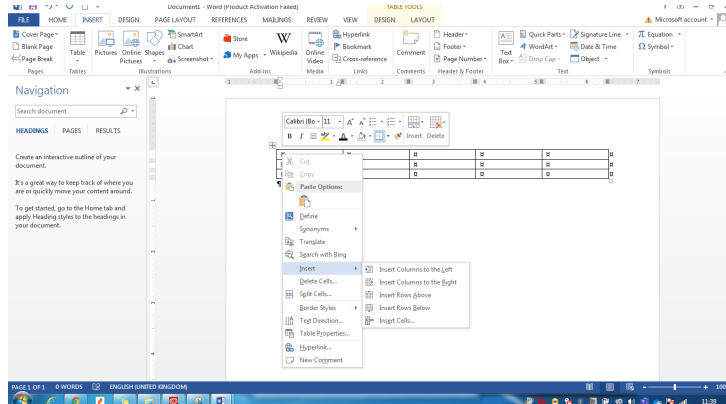


Figure 2. 15. Different Insert Columns and Insert Rows options

### iii>Delete a table Row or Column

There is an option of deleting a row or a column which is not needed in the created table. To do it follow these steps:

#### To delete a row:

1. Select the row to delete
2. Do a Right Click and click on Delete Rows

#### To delete a column:

1. Select the column to delete
2. Do a Right Click and click on Delete Columns

### Formatting a table

Formatting a table is to give specific properties to a table, cell, row or columns depending on what the user wants.

#### a) Merging Cells and Splitting Cells.

**Merge Cells** command is used to combine more than one cells to appear as one large cell while **Split cells** command is used to divide a cell into more than one cells to make it appear as many different cells.

### The following is the procedure for merging cells:

1. Select the cells to be merged.
2. Do a Right Click and choose Merge Cells.

### For splitting cells, do the following:

- a) Position the cursor in the cell to be split.
- b) Do a Right Click and choose Split Cells.

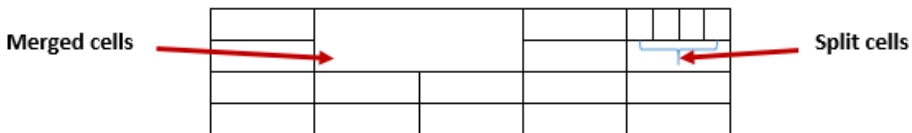


Figure 2. 16. Example of merged cells and split cells

### 2.3.2. Picture

Images of picture that are generated by a computer are called computer graphics. Examples are photographs, drawings, line art, mathematical graphs, line graphs, charts, diagrams, typography, numbers, symbols, geometric designs, maps, engineering drawings, or other images. Graphics often combine text, illustration, and color. A picture can be inserted from the Internet or from an existing file.

#### a) Inserting pictures from the Internet

- 1) Position the insertion point where the picture is to be inserted.
- 2) Click **Insert tab** from the menu bar in the **Illustrations group** and click **Online Pictures** icon.

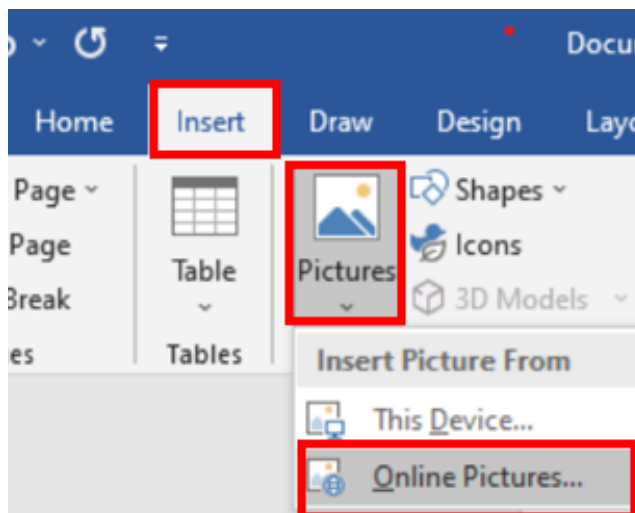


Figure 2. 17. Steps to follow in inserting an online picture

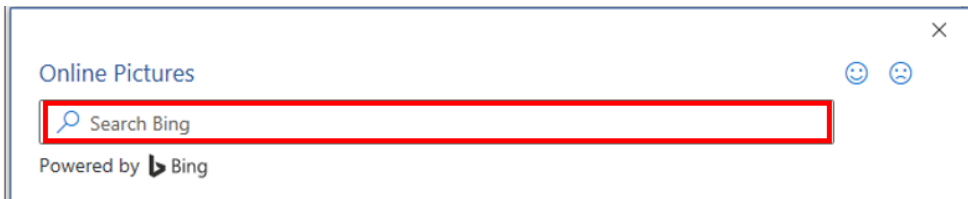


Figure 2. 18. Search box for searching an online picture

- 3) If there is Internet connection, a dialog box is displayed
- 4) Type the name of the image to be located in the box provided.
- 5) Click on Go button to display the result on the window
- 6) Click on the desired image then select Insert button

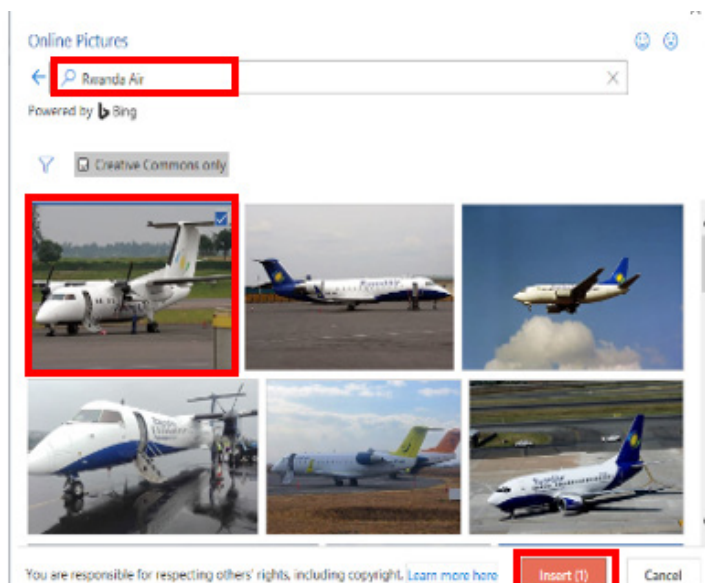


Figure 2. 19. Different online pictures ready to be inserted

### b) Inserting pictures from an existing file

To insert a picture from an existing file is done by following these steps:

- In the **Insert tab** click on Pictures
- Browse in the computer folders the images to insert and click on **Insert** button

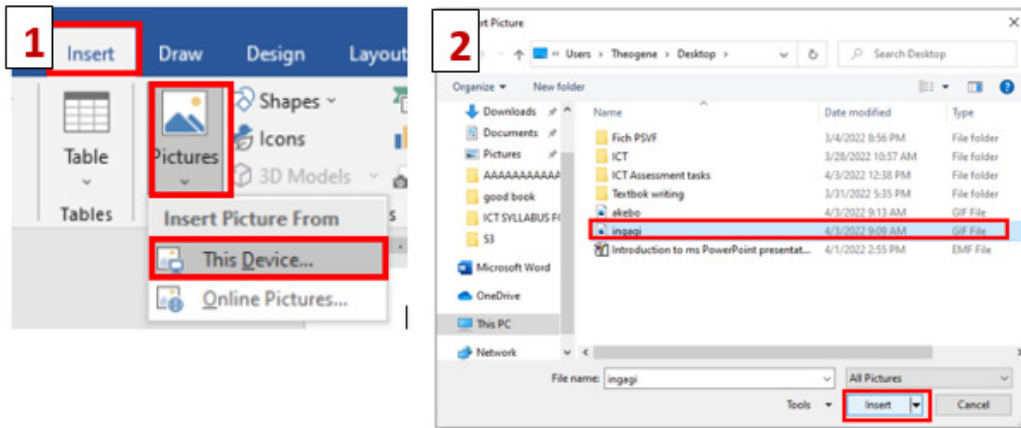


Figure 2. 20. Windows used to insert a picture located on a computer

## b) Cropping a picture

Cropping a picture is to reduce the size of that picture by removing undesirable or unnecessary elements.

**Cropping an image is done in the following way:**

- i) Select the picture by clicking it
- ii) Click the **Format** tab in the Picture Tools ribbon group.
- iii) Click the **Crop** tool.

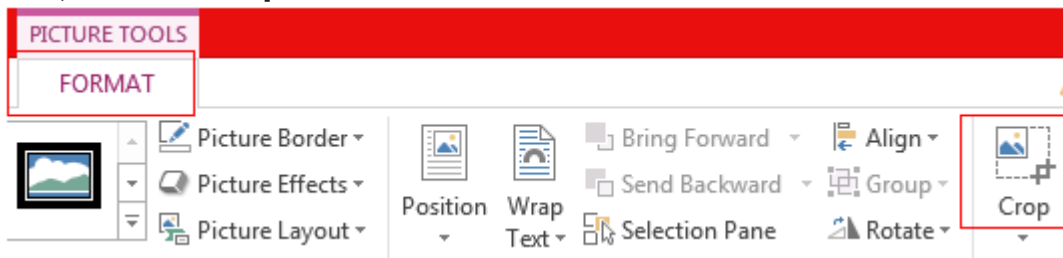


Figure 2. 21. Accessing the Word Cropping tool

- i) Crop handles appear on the sides and corners of the image. Hold down the left button of the mouse and displace the mouse depending on how you want to crop the image
- ii) Click and drag the crop handles where you want to crop.
- iii) To crop all four sides of a picture or graphic at once while maintaining the graphic's proportions, press and hold down **Ctrl** as you drag the handles.
- iv) Click the **Crop** button again when you're finished setting the crop area





Figure 2. 22. Image ready to be cropped (left) and after being cropped (right)

### 2.3.3. Shapes

A shape or figure is a graphical representation of an object or its external boundary, outline, or external surface, as opposed to other properties such as color, texture, or material type.

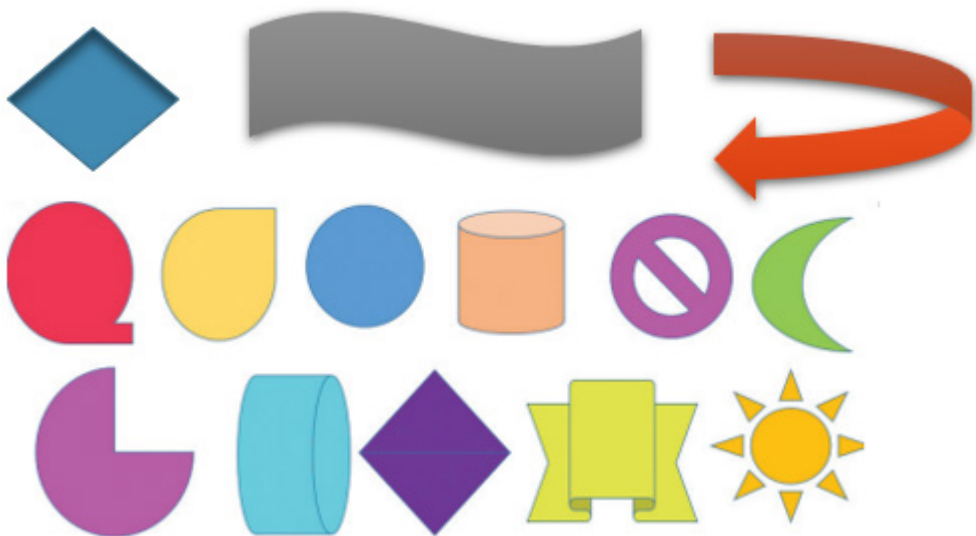

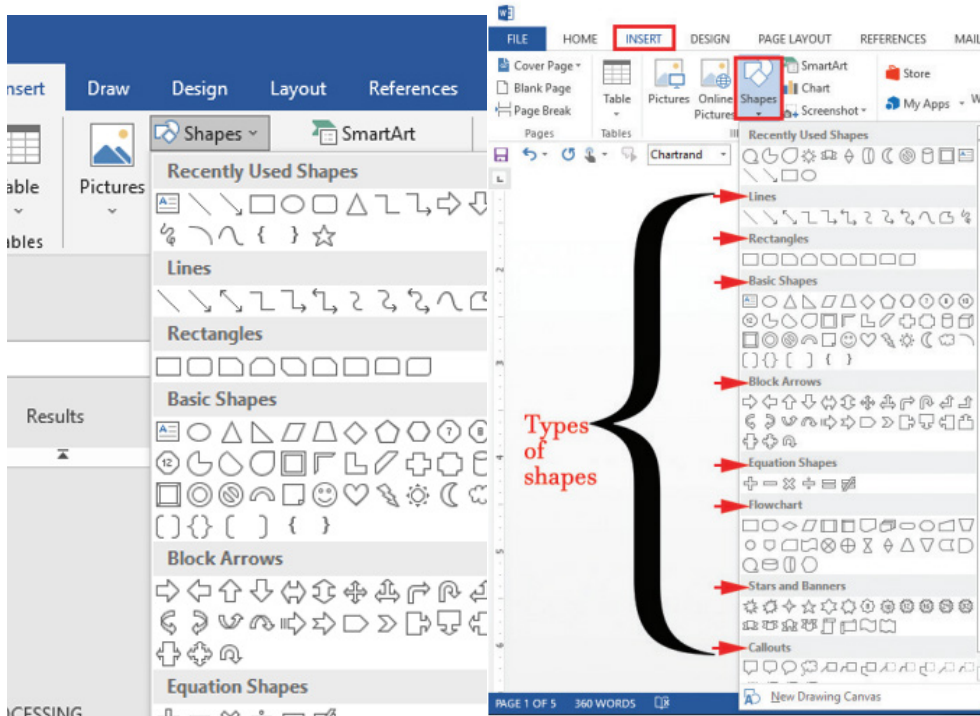


Figure 2. 23. Different shapes that can be used in a Word document

#### i) Adding shapes

Various shapes can be added in a Word document then formatted as required by the user. Follow these steps to insert shapes

1. Click on Insert tab from the menu bar,
2. Click **Shapes** icon  from **Illustration** group. Different types of shapes appear as shown in the figure below



3. Click on the desired shape
4. Position the pointer at the desired area of the document and drag it in the desired direction to draw the shape by using the pointer which has now changed to a plus sign.

### ii) **Formatting Shapes**

To format in this case means to arrange it in the desired way. Some formatting styles that can be applied on a shape include the following: changing the shape; rotating the shape to an angle; and grouping a number of shapes into one image.



1. Click the Shape Fill  button from **Shape styles in shape format** and select a color to change the shape's fill color.
2. Click the Shape Outline  button and select a color and weight for the shape's outline, as well as dash and arrow styles.



Figure 2. 24. A shape and its formatted version


Click the Shape Effects button  and select a shape effect, such as shadow, glow, or bevel.



Figure 2. 25. Different shape effects

1. Select a shape style preset from the Shape Styles gallery. Click the gallery's More button to see more presets

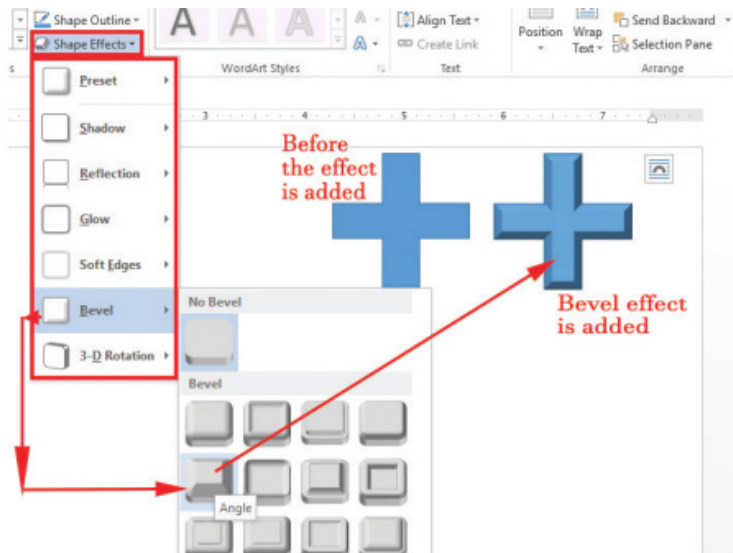


Figure 2. 26. Drawing tools options for editing



### Application activity 2.3

1. Use the Graphic Grid create the following table and save it as **table 1**

Name	Class	House
Komera	S2A	Muhanga
Keza	S2B	Huye
Kalisa	S2A	Rubavu
Nyamahoro	S2B	Gatsibo

- a) Insert three columns to the right of the column containing house.
- b) Add two rows after the row containing Nyamahoro details.
- c) Add another row on top and include the title "Examination Analysis"
- d) Save it as Table 2.
- e) Delete Nyamahoro's details.
- f) Add the following details in the three columns added: Column 1(History, 67, 89, 98), Column 2 (Business, 77, 56, 34) and column 3 (English, 74, 87, 65)
- g) Merge the cells containing the title.
- h) Split the cell containing the name Habimana into two.
- i) Save it as MyTable.

### Activity 2.4



In the table below there is the price of a certain goods which increased from 2005 to 2022 as shown in the table below:

How the above information could be interpreted without using table?

## 2.4 Chart and SmartArt

Smart charts are **the charts by which we can show numerical facts in visual form**. It shows the relationship between two or more numbers or quantities. It generally uses a tabular form, bar charts, line charts, pie charts, or pictographs to display data

The Role of charts is: the following

- Charts are used to summarize and display information in an easy manner to understand.
- Charts act as useful tools for conveying financial information.
- They are used to make patterns and trends in numerical order much easier to see.
- Charts facilitate data analysis.

### 2.4.1. Chart templates

#### a) Bar Chart (Bar graph)

A bar chart is a graphic representation of data with horizontal bars or objects. Bar charts usually display horizontal bars or objects going across the chart vertically, with the values displayed at the bottom of the chart.

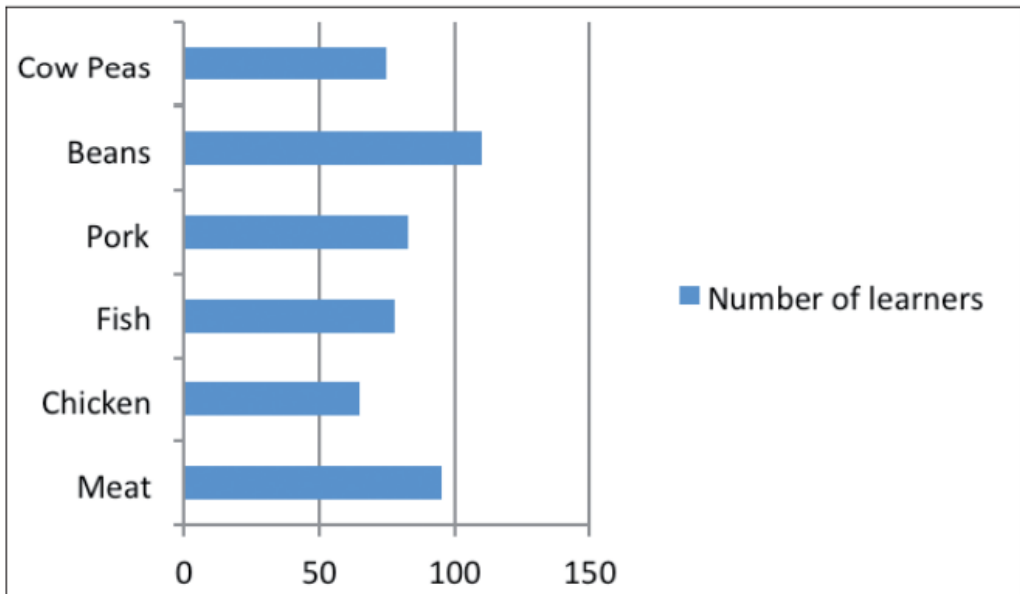


Figure 2. 27. An example of a bar chart

## b) Column Chart

A column chart is a graphic representation of data with vertical bars or objects. Column charts display vertical bars (categories) going across the chart horizontally (along the horizontal axis), with the values organized along the vertical axis (on the left side of the chart).

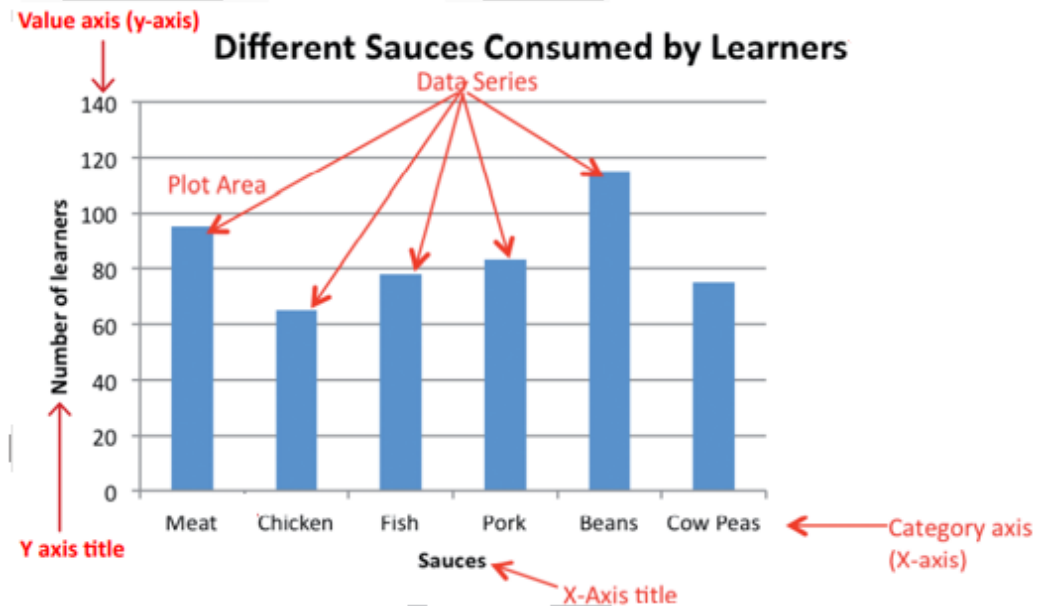


Figure 2. 28. Different parts of a column chart

## c) Line Chart (Line Graph)

A line chart is a graphic representation of data plotted using a series of lines. Line charts display lines going across the chart horizontally, with the values axis being displayed on the vertical axis (left side of the chart).

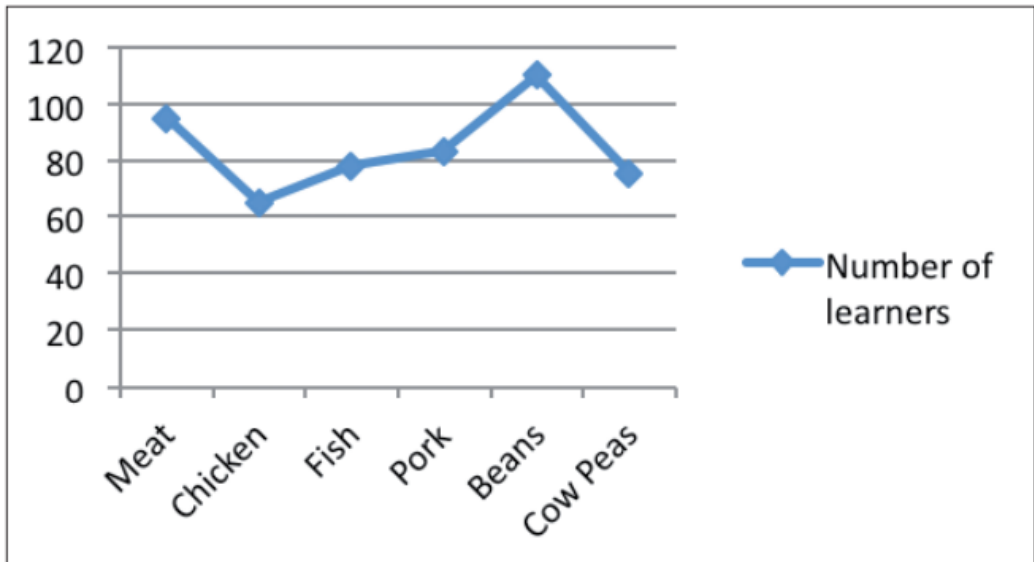


Figure 2. 29. An example of a line chart

#### d) Pie chart

This is a circular chart sliced into sections; each section represents a percentage of the whole. Pie charts do not display horizontal and vertical axes as other charts.

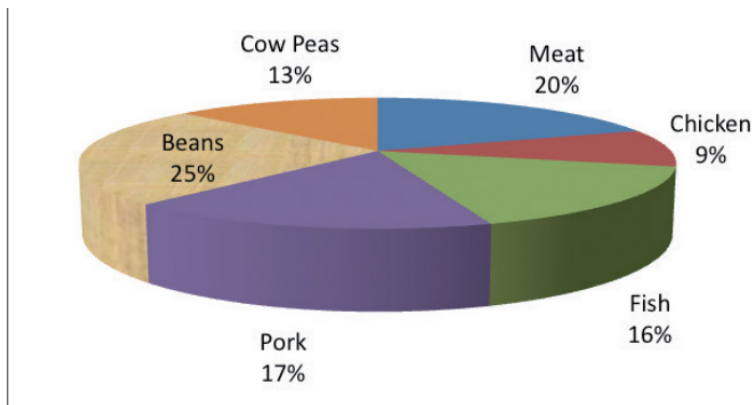


Figure 2. 30. An example of a Pie Chart

### 2.4.2. Creating a chart or graph

1. Prepare the data that is going to be used in making the chart
2. In Word, click where the chart will be placed.
3. On the Insert tab, in the Illustrations group click Chart.
4. Click on the type of chart to be inserted

1. The inserted chart is a default one. Edit the chart data so as to have the needed chart

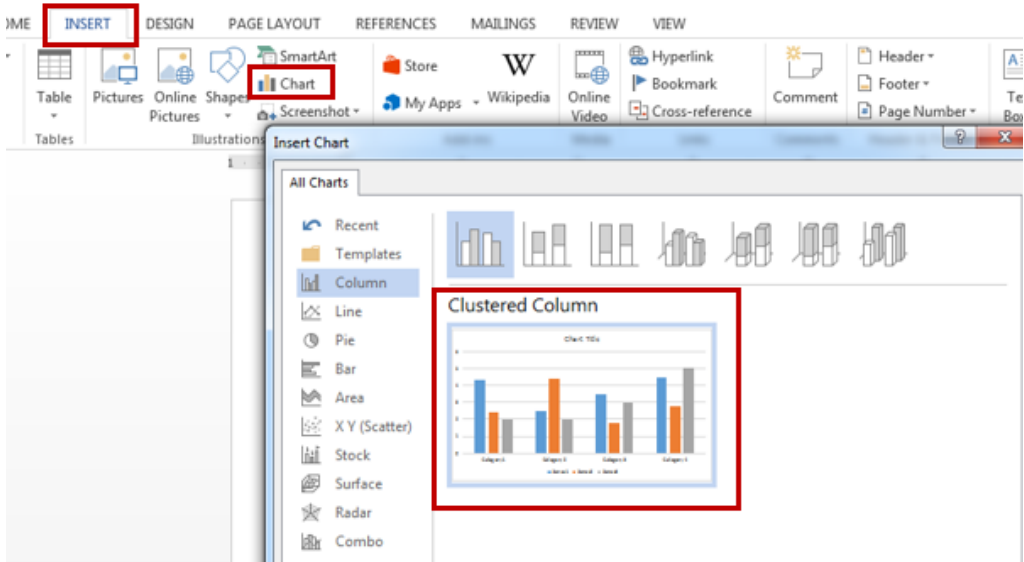


Figure 2. 31. Window showing how a chart is inserted

	A	B	C	D
		Series 1	Series 2	Series 3
Category 1		4.3	2.4	2
Category 2		2.5	4.4	2
Category 3		3.5	1.8	3
Category 4		4.5	2.8	5

Figure 2. 32. Edit this table to have a customized chart

### 2.4.3. Insert Smart Art Graphics

SmartArt is a picture used to communicate information in many different ways. It is an option that allows the user to create diagrams easily. Inserting Smart Art Graphics in a document is another way to communicate effectively the a message. Smart Art Graphics are :a list, process flow, cycle, a relationship or an organization hierarchy, Matrix Pyramid and chart. The steps to insert smart art graphics are outlined below:

1. Place the insertion point in the document where the SmartArt graphic will appear.
2. From the **Insert** tab, select the **SmartArt** command in the **Illustrations** group.



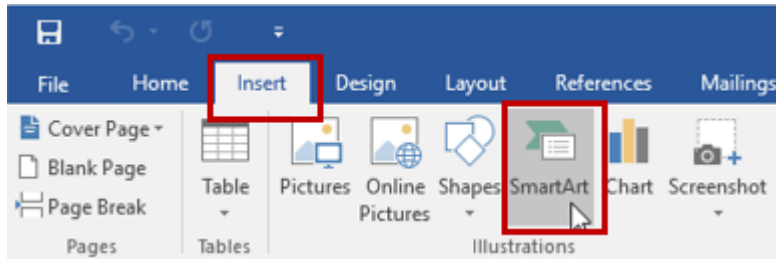


Figure 2. 33. Tools to be used in inserting a SmartArt

3. A dialog box will appear. Select a category on the left, choose the desired SmartArt graphic, then click OK.

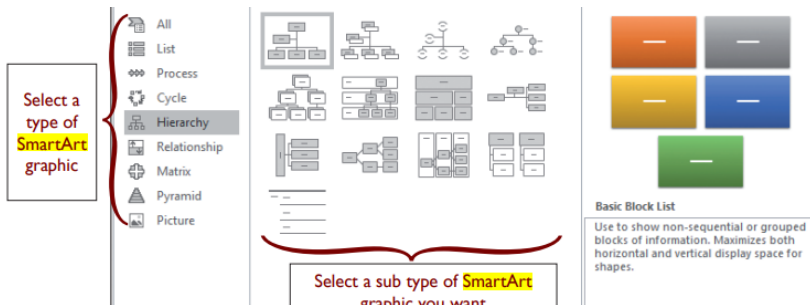


Figure 2. 34. Smart Art types and subtypes

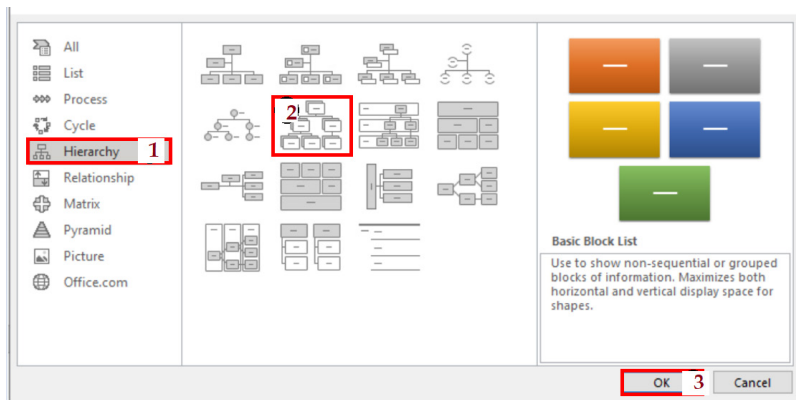
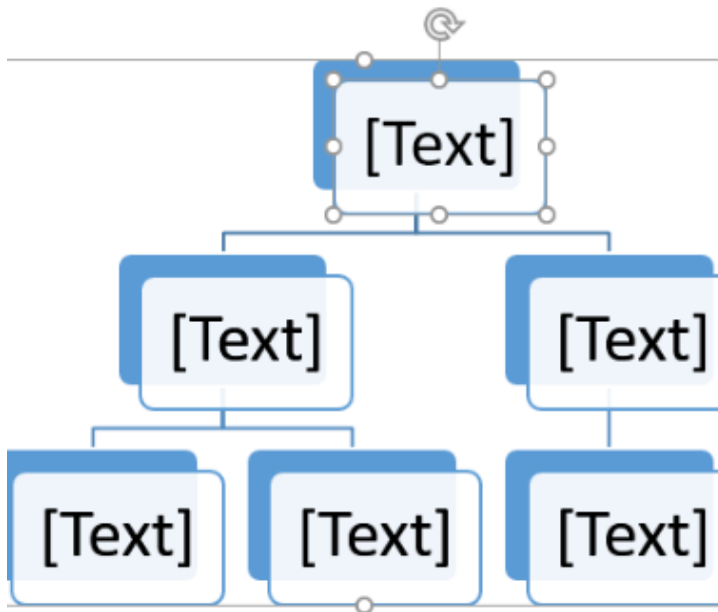


Figure 2. 35. Steps for inserting a Smart Art object



*Figure 2. 36. an example of a hierarchical smart graphic art*

5. Select the SmartArt graphic. The **text pane** should appear on the left side. If it doesn't appear, click the small arrow on the left edge of the graphic.
6. Enter text next to each bullet in the text pane. The text will appear in the corresponding shape. It will be resized automatically to fit inside the shape.



## Application activity 2.4

1. S4 Accounting class has a total of 120 students. The class teacher carried out a data survey to find out how many students regularly eat meat, pork, chicken or fish at home. The data below in the below table was collected

Sauce	Number of learners
Meat	75
Chicken	45
Fish	58
Pork	77
Beans	115
Cow Peas	65

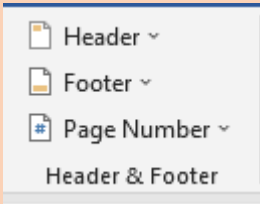
- a) Use the data given in the table above to create a clustered bar chart
  - b) On the chart created change the chart titles and Axis titles to make them reflect the kind of data they show.
- 2) Below are the data of old persons in 10 Rwanda Districts as published on [igihe.com](http://igihe.com) in its article of 7th December 2018. Represent those data using Pie chart.

1. Gicumbi: 22, 452
2. Nyamasheke: 21, 542
3. Rusizi: 20, 770
4. Gakenke: 20, 715
5. Nyamagabe: 20, 121
6. Gatsibo: 19, 770
7. Huye: 19, 444
8. Muhanga: 18, 917
9. Nyanza: 18, 604
10. Burera: 18, 580

## Activity 2.5



3) Observe the screenshot below taken from Word



- What among those the options shown on that screen is used to insert headers in a Word document
- Differentiate the terms Header and Footer as used in a Word document
- What is the importance of headers and footers in a document

A **header** is a section of the document that appears in the **top margin**, while the **footer** is a section of the document that appears in the **bottom margin**.

Headers and footers generally contain additional information such as **page numbers, dates, an author's name, and footnotes**, which can help keep longer documents organized and make them easier to read. Text entered in the header or footer will appear on **each page** of the document.

### 2.5.1 Insert header and footer

To insert a header and footer in Ms word follow steps given below:

- Click on the **Insert** tab at the top of the Ribbon
- Click on **either Header or Footer** drop-down menu in the **Header & Footer** section.

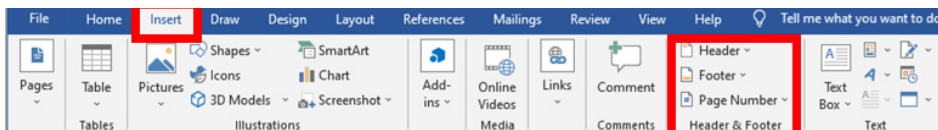


Figure 2. 37. The menu to use in inserting headers and footers

- A Header or Footer drop-down menu will display on the screen with a list of built-in Header or Footer options. Select your desired option from the Built-in list.

4. A **Design** tab with Header & Footer option will appear at the top of the document (on the Ribbon), as shown in the screenshot below.

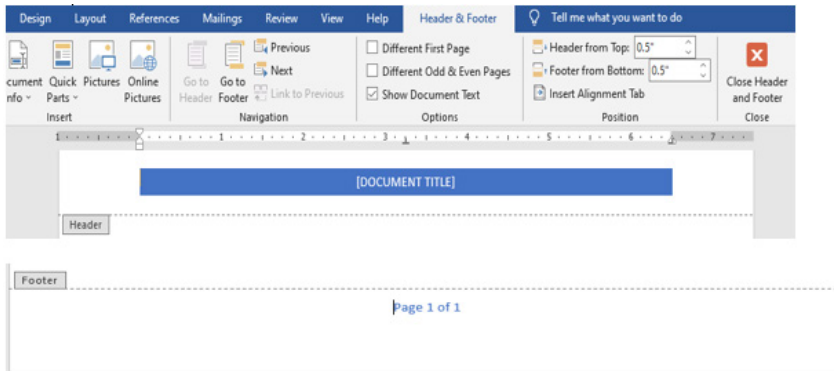


Figure 2. 38. Word document with header and footer ready to be inserted

### 2.5.2 Delete Header and Footer from Word document

Position the cursor within the header or footer and press the **Delete** button on the keyboard or

1. Go to the **Insert** tab on the Ribbon and click on the **Header & Footer** option.
2. A Header or Footer dialog will appear on the screen. Click on the **Remove Header** or **Remove Footer** option.

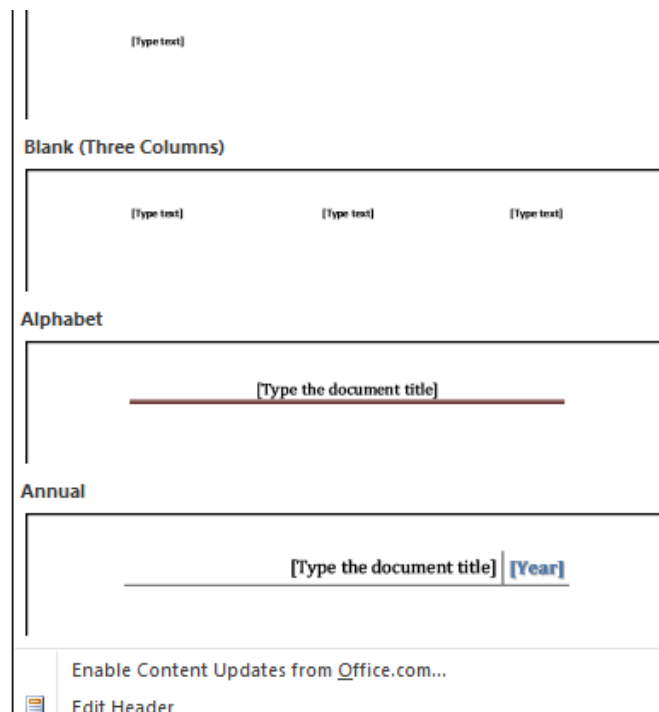


Figure 2. 39. Option to use while removing a header

### 2.5.3 Add page numbers to a document

Follow the following steps to add page numbers to a Word document:

1. Click on **Insert** tab then on **Page Numbering**.
2. Select **Current Position**.
3. Choose a page number style

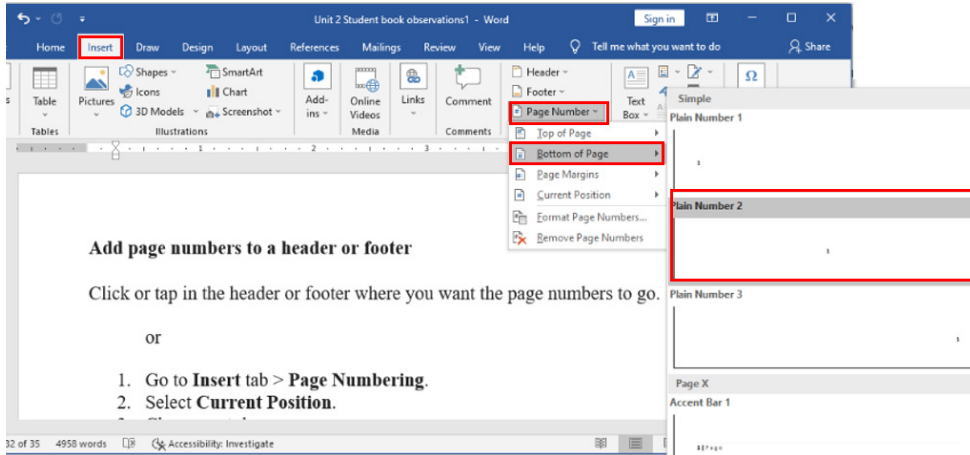


Figure 2. 40. Process to add page numbers to a Word document

**Note:** It is possible to have different formats of page numbers in one document. For example the first part of a document can have letter page numbers while other pages are numbers. Inserting such page numbers is done by inserting sections from the place where the page number format changes.



#### Application activity 2.5

You have a document of at least 5 pages whose content is about your everyday lessons

- a) In that document insert a footer text “Lessons for Senior 4”
- b) Insert page header text “Studying is the key in life”
- c) By doing a research insert page numbers (in letters) i and ii in the first two pages and numbers from those pages

## 6.1 Table of content

### Activity 2.6



Using internet or other available resources Search and prepare a Word document which describe computer hardware and software and save it as “Information and Communication Technology”. Make sure the document has at least 4 pages. Do the following with the created document:

1. Do the following with the created document:
2. Change the Font Type to “Book Antiqua”.
3. Change the Font Size to 12 and Line Spacing =”2.0”
4. Change Heading 1 to “Arial Black” and Font-size =”14”

### 2.6.1. Steps to create a table of content

A table of content is a list titles which are inside a document with the page number where they can those titles can be found. To create a table of content when the document is done in two steps namely creating headings and inserting the table of content.

#### ▪ Creating headings

In a Word document, headings are titles of different weight which have text under them. Word provides different levels of headings starting from heading one which is the highest level in a document. The created heading texts are the ones that will appear in the table of content. Follow these steps to create a heading:

- Select the text and click on the Home tab
- In the Style group Click on Heading 1 (or any other heading)

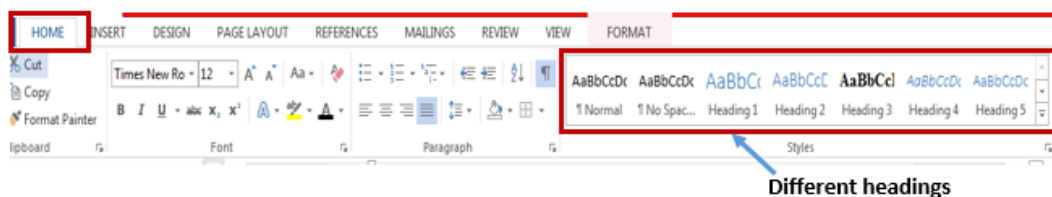


Figure 2. 41. Different headings that can be applied in Word

The heading is different in appearance to other text and to other headings which are not at its level. The font that a heading will have can be changed by:

- Do a right click on the heading to modify and click on Modify
- In the dialog box that appears, choose the new formatting to apply on the heading.
- Inserting a table of content

When all the titles that need to appear in the table of content have been changed into headings, a table of content can now be inserted by following these steps:

- Click where the table of content will appear
- In the References tab click on Table of content
- Choose one format of table of content to apply

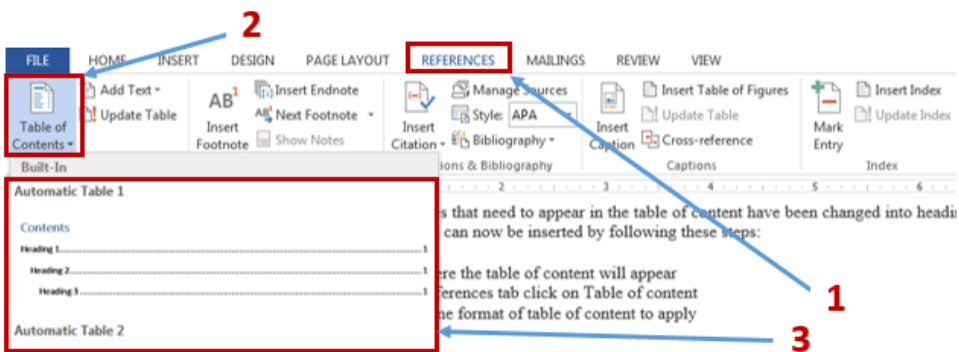


Figure 2. 42. Steps to go through in inserting a table of content

A table of content will be inserted and will appear like in the image below:

Contents	
UNIT 2: WORD PROCESSING .....	2
2.1. Formatting document .....	2
2.1.1. Text Formatting .....	3
(i) Font Style .....	3
(ii) Font color .....	4
(iii) Font size .....	4
(iv) Changing text case .....	5
(v) Making text Bold, Italic, and Underlined .....	6
2.1.2. Paragraph formatting .....	7
(i) Text Alignment .....	7
(ii) Line/Paragraph Spacing .....	9

Figure 2. 43. A created table of content



## 2.6.2 Updating the table of Content

When some headings or titles were added or modified in a document, an update of the table of content is needed.

Below are the steps to follow for making an update of table of contents.

**Step 1:** On the References tab, in the Table of Contents group, click Update Table. Click “Update Table” button in the selected Table of Contents

**Step 2:** In the Update Table of Contents dialog box that displays, select “Update entire table”. The new updated table of contents displays



Figure 2. 44. The different tools used for updating a table of content

Another option is to select the table of content, doing a right click and clicking on Update Field. In the dialog box choose one of the options «**Update page numbers only**» or «**Update entire table**».

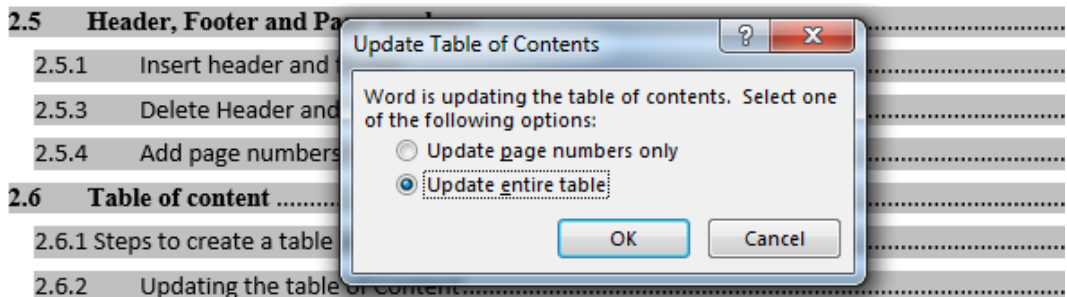


Figure 2. 45. How to update table of content

## 2.6.3. Creating a list of tables and list of figures

When creating a table of figures in a document, Microsoft Word searches for the captions, sorts them by number, and displays them in that document.

Creating captions which will generate a table of figures is done in this way:

Step1: Add Captions to every Table in the document using procedure given below:

1. First select a Table on which a caption is needed.
2. Click “Insert Caption” command on References tab.

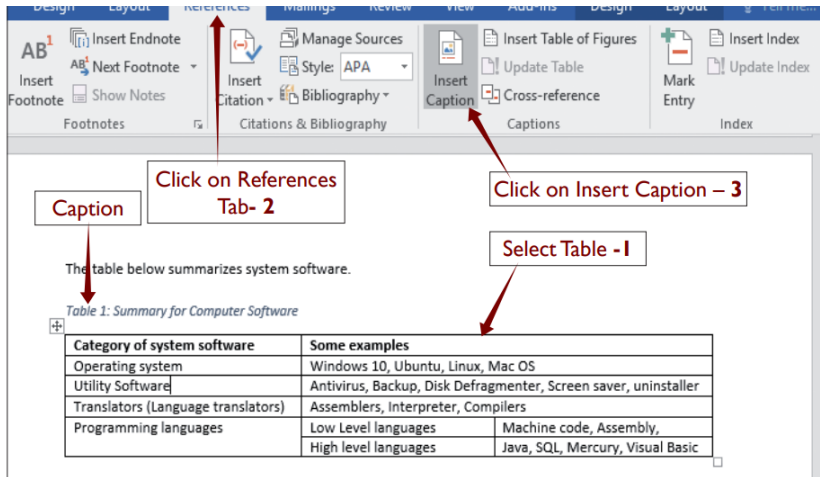


Figure 2. 46. Different steps to make a list of table

3. Edit table caption and click OK.

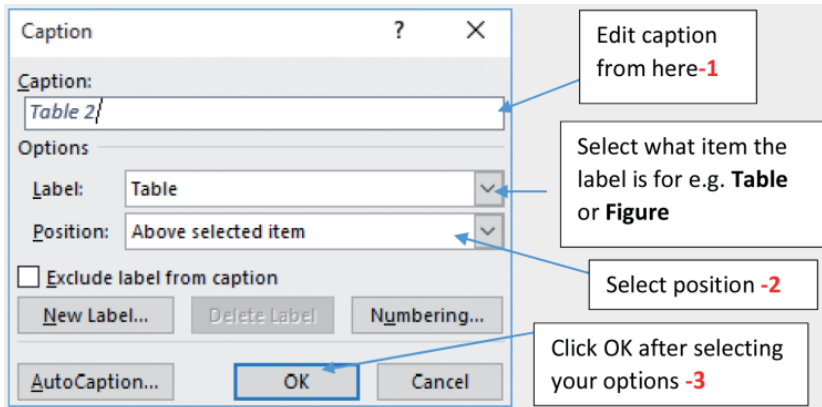


Figure 2. 47. Steps to edit a list of table

4. Repeat the procedure for all the tables in the document

**Step 2:** Click where the Table of Figures will be inserted

**Step 3:** On References Tab in the Captions group, click on Insert Table of Figures to build the table

A Table of figures dialog box will be displayed as shown in the picture below and will automatically be inserted when the OK button is clicked.

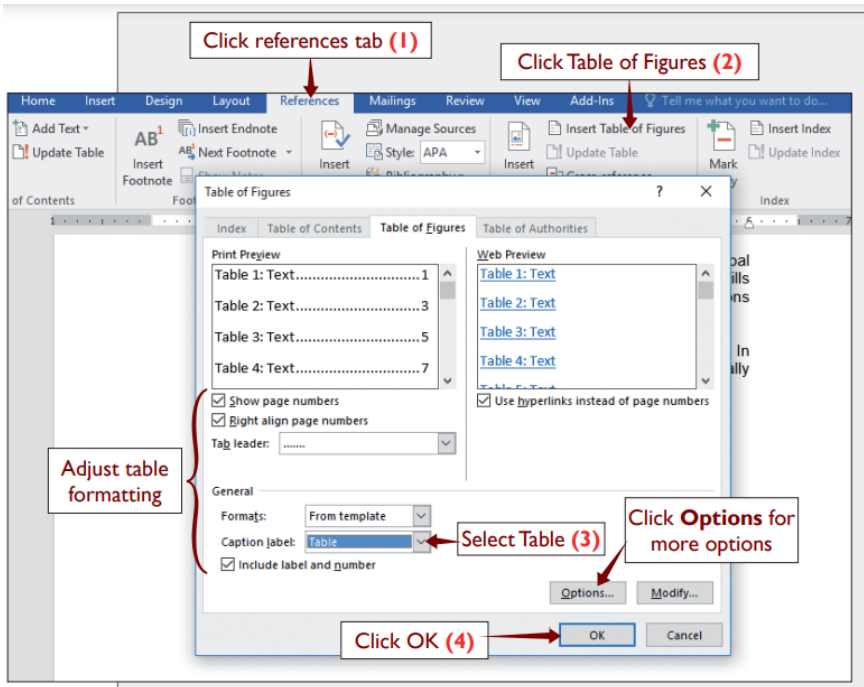


Figure 2. 48. Steps to add a list of figures

**Below are optional steps to take before clicking OK:**

- Adjust Table’s formatting such as setting whether to show page numbers or changing the style of tab leader. Use a preset style from “Formats” drop down menu. In case you want to customize the style, leave it set to “From Template”.
- Click “Modify” and click again “Modify” in the style dialog box to customize the style of the table. You can change the table’s font, size and other settings in the two dialog boxes. Then c



## Application activity 2.5

1. Create a document on ICT which has the following headings:

Computer Hardware (Heading 1). Develop the content on computer hardware by including the following these titles which will be at the level of Heading 2:

- Input Hardware
  - Output hardware
  - Processing hardware
  - Storage hardware
2. Create additional headings in Heading 2 where possible. Those headings will be Heading 3 and Heading 4
  3. Add a new title “SOFTWARE” in the document. Make that title a heading appropriately and in it create other headings. Update your table of content.
  4. Insert a table of content in your document basing on the headings you have created

## Skills Lab 1



Using Microsoft Word write a document about the profile of your school. That profile should include the school's background, current situation and the plan for the future. Where possible include the pictures.





## End of unit assessment 2

According to the above mentioned information, present that process using Smart Art object

- Take school uniforms
  - Go to classroom(S1) where the taken Reg Num is belong
  - According to the Reg Num, search and find the correspondence seat in dining hall and bed in dorm.
1. Use Microsoft Word, type the following document and save it as 'Certificate of Appreciation form'. This document is a certificate and should have a page border as shown below.

<b>School Name</b>
<b>District</b>
<b>Province</b>
<b>ICT CLUB</b>
<i><b>Certificate of Appreciation</b></i>
This is to certify and acknowledge that
.....
has worked hard for the ICT club of the school as a club
.....
for Academic year .....
Your efforts shall always be treasured.
 <i>"Science, conscience and Excellence"</i>
_____
<b>Club Patron</b> <b>Headmaster</b>

- b) a) Use 1.5 line spacing for your work and no space after each paragraph.
- c) b) Make the following changes to the title:
- iv) Change the font of the name of the school to Stencil bold font face, font size 26 and dark blue colour.
- v) Change the second line to font size 16 and bold
- vi) Change the third line to font size 14 and bold.
  - a) Leave enough space between "Province Name" and ICT Club to accommodate a suitable graphic (good image) that will work like your school badge
  - b) Underline the heading, "Certificate of Appreciation" change it to size 20 and color dark red.
  - c) Use blue font color for signatories in font size 15.
  - d) Apply dark red color to page border.



## End of unit assessment 2

1. 2) When a new student of senior one come to GS Karama, the below stages must be applied:
  - Take a picture(Passport photo)
  - Present the bank sleep to school accountant
  - Get registration number(Reg Num)

According to the above mentioned information, present that process using Smart Art objects

- Take school uniforms
- Go to classroom(S1) where the taken Reg Num is belong
- According to the Reg Num, search and find the correspondence seat in dining hall and bed in dorm.

# UNIT 3

## MICROSOFT EXCEL



### Introductory activity

Create the following table in a spreadsheet:

PAYROLL LIST FOR STAFF-January-2022													
No	First Name	Last Name	Position	Category	Basic salary	Allowances		Gross Salary	Deductions			Net salary	
						Transport(5%)	House(15%)		PAYE(8%)	NSSF Pension(2%)	NSSF Insurance(0.5%)		
1	HARINGIRO	Jean Marie Vianney	Director	Administrative	FRW572,888								
2	KABALISA	Rita	Secretary	Administrative	FRW48,000								
3	KANOGESA	Jean Marie Vianney	Accountant	Administrative	FRW675,000								
4	MULISA	Jana	Cashier	Administrative	FRW500,000								
5	IRAMUNDA	Aline	ICT officer	Administrative	FRW720,000								
6	NDIMBARANA	Joseph	Driver	Administrative	FRW250,000								
General Total of January Salary													
Salary average													
					Big salary								

- i) Apply borders as done with the table above
- ii) Enter all data as provided in the table above
- iii) Calculate staff allowances, Gross salary, deductions and Net salary
- iv) Using SUM, AVERAGE, MAX and MIN, calculate the General total of January Salary, Salary average, the staff who gain a big salary and the one who get less salary than others.

### 3.1 Worksheet and workbooks basics

#### Activity 3.1



1. Compare a worksheet and a workbook
2. Outline 5 features of Ms excel
3. Using internet search and discuss the following:
  - Amortization of a loan
  - Different steps of creating a loan amortization schedule



Microsoft Excel is one of the spreadsheet programs that helps to store and represent data in a tabular form, manage and manipulate data, create optically logical charts, and more.

To open Microsoft Excel, click on the **Start** button and search for the MS Excel application. Double click on the Excel icon to open the Excel. When Excel opens, an interface will appear.

### 3.1.1. Introduction on workbooks and worksheets

A workbook is a collection of many sheets. A worksheet is made of rows and columns that intersect each other to form cells where data is entered. In Excel worksheet, rows are represented **by numbers** and **columns by alphabets**.

A single Excel workbook can consist of several sheets, named **Sheet1, Sheet2, Sheet3, etc.** One or more sheets can be added to an Excel workbook. By clicking to the Plus (+) sign next to a worksheet name

#### A. Opening an existing workbook

An existing Excel file (workbook) is opened in the same way as other files. First know where it is located and open the folders where it is stored. When reached double click it.

An existing file can also be opened from an opened Excel file. To do it do the following:

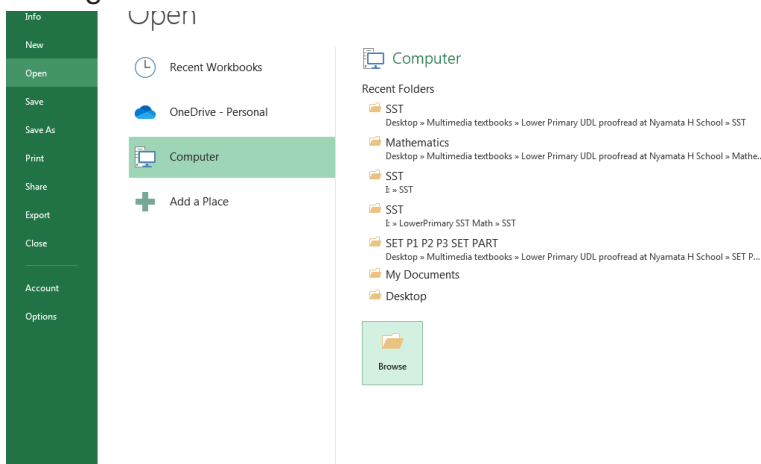


Figure 3. 1. Steps to follow in opening an existing workbook

In addition to creating a new workbook. An existing workbook may contain data. It can be opened directly from the location where it is stored or through MS Excel. Follow the given steps below:

## B. Worksheet environment

A worksheet consists of many rows and columns and other tools that are used to carry out different operations. When using a worksheet, the user has also to be aware of the different views possible which will rule how the worksheet will appear. There are three main views namely **Normal View**, **Page Layout View** and **Page Break View**.

The different views are accessed by clicking to their respective icons which are located in a worksheet near the bottom left corner.

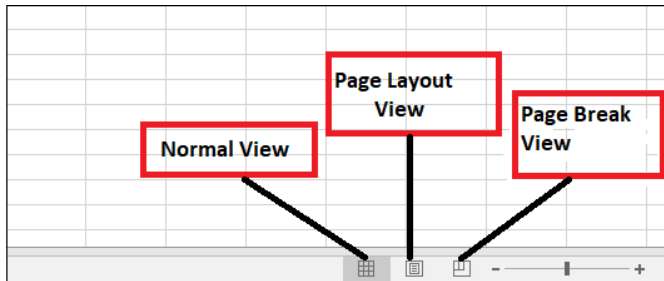


Figure 3. 2. Worksheet view options

A worksheet contains different tools which are shown below:

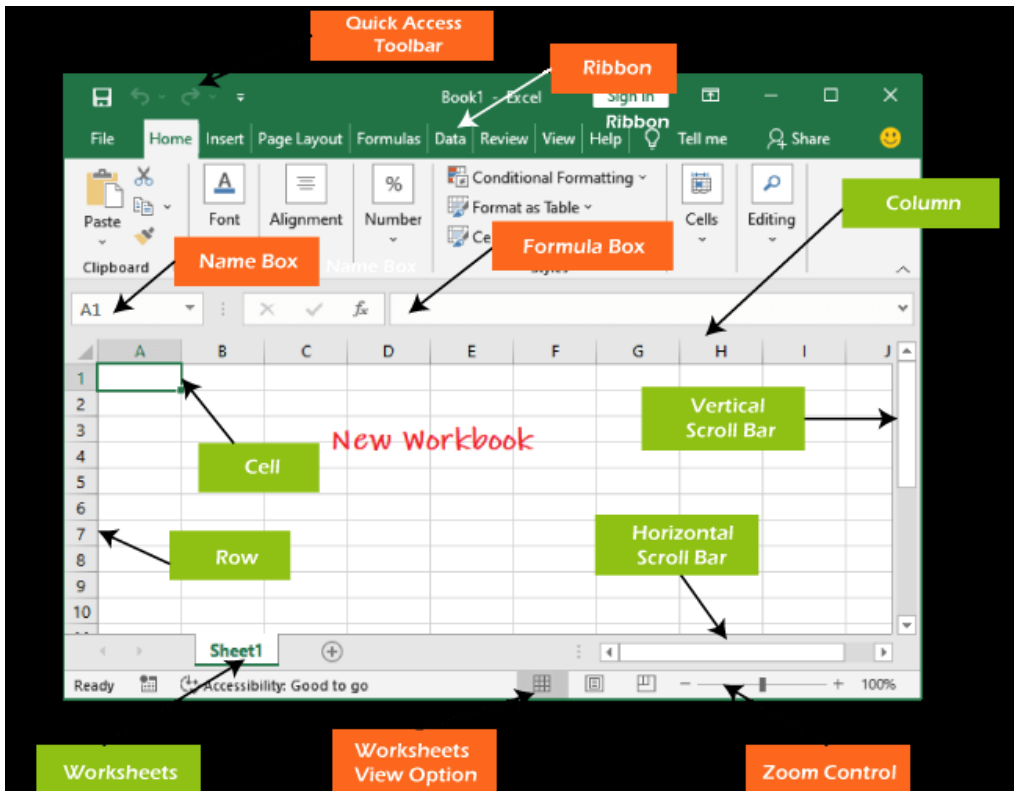


Figure 3. 3. The different tools and parts of an Excel interface

### 3.1.2. Operations on a worksheet

Excel enables the users to perform several types of operations on Excel worksheet and its data. **For example**, Rename a worksheet, insert a new worksheet, delete a worksheet, and many more.

#### A. To rename a worksheet

A new worksheet named Sheet1 gets added to the workbook by default. Excel allows its users to rename the worksheet name. A worksheet is renamed in order to reflect its content. Follow these steps to rename a worksheet:

1. Right-click on the worksheet to be renamed, then select **Rename** from the worksheet menu.

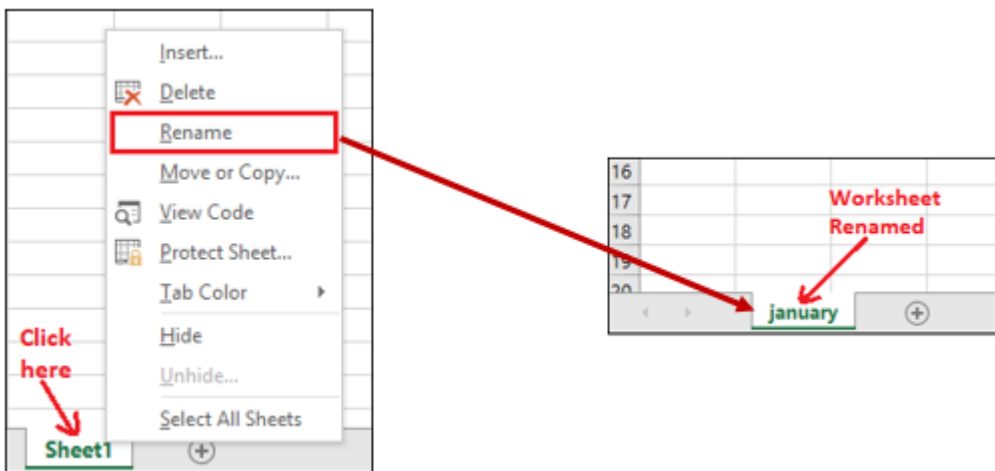


Figure 3. 4. Process to rename a worksheet

2. Type the **desired name** for the worksheet. In this case «**januar**» has been written
3. Click anywhere outside of the worksheets, or press the **Enter** on our keyboard. The worksheet will be **renamed**.

#### B. To create a new worksheet

Excel provides a new sheet button (+ symbol) near the different worksheet names that allow the users to add any number of worksheets to their currently active workbook. To create a new worksheet click on that Plus button a new worksheet is immediately created

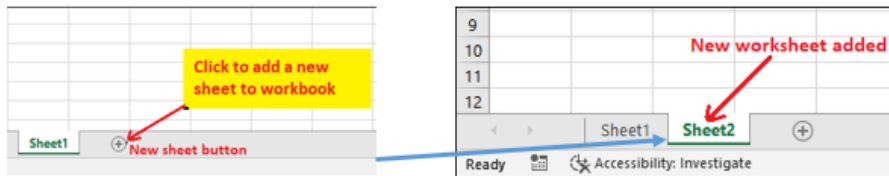


Figure 3. 5. The Plus sign which is clicked for creating a new worksheet

### C. To delete a worksheet

1. Right-click on the worksheet to be removed then select Delete from the worksheet menu.

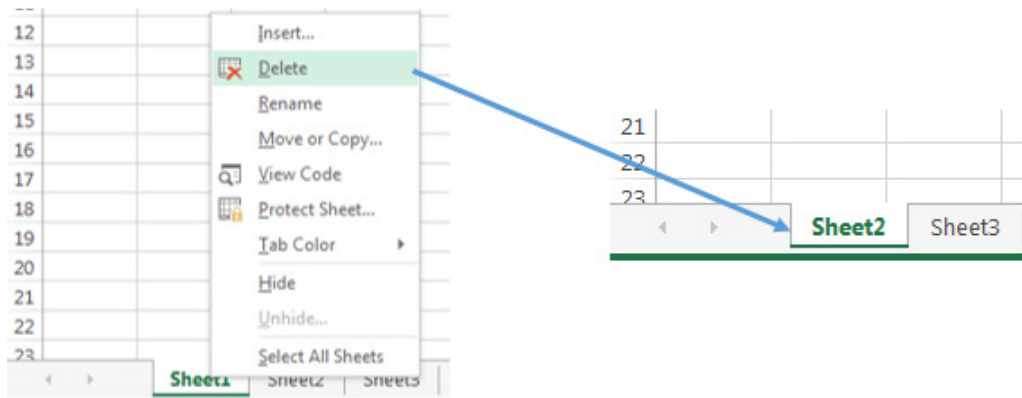


Figure 3. 6. Left: Option to delete a worksheet, Right: Sheet1 deleted.

### 3.1.3. Loan amortization worksheet

Loan amortization is the process of scheduling out a fixed-rate loan into equal payments. A portion of each installment covers interest and the remaining portion goes towards the loan principal.

In banking and finance, an amortizing loan is a loan where the principal of the loan is paid down over the life of the loan according to an amortization schedule, typically through equal payments.

#### Creation of loan amortization worksheet

In order to create an amortization of a given loan follow these steps :

1. Select the worksheet on which a loan amortization can be calculated.
2. Right click on the selected worksheet and click on **Insert**
3. Click on **Spreadsheet solutions** on the insert window
4. The select **Loan Amortization**
5. Then click Ok

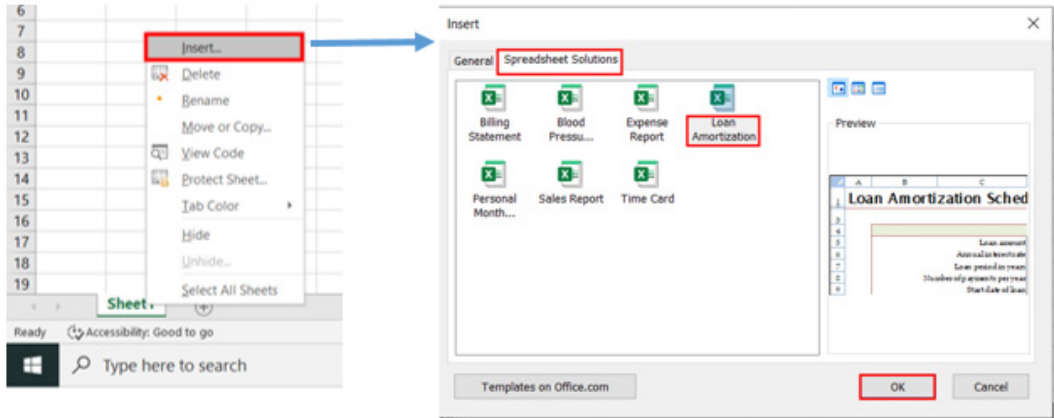


Figure 3. 7. Process to create a Loan Amortization worksheet

The loan amortization worksheet will appear like in the window below

The screenshot shows an Excel spreadsheet titled 'Loan Amortization Schedule' for 'NIYONZIMA Charles'. The spreadsheet is divided into two main sections: input fields and a payment schedule table.

**Input Fields:**

Enter values	
Loan amount	\$ 4,500,000.00
Annual interest rate	11.00 %
Loan period in years	10
Number of payments per year	12
Start date of loan	4/3/2022
Optional extra payments	

**Summary:**

Scheduled payment	\$
Scheduled number of payments	
Actual number of payments	
Total early payments	\$
Total interest	\$

**Lender name:** NIYONZIMA Charles

**Payment Schedule Table:**

Pmt. No.	Payment Date	Beginning Balance	Scheduled Payment	Extra Payment	Total Payment	Principal	Interest	Ending Balance	Cum
1	5/3/2022	\$ 4,500,000.00	\$ 61,987.51	\$ -	\$ 61,987.51	\$ 20,737.51	\$ 41,250.00	\$ 4,479,262.49	\$
2	6/3/2022	\$ 4,479,262.49	\$ 61,987.51	\$ -	\$ 61,987.51	\$ 20,927.60	\$ 41,059.91	\$ 4,458,334.90	\$
3	7/3/2022	\$ 4,458,334.90	\$ 61,987.51	\$ -	\$ 61,987.51	\$ 21,119.44	\$ 40,868.07	\$ 4,437,215.46	\$
4	8/3/2022	\$ 4,437,215.46	\$ 61,987.51	\$ -	\$ 61,987.51	\$ 21,313.03	\$ 40,674.48	\$ 4,415,902.43	\$
5	9/3/2022	\$ 4,415,902.43	\$ 61,987.51	\$ -	\$ 61,987.51	\$ 21,508.40	\$ 40,479.11	\$ 4,394,394.03	\$
6	10/3/2022	\$ 4,394,394.03	\$ 61,987.51	\$ -	\$ 61,987.51	\$ 21,705.56	\$ 40,281.95	\$ 4,372,688.47	\$

Figure 3. 8. Loan amortization worksheet



### Application activity 3.1

1. UMURAZA Febronie is a secondary teacher at G.S. MUHAMBARA, she went to UMWALIMU SACCO to request for a salary advance loan of 2000000 Rwf to be paid in three years (36 months) . As a loan officer, create a loan Amortization schedule for that teacher.
2. Explain how you can :
  - a) Add new worksheet
  - b) Delete a worksheet
  - c) Rename a worksheet

## 3.2. Cells basics

### Activity 3.3



1. Given the following table created in a Excel:

	A	B	C	D	E
1	No	Items	Quantity	Unit price	Total Price
2	1	HP Computer	3	400000	
3	2	RAM	12	25000	
4	3	Keyboard	20	7000	
5	4	Mouse	15	4000	
6	5	Power cables	8	5000	
7	<b>General Total</b>				

- a) Using cells references, calculate the **Total Price** for each item and
- b) The **General Total**

### 3.3.1 Cell references

There are three types of references in Excel namely relative cell references, absolute cell references and mixed cell references in Excel

#### 0. Relative Cell References

By default, all cell references are relative references. *Relative references are changed when copied across different cells based on the relative positions of rows and columns.* For example, suppose this formula **=B1\*C1** is to be copied

from row 1 to row 2, the formula will become **=B2\*C2**. Relative reference is useful when it requires to repeat a calculation across numerous rows or columns.

	A	B	C	D
1	20			
2	40			
3	60			
4	=A1*A2*A3			

Figure 3. 9. Using Relative cell references

## 1. Absolute Cell References

*Absolute cell reference is one in which the cell references being referred to do not change like they did in a relative reference.* To set an absolute cell reference use the **\$** sign by pressing **f4** to create a formula for absolute referencing. The **\$** sign means lock, and it locks the cell reference for all of the formulas, ensuring that the same cell is referred to all of them. To use a formula with absolute cell reference use the **\$** (dollar sign) in front of every cell

	A	B	C	D
1	Product	Price	Discount	
2			20%	50%
3	Product A	500	400	
4	Product B	677		
5	Product C	800		
6	Product D	1000		
7	Product E	400		

Figure 3. 10. Using absolute cell reference in an Excel formula

## 2. Mixed Cell Reference in Excel

*A Mixed cell reference is a mixture of both relative and absolute cell reference.* In mixed cell reference, dollar signs are attached to either the letter or the number. For example, **\$B2** or **B\$4**. It's a mix of relative as well as absolute reference.

There are two types of mixed cell references:

1. The row is locked while the column changes when the formula is copied.
2. The column is locked while the column changes when the formula is copied.

	A	B	C	D
1	Product	Price	Discount	
2			20%	50%
3	Product A	500	400	
4	Product B	677	541.6	
5	Product C	800	640	
6	Product D	1000	800	
7	Product E	400	320	

Figure 3. 11. Applying a mixed cell reference

### 3.3.2 Text Alignment

Text alignment is a feature that helps users to align text within worksheet cells. It enables the composition of text documents with various text positions or alignments on one or more cells within the Excel document.

#### a. Change Text Alignments from Ribbon

The easiest and straightforward way to access text alignment options in Excel is to use ribbon tools. Both horizontal and vertical alignment options can be accessed by going to **the Home** tab and using the alignments from the **Alignment** group.

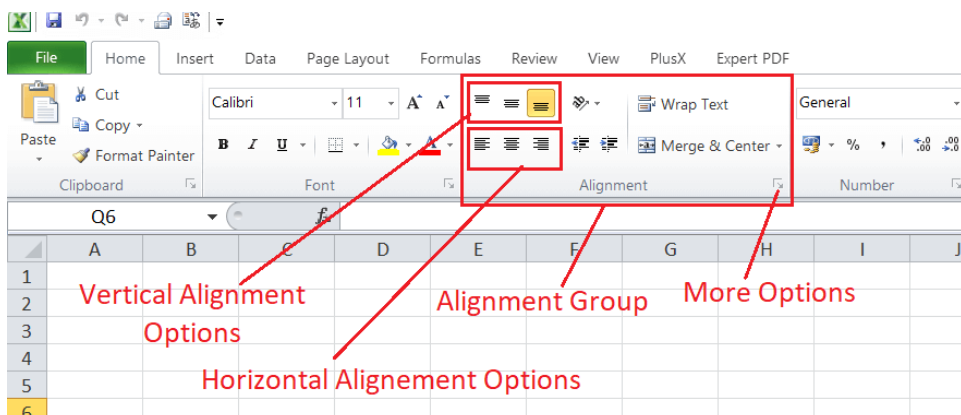


Figure 3. 12. Different alignment options available in Excel



By default, Excel automatically aligns entered text contents to the left position of the cell and numbers to the right position. Alignment options from the Alignment group can be used to change the alignment accordingly.

Follow these steps to align a text:

- Select the text to be aligned
- Click the tool to be used from the vertical alignment options and pick Top Align, Middle Align, or Bottom Align, respectively.
- Click the tools from the horizontal alignment options and pick Left Align, Center Align, or Right Align, respectively.

a) Change Text Alignments from Format Cells

The Format Cells dialog box is another efficient way to change text alignments in Excel cells. Perform the following steps to use this method:

- First, select the cells on which to align texts.
- Open a **Format Cells** dialogue box and launch a dialogue box by clicking the arrow at the bottom right corner of the Alignment group under the **Home** tab.
- In the new dialog box that appears click on **Alignment**
- Select the different types of alignment to be applied. If the text orientation needs to be changed change it using the **Orientation** option which is set by moving the needle or setting the text orientation degrees.
- Click on **OK** to apply the new text alignment

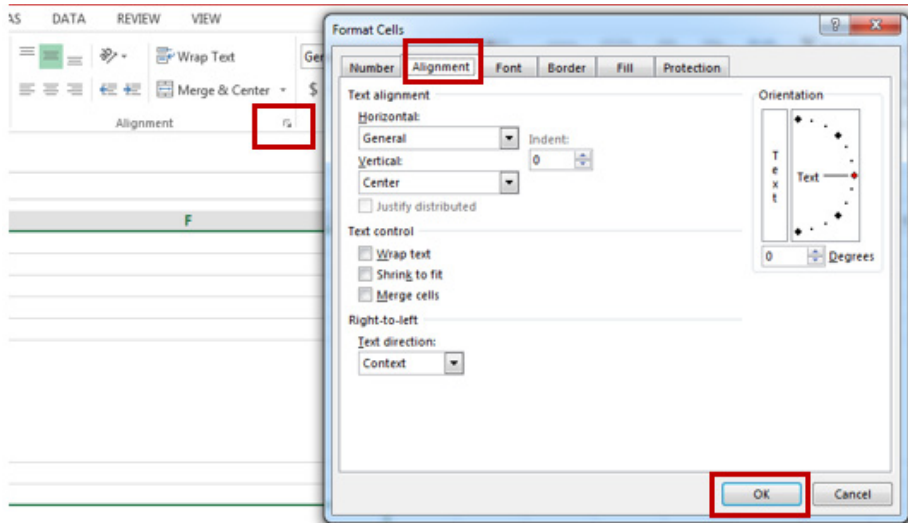


Figure 3. 13. Text alignment using the Format Cell dialog box

Names	Sex	Age	Telephone number		

Figure 3. 14. An example of text aligned at 45° using the Orientation option

Alternately, pressing **Ctrl+1** the keyboard shortcut keys combination can open the Format Cells dialogue box.

### 3.3.3 Setting Font

Excel has a variety of built-in customizations that can help to change the appearance of the sheet to a maximum extent. The font properties that can be changed are: font type, font size, font color, and changing the text to bold, Italic and Underlining the text. The font can be changed using the menu Ribbon or using the Format Cells dialog box.

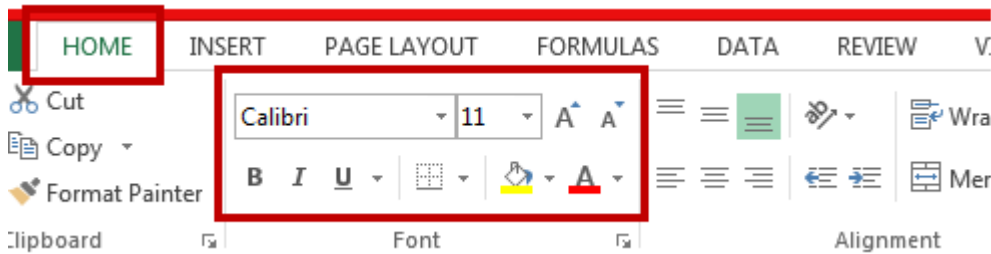


Figure 3. 15. The tools for changing the font available on the menu ribbon

#### ▪ Changing Font Type

To change the font type or style using the menu ribbon in one or more Excel cells, perform the following steps:

- Select the cell (s) consisting of the needed values to format.
- Next, go to the **Home** tab and click the initial **drop-down** list under the category **font**, as shown below :

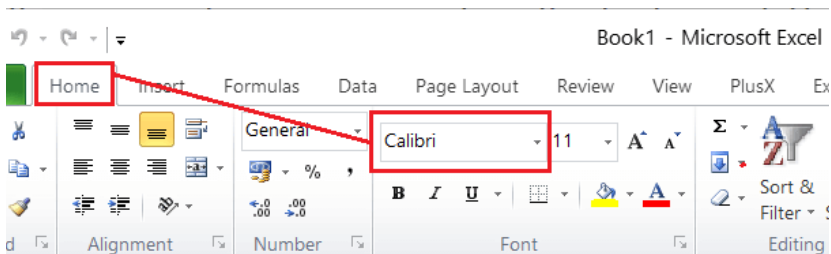


Figure 3. 16. Changing the font type using the menu ribbon

- We can scroll down to view all the installed fonts on computer **click** on the desired font type/style to instantly use it in the selected cell (s).
- **Changing Font Size**

To change the font size in the desired Excel cells, perform the following steps:

- Select the cells to adjust font size.
- Go to the **Home** tab and click on the **drop-down list** associated with the **number** (i.e., 11, 12, etc.), next to the Font drop-down list, under the Category Fonts, as shown below:

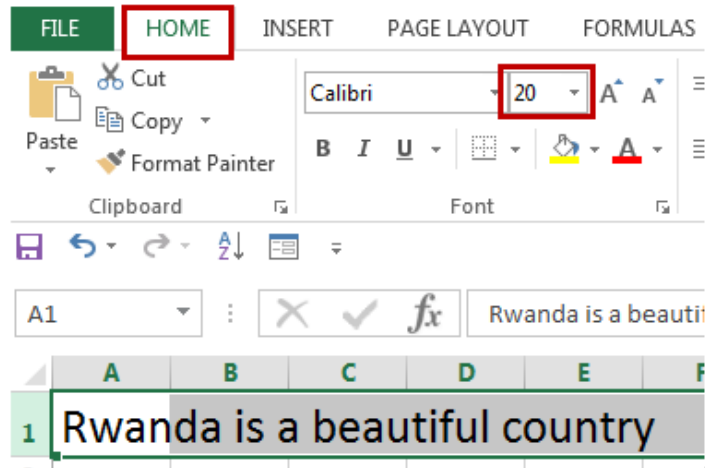


Figure 3. 17. Tools used to change the font size

There is a selection of multiple pre-defined font sizes to choose from. to use the desired font size, click the number from the list. However, if there is no suitable size, type the number directly in the font size box and press the **Enter** key. The font size can be quickly adjusted by clicking on Increase Font Size and Decrease Font size tools, displayed next to the Font size box.

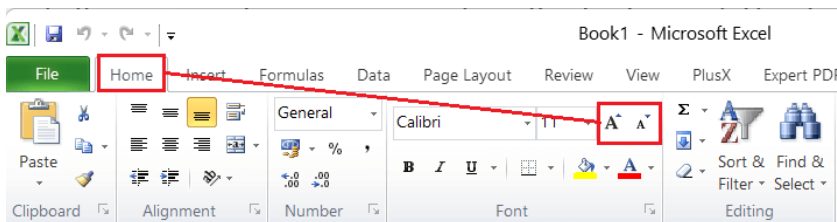


Figure 3. 18. Changing the font size by using the Increase and Decreasing Font Size tools

- **Changing Font Color**

To change the font color for the desired Excel cells, perform the following steps:

- Select Excel cells to apply the desired color.
- Next, navigate the **Home** tab and click the last **drop-down list** under the category **Font**. It is associated with the letter <A> and a red color bar below it. Refer to the screenshot below:

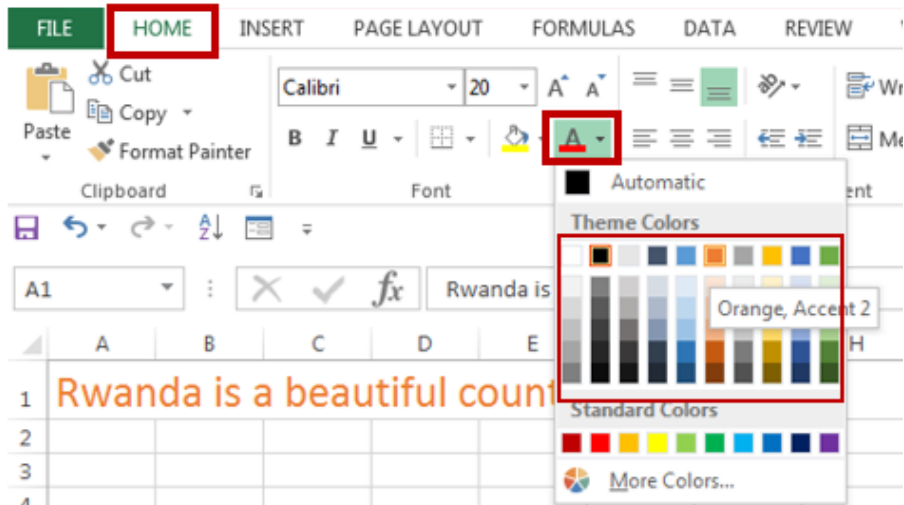


Figure 3. 19. Tools used to change the font color

- After clicking the drop-down arrow for the font color, click on the desired color from the list of **Theme Colors** or the **Standard Colors**. **In this case the red color was clicked.**

Note: If the cell is empty while setting the font in Excel, then as soon as we start typing text or data in the respective cell, the applied style, size, color, etc., will be applied automatically.

- **Setting Font to use Bold, Italic, and Underline**

To change the font format in the desired Excel cell to make it bold, italic, or underlined, perform the following steps:

- Select one or more Excel cells to modify their respective values.
- Go to the **Home** tab and click the **Bold (B)**, **Italic (I)**, or **Underline (U)** shortcut under the category Font. These tools help to change the appearance of the selected cell accordingly. Now the text becomes more black, underlined and oblique (italic)

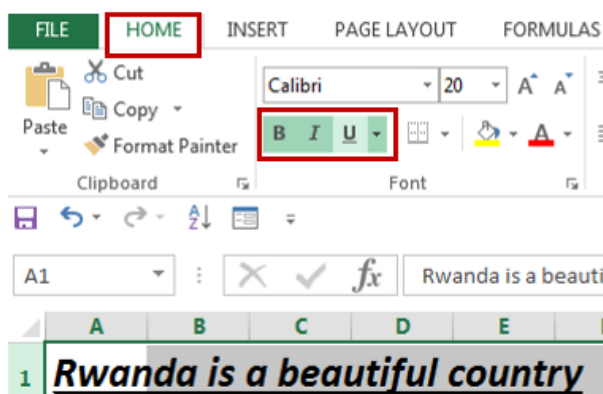


Figure 3. 20. Tools used to make text bold, italic and underlined



### Application activity 3.2

1. Discuss the different ways of text alignment
2. Using the data of an Activity 3.2, apply the following :
  - a. Align on top the first row
  - b. Make all items centered
  - c. Make the Total Price centered to the right side and make it be in a red color
  - d. Make the font size of General Total be 18
  - e. The font style should be Tahoma, Bold and Italic
  - f. Fill the whole table with green color

## 3.3 Arithmetic operators in formula

### Activity 3.3



1. What do you understand by an operator ?
2. Give two examples of arithmetic operators and its uses

In mathematics, the term **operator** refers to a sign or symbol used to evaluate mathematical operation.

The most basic mathematical signs are the arithmetic operators which include addition (+), subtraction (-), multiplication (×), and division (÷).

Brackets

$$Y = 15 + 3 \div 3 \times (12 + 5)$$

operators                  operands

In mathematical computing, the same operators are used but multiplication and division operators are replaced with asterisk (\*) and forward slash (/) respectively.

The table below, gives a summary of the four arithmetic operators supported in Excel and their functions :

Operator	Name	Description	Example (A=10, B=20)
+	Addition	Adds two operands	A+B returns 30
-	Subtraction	Subtract right operand from left	A-B returns -10
*	Multiplication	Multiplies binary operands	A*B returns 200
/	Division	Divides numerator by denominator	B/A returns 2

### 3.3.1 Addition operator

The addition operator (+) evaluates mathematical addition operation

**Example:** The figure below represents data of students 'performance in three subjects. Find the total marks for every student

Student's Name	Mathematics	Chemistry	ICT	Total
Kundwa	46	50	68	
Kamali	67	52	90	
Sentwali	81	76	75	
Mukamana	38	49	64	
Habimana	70	92	86	
Mukeshimana	29	35	75	

Figure 3. 21.Example of an Excel sheet with students data

To complete the total column, consider the below steps:

- Click on the first cell of the total column.
- Drag the mouse on the formula bar and type **=B2+C2+D2**
- Click on the bottom-right corner of that block and drag to the last cell of the total column.
- And release the mouse, the result will appear on all the specified cells of the column as it is shown below:

The screenshot shows an Excel spreadsheet with the following data:

Student's Name	Mathematics	Chemistry	ICT	Total
Kundwa	46	50	68	164
Kamali	67	52	90	209
Sentwali	81	76	75	232
Mukamana	38	49	64	151
Habimana	70	92	86	248
Mukeshimana	29	35	75	139

The formula bar shows the formula  $=B2+C2+D2$  for cell E2.

Figure 3. 22.The result from addition Operation

### 3.3.2 Subtraction operator

The subtraction operator (-) evaluates mathematical subtraction operation

Example: Using data stated in example above, Calculate the difference between Mathematics marks for Kundwa and Kamali.

Perform the following steps:

- Click on the cell where the difference/resultat will appear.
- Write in cell the Substraction formulas **=B3-B2**
- Click on enter button, the result will come in cell as it is shown bellow:

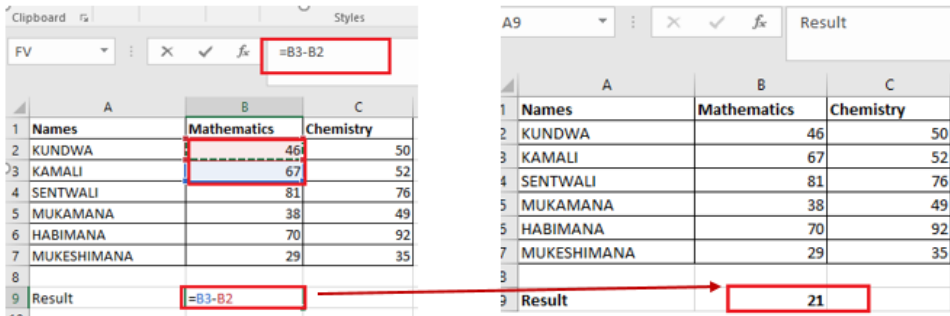


Figure 3. 23. The result from subtraction operation

### 3.3.3 Multiplication operator (\*)

The product of numeric values is performed by using a multiplication operator in formulas. Let's use the example of purchasing different products, where the total price as product will be obtained by multiplying quantity with price per unit

Here below, are the steps to be followed:

- Click on the first cell of the Product column.
- Drag the mouse on the formula bar and type **=B2\*C2**
- Click on the bottom-right corner of that block and drag to the last cell of the Product column
- Release the mouse Button, to see the result as follows :

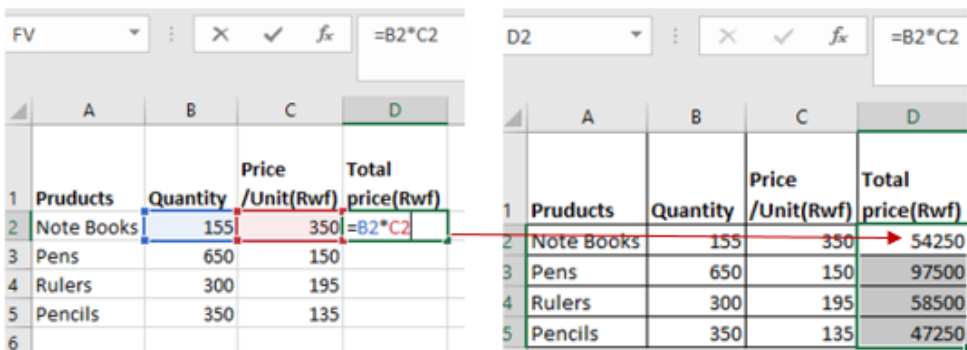


Figure 3. 24. The result from the multiplication operation

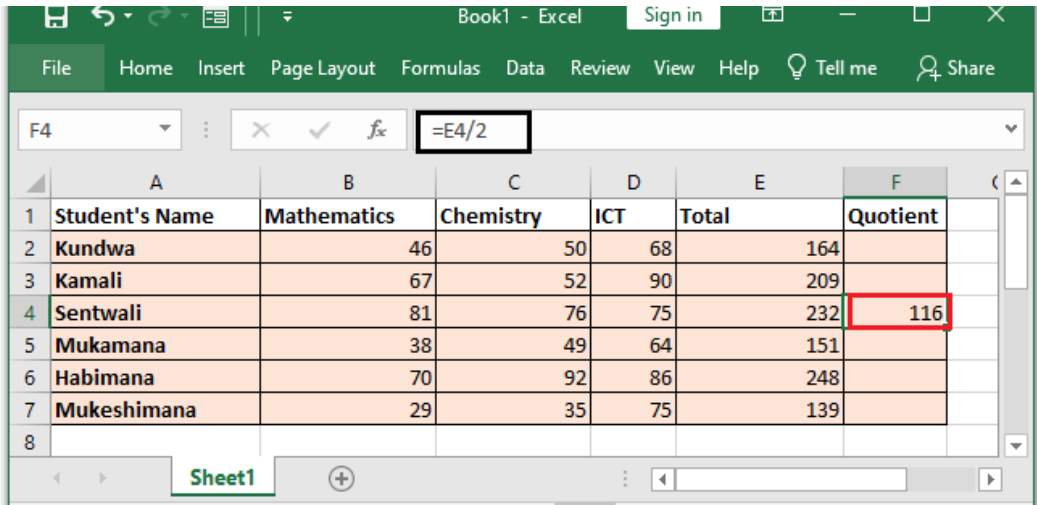
### 3.3.4 Division operator



The division operator is used in calculation of quotient of two numeric values. Use the same data of additional operator in order to understand how division operator works.

For example, let divide total marks for Sentwali by 2. Proceed as follows:

- Select F4 cell of the Quotient column.
- Drag the mouse on the formula bar and type **=E4/2**
- Press Enter key to find the result



The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F
1	Student's Name	Mathematics	Chemistry	ICT	Total	Quotient
2	Kundwa	46	50	68	164	
3	Kamali	67	52	90	209	
4	Sentwali	81	76	75	232	116
5	Mukamana	38	49	64	151	
6	Habimana	70	92	86	248	
7	Mukeshimana	29	35	75	139	
8						

The formula bar shows the formula **=E4/2** entered in cell F4. The result **116** is displayed in cell F4.

Figure 3. 25.The result from division operation



### Application activity 3.3

1. Study the figure given below that presents the national examination result of 4 primary students and work out the related questions

Students' name	Maths	English	Kiny	SET	Social Studies
UMUKUNZI Anne Marie	38	87	65	35	45
KAMANA Charles	67	76	56	67	67
Mutoni Eugenie	54	75	54	87	87
NIYONDANGAMIYE Seraphine	33	59	52	60	34

- a) Calculate the total marks for all given students. Total marks will appear in G column
- b) Calculate the difference between the marks of UMUKUNZI and MUTONI
- c) The marks of mentioned students are on 100 for each subject. You are requested to put their total marks on 100. The result will appear in H column.
- d) For each student, add 2 marks on her/his percentage of marks
- e) For student named NIYONDANGAMIYE, add 3 marks to each subject

## 3.4. The use of functions

### Activity 3.4



After doing a research on internet or any other resource:

- a. Identify different parts of a function
- b. Explain different types of functions available in Excel

### 3.5.1 The parts of a function

In order to work correctly, a function must be written in a specific way. The basic syntax for a function is the **equals sign (=)** followed by the **function name** (SUM, for example), and one or more **arguments**. Arguments contain they are numbers or any other data on which the function operations are going to be done. The arguments of a function can be written in two ways:

- Writing every single argument in a function. This option is used when the arguments to be added are not many.
- Writing the range starting from the first argument to the last argument. This is possible only if the cells (arguments) are in the same row or in the same column.

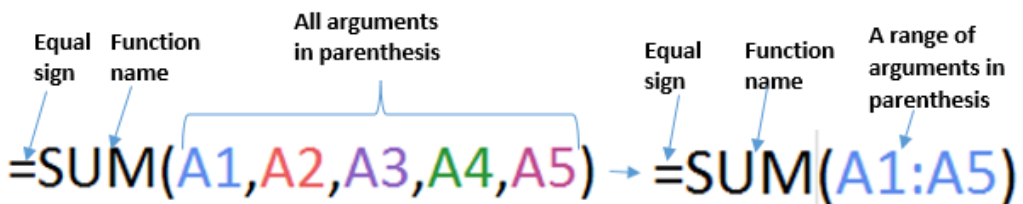


Figure 3. 26. Left: A function with all arguments listed, Right: A function with a range of arguments

Arguments can refer to both **individual cells** and **cell ranges** and must be enclosed within **parentheses**. You can include one argument or multiple arguments.

### 3.5.2 Excel Aggregate functions

#### A SUM function

The sum SUM function is used to add numbers. It can add two or more arguments which are all enclosed in parenthesis or just a range of arguments starting from the first cell and ending by the last cell. In the first case, cells (arguments) are separated by comma (,) while for the second case the first and last cell are separated by a colon (:).

For example the function **=SUM(A2,B2,C2,D2,E2)** will **add** the values of in the cells **A2,B2,C2,D2** which are in the same row. **This same function can be written as =SUM(A2:E2).**

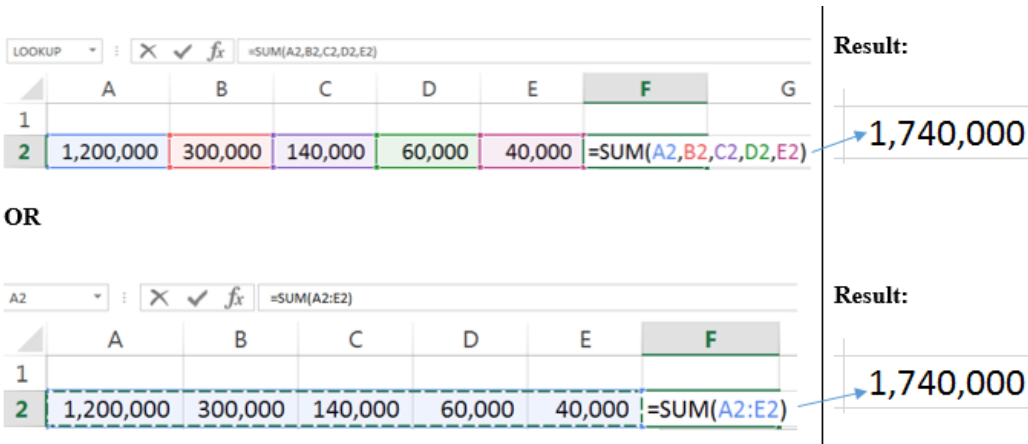


Figure 3. 27. Different ways to write arguments in the SUM function

To use the SUM function and get addition results like in the screenshot above, do the following:

- Put the cursor in the cell where the sum will be calculated and write an Equal sign (=)
- Write the word SUM ( ) and put the cursor inside the parentheses
- If all the cells (arguments) will appear in the parentheses, click on every cell and write a comma after every cell. If only the first cell and the last will appear in the parentheses just select all the cells whose content is to be added
- Click outside the cells for the sum to be calculated

When the data to be added is not in the same row or the same column, the two ways of writing arguments can be used. For example, the function **=SUM(A1:A3,C1:C2,E1)** will **add** the values of all of the cells A1 to A3 then C1 to C2 and E1. This same function can be written as =SUM(A1,A2,A3,C1,C2,E1)

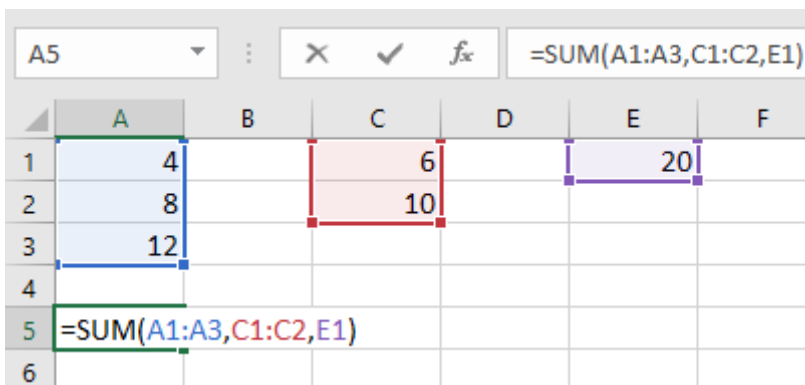


Figure 3. 28. Example of a function with multiple arguments located in different cells

The **AutoSum** command allows you to automatically use the most common functions including SUM, AVERAGE, COUNT, MIN, and MAX. In the example below, the **SUM** function is accessed by using the **AutoSum** command. The AutoSum command is available under the **Formula** tab. It can also be accessed under the **Home tab** in the Editing group.

1. Select the **cell** that will contain the function.
2. In the **Editing** group on the **Home** tab, click the **arrow** next to the **AutoSum** command. Next, choose the **desired function** from the drop-down menu. In this example **Sum** was selected.

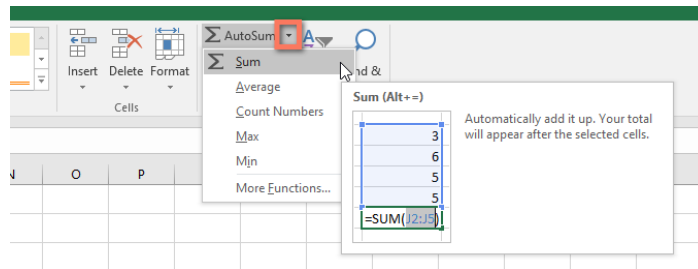


Figure 3. 29. Using AutoSum command to select a function

1. Excel will place the **function** in the cell and automatically select a **cell range** for the argument. In this example, cells **D2:D7** were selected automatically; their values will be **added** to calculate the total cost. If Excel selects the wrong cell range, you can manually enter the desired cells into the argument.
2. Press Enter on your keyboard. The function will be calculated, and the result will appear in the cell.

## B. AVERAGE function

The average function determines the **average** of the values included in the argument. It calculates the sum of the cells and then divides that value by the number of cells in the argument.

Its syntax if all the arguments will appear in the parentheses is:

**=AVERAGE(number1, number2,...)**

A syntax containing only the first and last cell between the parentheses can also be use.

For example, the function **=AVERAGE(F1,F2,F3,F4)** would calculate the **average** of the values in the cells F1, F2, F3 and F4. This same function can also be written as **=AVERAGE(F1:F4)**

**Result:**

F
5
6
7
18
9

Figure 3. 30. Example how the average function is used

To calculate the average using the AVERAGE function as it was done in the screenshot above, do the following:

3. Select the **cell** that will contain the function result.
4. Type the **equals sign (=)**, and write the **function name** which is AVERAGE. You can also select the desired function from the list of **suggested functions** that appears below the cell as you type.
5. Enter the **cell range** for the argument inside **parentheses**. In this example type **(F1:F4)** or type **(F1,F2,F3,F4)** or just select those cells.

Press **Enter** on the keyboard or click in any other cell.

### C MIN function

The Excel MIN function returns the smallest numeric value in the data provided. The MIN function ignores empty cells, the logical values TRUE and FALSE, and text values.

The syntax of the MIN function is:

**=MIN(number,number2, ...)**

This syntax can also be written in such a way that only the first argument (cell) and the last appear in the parentheses. In this case, the two cells are separated by colon (:)

**Example:** =MIN(A1,A2,A3,A4) OR =MIN(A1:A4)

To use the MIN function proceed in this way:

- Go in the cell where the min will be calculated
- Write the Equal sign followed by MIN( )
- In the parentheses write the arguments or select them. In this case the arguments are C1, C2, C3 and C4.
- Hit the Enter key or click in any other cell for the result to be calculated

The image shows two methods for using the MIN function in Excel. In the first method, the formula bar shows `=MIN(C1,C2,C3,C4)` and the spreadsheet shows cells C1 (20), C2 (10), C3 (34), and C4 (9) being selected, with the formula entered in C5. In the second method, the formula bar shows `=MIN(C1:C4)` and the spreadsheet shows the range C1:C4 being selected, with the formula entered in C5. A 'Result:' table on the right shows the values 20, 10, 34, 9, and 9, with blue arrows pointing from the formula results in the spreadsheet to the corresponding values in the table.

Result:
C
20
10
34
9
9

Figure 3. 31. Using the MIN function

## D MAX function

The MAX function returns the largest numeric value in the data provided. For example, MAX function can return the highest marks for a student for all subjects or the highest mark for a student for a given subject.

The syntax of the MAX function is:

=MAX(number1,number2,...)

The arguments in the parentheses can be only the starting cell (argument) and the last cell separated by a colon.

To use the MAX formula in Spreadsheet follow these steps:

6. In a cell where the maximum value will appear, type =MAX( )
7. Inside the parentheses write the cells for which the maximum number is to be calculated or select those cells
8. Press the Enter key or click in any other cell.

**Result:**

C
20
10
34
9
34

**OR:**

A	B	C	D	E	F
		20			
		10			
		34			
		9			
		=MAX(C1,C2,C3,C4)			

Figure 3. 32. An example of how the MAX function is used

## E. COUNT function

The COUNT function **counts** the number of cells with numerical data in the argument. This function is useful for quickly counting items in a cell range. For example, you can enter the following formula to count the numbers in the range A1:A20

The syntax of the COUNT function is:

=COUNT(value1,value2,...)

However there is no need to put in the parentheses all the arguments if the cells whose values are to be counted are in the same row or column.

Use the COUNT function in the following way:

- Click in the the cell where the count value will appear and type =COUNT( )
- Inside the parentheses write the cells that will be counted
- Press the Enter key or click in any other cell.

Note that the COUNT function does not consider cells with content other than numbers. It does not consider text or empty cells.



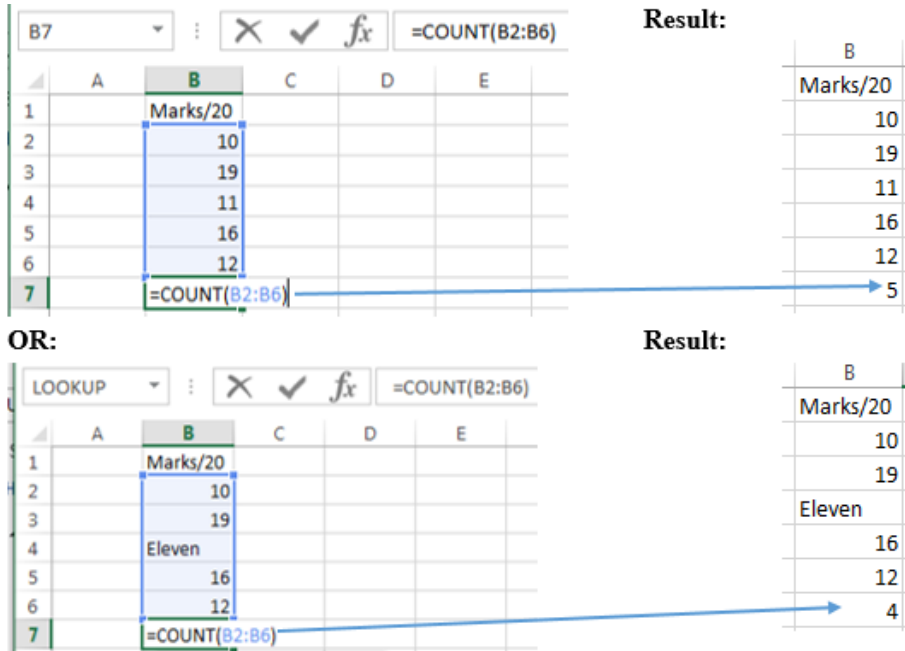


Figure 3. 33.The results of using the COUNT function

Note that in the second screenshot the result of the COUNT function is 4 instead of being 5. This is because this function does not count cells containing text.



### Application activity 3.5

Types the following and then calculate the total price, general total, average, minimum and maximum using spreadsheet functions

No	Items	Quantity	Unit price	Total Price
1	HP Computer	3	400000	
2	RAM	12	25000	
3	Keyboard	20	7000	
4	Mouse	15	4000	
5	Power cables	8	5000	
<b>General total price</b>				
<b>Average price</b>				
<b>Minimum price</b>				
<b>Maximum price</b>				

## 3.5. Tables and borders design

### Activity 3.5



- What do you understand by table borders?
- With internet search ,
- 1) Explain the importances of using tables borders
- Discuss different steps of applying borders

In Excel, borders refer to a line drawn across any or all of four sides of a cell in a worksheet. When adding a border to one or more cells, choose specific sides to include or exclude. Moreover, borders for custom or desired sides of cells can be drawn manually.

#### ▪ Applying borders from ribbon

Excel Ribbon is the primary area for accessing most existing commands or tools. While creating a border in Excel, we can take advantage of the Excel ribbon and apply a border to the desired cell using the following steps:

- **Select the Excel cells** on which to apply borders. Hold down the mouse's left button and drag the selected shading from one cell to the others. When selecting non-adjacent cells in Excel, click on individual cells while holding down the **Ctrl** key.
- Go to the **Home** tab on the ribbon and click on the **drop-down** icon next to **Border**
- **Click on the desired border style** to apply it. Here **All Borders** was selected.

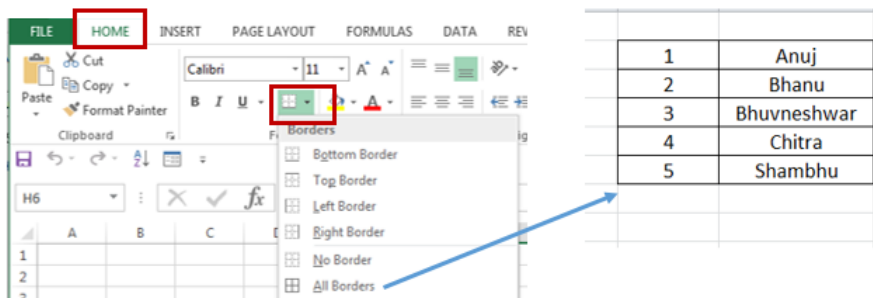


Figure 3. 34. Left: Menu and tools to set borders, Right: An Excel table with All Borders set

Although there are many existing border options, sometimes, borders can be drawn using the **Draw Border** option from the drop-down list. This option is accessed after clicking on **Home** then on the **Border** tool found in the **Font** group. One can also use the **Draw Border Grid** which create a table over the cells moves on.

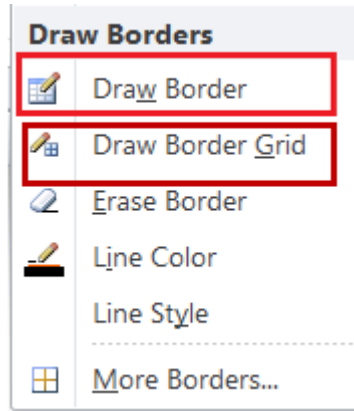
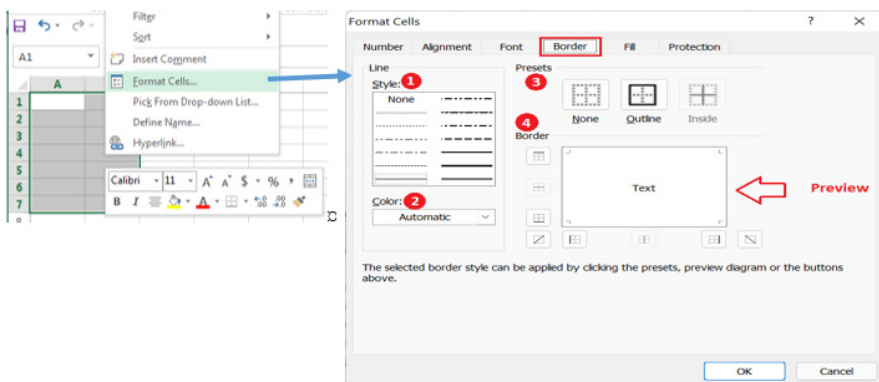


Figure 3. 35. Draw border and Draw Border Grid tools  
Applying Borders from Format Cells dialogue box

A border can be applied using the Format Cells dialog box. Go through the following steps to access the **Format Cells** dialog box and insert a border in the desired Excel cell:

- **Select the cells** in the worksheet.
- Launch the **Format Cells** dialogue box by doing a Right click then choose Format Cells
- In the Format Cells dialog box that appears click on Borders



o

Figure 3. 36. Format Cells tool and the resulting Format Cells dialog box

- Click on the different border styles to apply then click OK
- Removing borders in Excel

To remove borders in the Excel worksheet, one of the following methods can be used:

- Select the cells from which the borders are going to be . Click on **Home** tab then on **Border** then on **No Border**.

- To delete borders using the Erase border tool. For this, go to **Home** then click on the **Border** tool then click on **Erase Border**. This will convert the mouse cursor into an eraser icon, using it erase or delete the desired border in the worksheet.
- Another method is: Select the cells and go to **Home** then **Clear** then **Clear All**. Although this method helps remove borders, it also removes other formattings like font color, background color, etc.

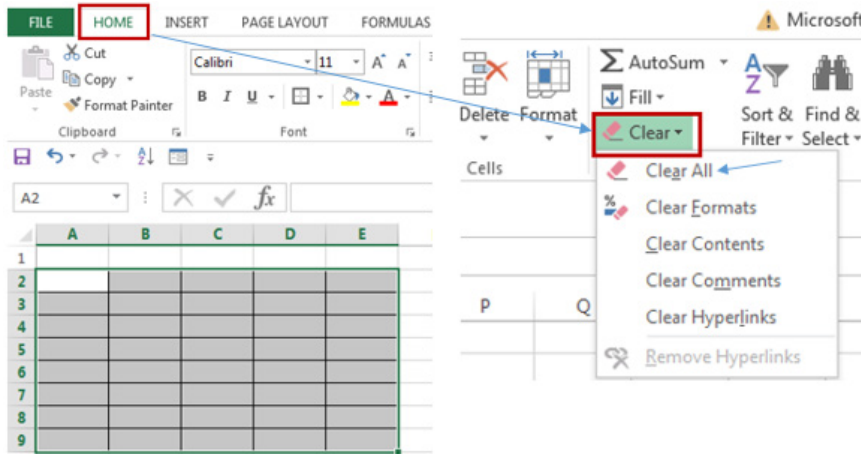


Figure 3. 37. Left: Home tab and Clear tool



### Application activity 3.5

1. Outline different steps to delete borders
2. Create the following table and apply the different types borders as indicated below:

No	Items	Quantity	Unit price	Total Price
1	HP Computer	3	40000	
2	RAM	12	25000	
3	Keyboard	20	7000	
4	Mouse	15	4000	
5	Power cables	8	5000	
<b>General Total</b>				
<b>Minimum</b>				
<b>Maximum</b>				

### 3.6. Creation of charts

#### Activity 3.6

- Identify different types of charts you know
- Give the importance of using chart for data presentation

**Charts** allow you to illustrate workbook data **graphically**, which makes it easy to visualize **comparisons** and **trends**. The data represented through charts is more understandable than the data stored in an Excel table. This makes the process of analyzing data fast.

A chart is often called a graph. It brings more understanding to the data than just looking at the numbers. Excel offers many charts to represent the data in different manners, such as [Column Chart](#), [Line Chart](#), [Bar Chart](#), [Area chart](#), [Pie Chart](#)

To illustrate the different types of charts, the data used are those on a company owning a small business of making different types of soap. The quantities of soaps in Tons made per year is shown in the table below:

Year/Animal	Solid soap	Liquid soap	Powder soap
2015	12	5	9
2016	14	5	10
2017	15	7	12
2018	21	9	13
2019	30	13	15
2020	28	13	16
2021	27	12	16
2022	22	12	17

The different charts are inserted by following this procedure:

- Select the data then click on **Insert**
- In the **Chart group** choose one type of chart to be generated. If among the visible templates the one needed is not available, click on the See All Charts tool to view more chart types

#### A. Column Charts

A column chart is basically a vertical chart that is used to represent the data in vertical bars. It works efficiently with different types of data, but it is usually used for comparing the information.

**For example**, the company wants to see whose data was shown above wants to visualize its production progress from 2015 to 2022 using a column chart. To make that column chart the following steps will be used.:

**Step 1:** Select the data for which the chart is to be made

**Step 2:** On the **Insert tab**, in the **Charts** group, choose the type of chart to use. In this case the type chosen is the **Column chart**. Click the **Column chart** symbol

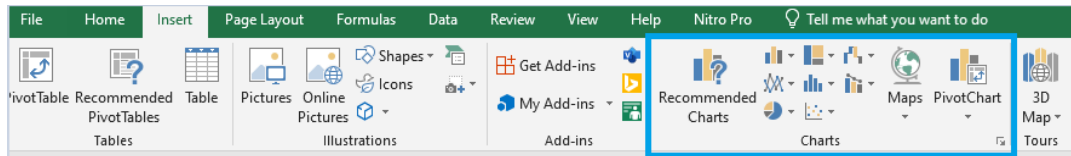


Figure 3. 38. Insert tab with its Charts group

**Step 3:** Choose the appropriate style. Here a Column Chart has been chosen. The chart looks like in the image below:

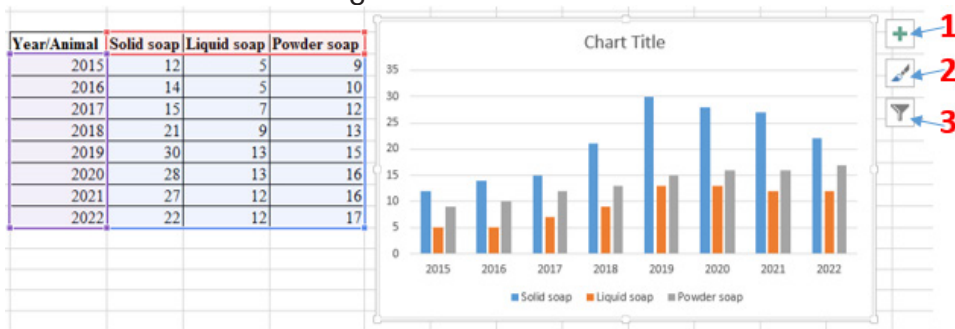


Figure 3. 39. Left: Data for creating a chart, Right: the column chart created from the data on the left

**Step 4:** Customize different settings of the created chart by changing the default chart title (Chart Title) and other settings which are done using the tools labelled 1, 2 and 3. The tool **1** is used to add and edit charts elements, the tool **2** is used to choose any other variant of the chosen chart and the tool **3** is used to remove the charts elements that are not needed.

- **Adding chart elements**

The chart for can be customized by adding new charts elements. Charts elements can be added by clicking on the tool which is labelled as 1 in the above chart. The chart below has been customized in order to add the Axis Titles, Data labels. The different chart elements are added by ticking the corresponding checkboxes.

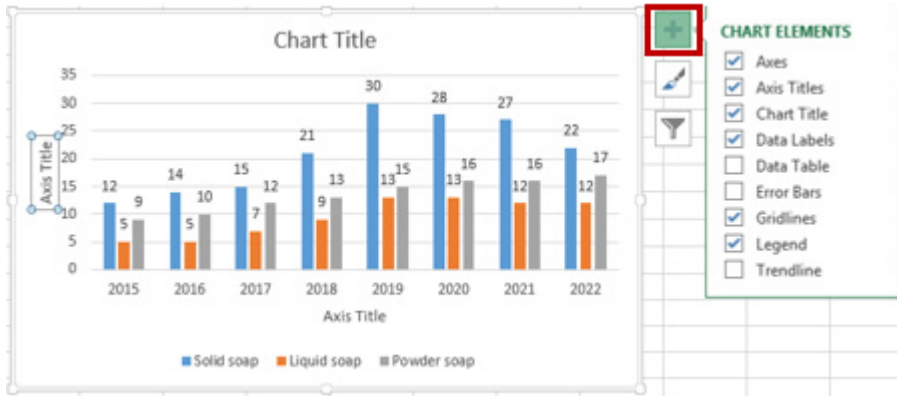


Figure 3. 40. A customized chart on which Axis Titles and Data Labels have been added

- Changing the chart style

There are different types of chart which can be used depending on the data to display. Switching from one chart type to another is done in this way:

Step 1: Select the chart for which the type is to be changed

Step 2: Click on the Chart Styles tool

Step 3: Click on the new chart type. In this case the chart labelled with an arrow was selected.

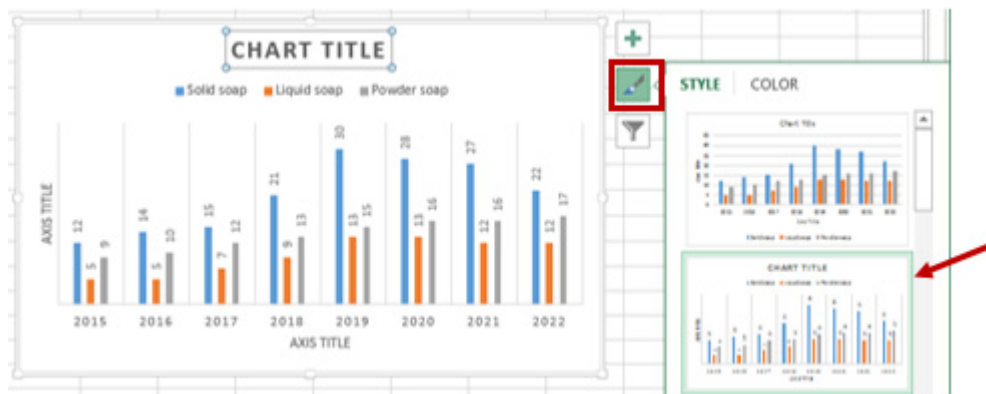


Figure 3. 41. Change chart Type option

Apart from these operations, one can add new elements or remove them using the Chart Filters option allow to add or remove chart elements like Chart series.

## A. Line Chart

Line charts are most useful for showing trends. Using this chart, you can easily analyze the ups and downs in data over time. In this chart, data points are connected with lines.

With the company's data, a line chart showing the status of the quantities of soap produced can be created like by following this procedure:

- Select the data for which the chart is to be created
- Click on the Insert tab
- In the Charts group click on one type of chart here click on the Line Chart

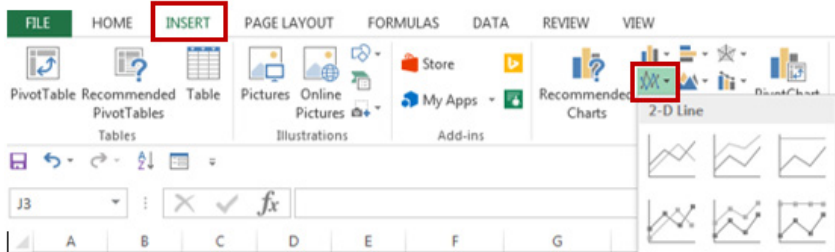


Figure 3. 42. The process of inserting a line chart

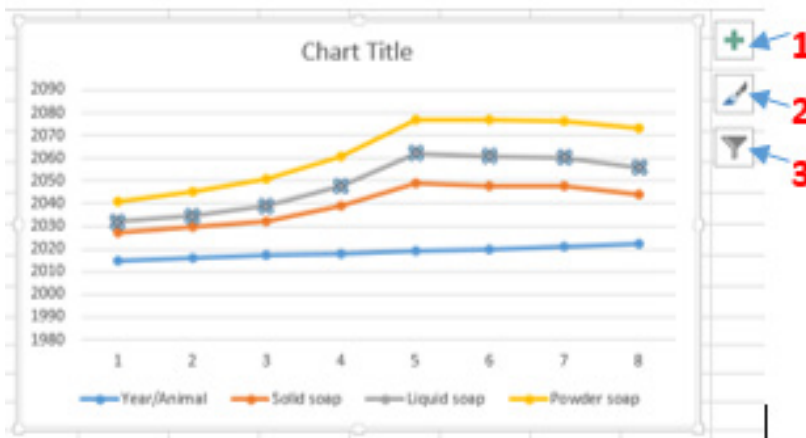


Figure 3. 43. A line chart created in Excel

Next to the line chart above there are three tools which are used to edit it namely has s tools next to it which are used the Chart Element tool (1), the Chart Styles tool and the Chart filters tool.

### A.Bar chart

Bar charts are horizontal bars that work like column charts. Unlike column charts, Bar charts are horizontally plotted. Or you can say that bar charts and column charts are just opposite to each other.

The data used in creating line chart and column chart can generate the bar chart below:



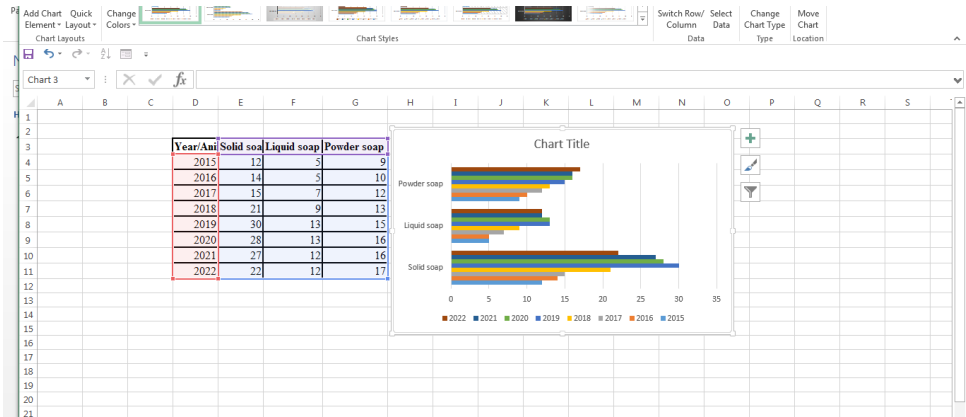


Figure 3. 44. Bar chart showing the company's production

The chart above was obtained by using the same procedure as for other charts. This procedure involves clicking the **INSERT** tab then click on the type of chart which is now the bar chart and finally selecting the variant of the chart to be applied. This chart can be edited using the tools on its left which are Charts Elements, Chart Styles, Chart Filters.

### A. Area chart

Area charts are just like line charts. Unlike the line charts, gaps are filled with color in area charts. They are easy to analyze the growth in business as its shows ups and downs through line. Information in an area chart is plotted on the x and y axis; data values are plotted using data points that are connected using line segments.

The data that was used to create the different charts generate the chart below:

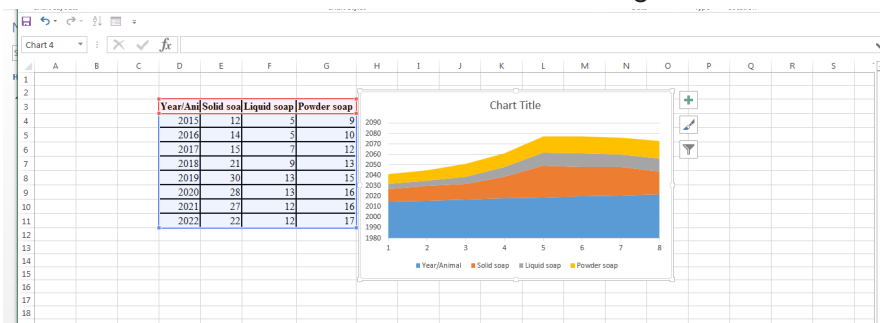


Figure 3. 45. Left: Company's data, Right: the same data represented using an area chart

The chart above was created by first selecting the data then clicking on the **INSERT** tab then click on the Area Chart and then choosing one type of chart to use. In the screenshot below, the area chart use is in a red rectangle.

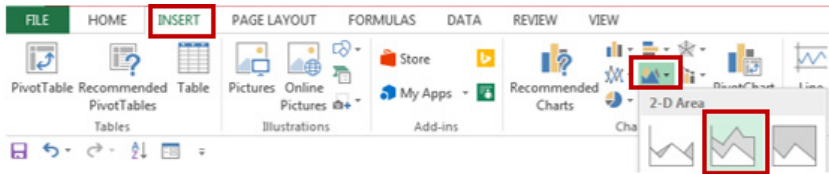


Figure 3. 46. The different tabs and tools used to insert an Area Chart

## A. Pie chart

A pie chart is a rounded shape graph that is divided into slices of pie. Using this chart, you can easily analyze data that is divided into slices. It makes the data easy to compare the proportion.

Like other charts, a pie chart is inserted by selecting the data then clicking on the Insert tab and choosing the type of chart which is the Pie chart. This process is shown below:

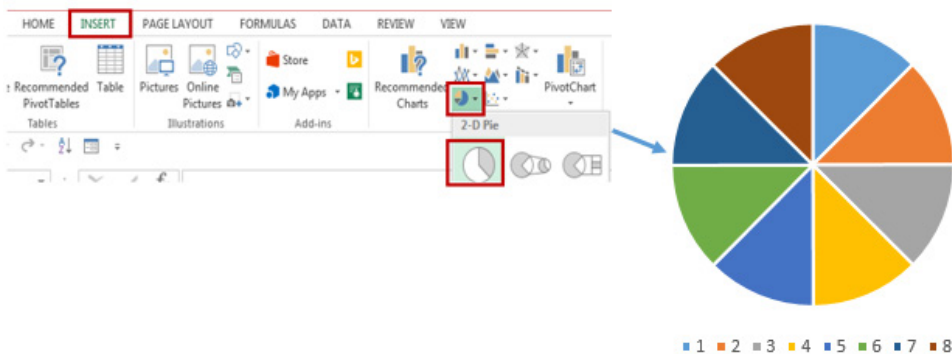
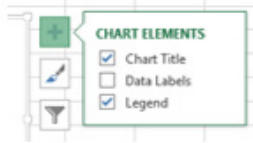


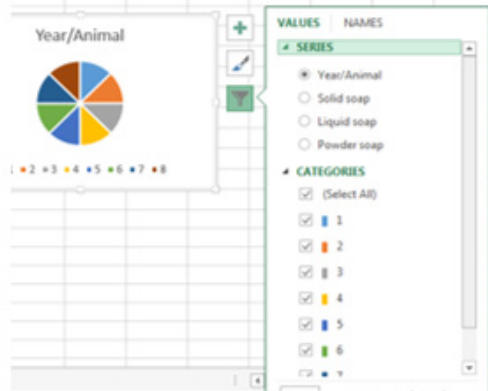
Figure 3. 47. Left: The process of inserting a pie chart, Right: The generated Pie chart

The generated chart lacks some details to be easily understood. That is why details can be used by using the **Charts Elements**, **Chart Styles** and **Chart Filters** tools. To add those details just click on the tool and check the detail to appear on the chart.

**The Chart Elements tool:**



**The Chart Filter tool:**



**The Chart Style tool:**



Figure 3. 48. The different tools used to customize a chart.

The different chart tools shown above can be used to change other charts of the same category like the ones shown below:

**Chart customized using the Chart Elements Tool, here data labels are added:**



**Chart customized using the Chart Styles tool:**

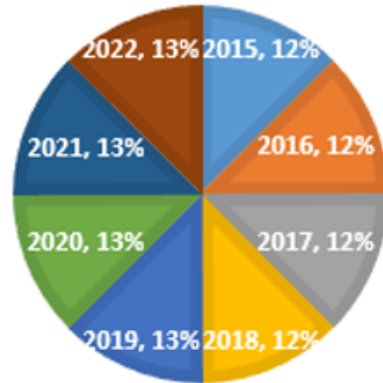


Figure 3. 49. Customization of a Pie chart using the different chart style



### Application activity 3.6

1. Use the following table to create :
  - Line chart
  - Column chart

No	Items list	Quantity	Unit Price	Total Price
1	HP Com-puter	3	400,000	1,200,000
2	RAM	12	25,000	300,000
3	Keyboard	20	7,000	140,000
4	Mouse	15	4,000	60,000
5	Power ca-bles	8	5,000	40,000

## 3.7. Data organization

### Activity 3.7



By doing a research using the internet or any other resource

- a. Discuss the types of sorting.
- b. Outline different steps of sorting list in ascending order
- c. What do you understand by filtering data?

After data has been entered into an Excel worksheet and even after it has been organized into a table, it can still be manipulated and reorganized. One of the easiest options is to sort data in a particular order for example, sorting data in alphabetical order. On the other hand, Filtering data allows to analyze data easily. When data is filtered, only rows that meet the filter criteria is going to be displayed and other rows will be hidden. Filters narrow down the data in a worksheet, allowing to view only needed information.

### 3.7.1. Filtering data

After entering data in Excel, it is also possible to filter, or hide some parts of the data, based on user-indicated criteria. When using the Filter option, no data is lost; it is just hidden from view.

In order for filtering to work correctly, the worksheet should include a **header row** which is used to identify the name of each column and is used for filtering. Follow these steps for filtering data in an excel table:

**Step 1:** Select the **Data** tab, and then click the **Filter** command. Immediately a **drop-down arrow** will appear in the header cell for each column. The filter command can also be accessed by clicking the **Home** tab and finding it at the far right side of the menu in the **Editing Group**.

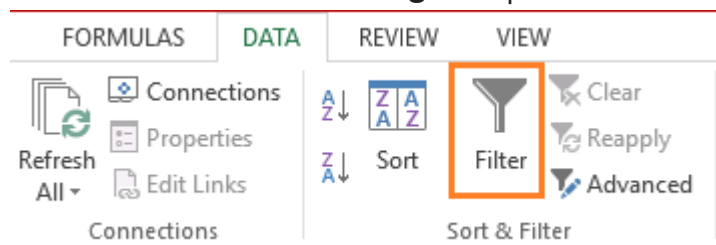


Figure 3. 50. Data tab with its filter option

**Step 2:** Click the **drop-down arrow** for the column you want to filter. In this activity, filter column **B (Region)** is filtered to view only certain region.

Click here to filter region column

	A	B	C	D	E	F	G	H
1	<b>Burera Ltd Sales data</b>							
2	Salespers	Region	May	June	July	August	September	October
3	Muhirwa	Northern	39,470	5,570	38,630	11,170	82,370	86,900
4	Mukamana	Eastern	44,110	10,420	93,550	11,000	101,850	187,490
5	Rugira	Eastern	25,210	30,720	67,020	21,160	134,520	80,460
6	Uwera	Western	47,520	37,550	44,150	10,890	44,040	201,140
7	Mwiza	Northern	49,640	31,520	116,010	11,220	31,700	107,330
8	Uwimana	Eastern	23,270	40,520	37,260	11,350	88,170	185,240
9	Ishimwe	Northern	39,670	49,060	90,070	21,130	130,900	139,630
10	Rurangwa	Eastern	53,630	5,210	45,050	10,240	35,280	152,750
11	Umutesi	Western	32,750	34,280	39,730	17,160	48,390	137,140
12	Kalisa	Northern	38,600	15,620	29,450	11,010	58,500	150,650
13	Kagabo	Eastern	46,850	27,790	75,490	10,400	100,240	183,890
14	Berwa	Northern	40,520	34,700	38,620	11,260	55,030	106,860
15	Hirwa	Western	5,541	29,230	45,960	20,120	135,470	219,830
16	Mugisha	Northern	56,670	2,883	2,142	1,054	9,543	11,967
17	Abatoni	Northern	42,690	49,310	84,200	13,890	104,680	126,770

Figure 3. 51. Data to be filtered

**Step 3:** In the Filter menu that will appear uncheck the box next to Select All to quickly deselect all data. When the Select All checkbox is unchecked, all the other checkboxes will also be unchecked.

**Step 4: Check** the boxes next to the data you want to filter, and then click **OK**.

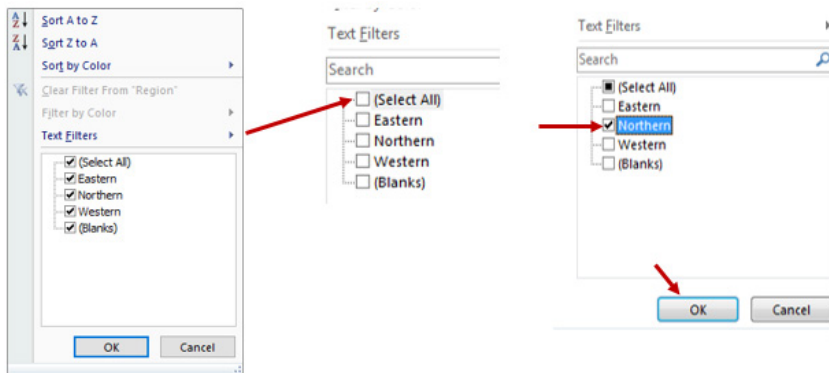


Figure 3. 52. Process of checking filter conditions

In this example, **Northern** is checked to view only those types of equipment matching the criteris. The data will be **filtered**, temporarily hiding any content that doesn't match the criteria.

	A	B	C	D	E	F	G	
	<b>Burera Ltd Sales data</b>							
	<b>persc</b>	<b>Region</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>October</b>
	wa	Northern	39,470	5,570	38,630	11,170	82,370	
	a	Northern	49,640	31,520	116,010	11,220	31,700	
	ve	Northern	39,670	49,060	90,070	21,130	130,900	
		Northern	38,600	15,620	29,450	11,010	58,500	
		Northern	40,520	34,700	38,620	11,260	55,030	
	ha	Northern	56,670	2,883	2,142	1,054	9,543	
	ni	Northern	42,690	49,310	84,200	13,890	104,680	

Figure 3. 53. Table after filtering Northern salespersons

### 3.7.2. Clear a filter

After applying a filter, you may want to remove or clear it from your worksheet so you'll be able to filter content in different ways.

**Step 1:** Click the **drop-down arrow** for the filter you want to clear the **Filter menu** will appear.

**Step 2:** Choose **Clear Filter from [COLUMN NAME]** from the Filter menu. In this case the option **Clear Filter from «Region»** is selected

Click here to clear the Region filter

Click on this option

	A	B	C	D	E
1	<b>Burera Ltd Sales data</b>				
2	Salespers	Region	May	June	July
8	Muhirwa	Northern	39,470	5,570	38,630
9	Mwiza	Northern	49,640	31,520	116,010
10	Ishimwe	Northern	39,670	49,060	90,070
11	Kalisa	Northern	38,600	15,620	29,450
12	Berwa	Northern	40,520	34,700	38,620
13	Mugisha	Northern	56,670	2,883	2,142
14	Abatoni	Northern	42,690	49,310	84,200

Sort A to Z

Sort Z to A

Sort by Color

Clear Filter From "Region"

Filter by Color

Text Filters

Search

(Select All)

Eastern

Northern

Western

(Blanks)

Figure 3. 54. Process to clear the filter

**Step 3:** The filter will be cleared from the column. The previously hidden data will be displayed like the data was before applying the filter.

### 3.7.3. Sorting

Sorting refers to ordering data in an increasing or decreasing fashion according to some linear relationship among the data items. Sorting can be done on names, numbers and records.

Below are steps to sort data:

**Step 1:** Select the entire table you want to sort

**Note:** In most cases, you can select just one cell and Excel will pick the rest of the data automatically, but this is an error-prone approach, especially when there are some gaps (blank cells) within the data.

2	Salesperson	Region	May	June	July	August	September	October
3	Mukamana	Eastern	44,110	10,420	93,550	11,000	101,850	187,490
4	Rugira	Eastern	25,210	30,720	67,020	21,160	134,520	80,460
5	Uwimana	Eastern	23,270	40,520	37,260	11,350	88,170	185,240
6	Rurangwa	Eastern	53,630	5,210	45,050	10,240	35,280	152,750
7	Kagabo	Eastern	46,850	27,790	75,490	10,400	100,240	183,890
8	Muhirwa	Northern	39,470	5,570	38,630	11,170	82,370	86,900
9	Mwiza	Northern	49,640	31,520	116,010	11,220	31,700	107,330
10	Ishimwe	Northern	39,670	49,060	90,070	21,130	130,900	139,630
11	Kalisa	Northern	38,600	15,620	29,450	11,010	58,500	150,650
12	Berwa	Northern	40,520	34,700	38,620	11,260	55,030	106,860
13	Mugisha	Northern	56,670	2,883	2,142	1,054	9,543	11,967
14	Abatoni	Northern	42,690	49,310	84,200	13,890	104,680	126,770
15	Uwera	Western	47,520	37,550	44,150	10,890	44,040	201,140
16	Umutesi	Western	32,750	34,280	39,730	17,160	48,390	137,140
17	Hirwa	Western	5,541	29,230	45,960	20,120	135,470	219,830

Figure 3. 55. Data to use for sorting

Step 2: On the *Data* tab, in the *Sort & Filter* group, click the **Sort**

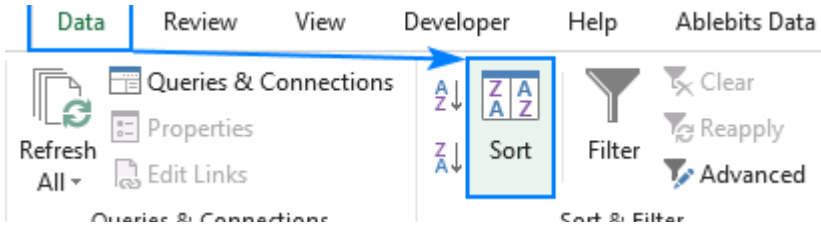


Figure 3. 56. Sort & Filter dialog box

Step 3: The Sort dialog box will show up with the first sorting level created for you automatically as Excel sees fit.

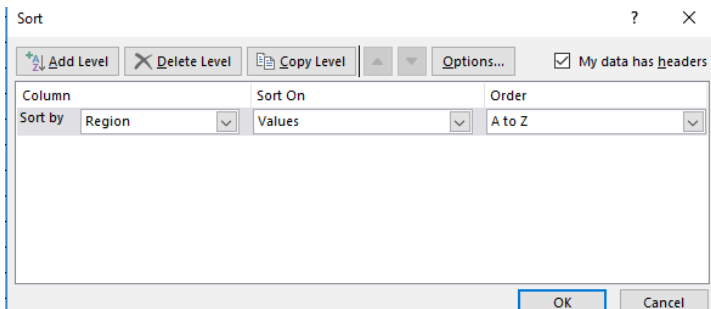


Figure 3. 57. Sort dialog box

Note: If the first dropdown is showing column letters instead of headings, tick off the “My data has headers” box.

Step 4: Click the Add Level button to add the next level and select the options for another column.

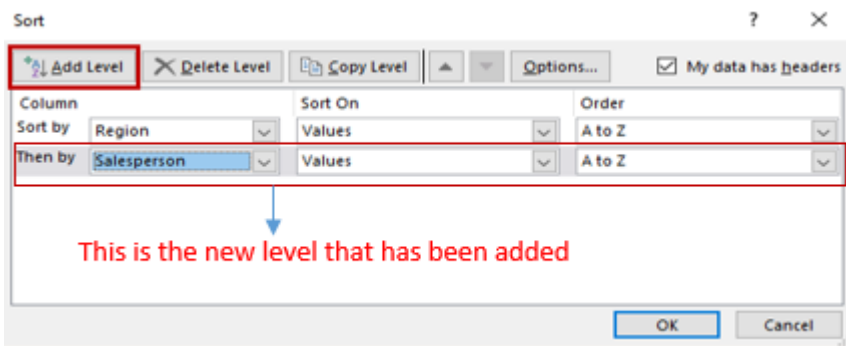


Figure 3. 58. Sort dialog box with a new level added

Note: If you are sorting by multiple columns with the same criteria, click Copy Level instead of Add Level. In this case, you will only have to choose a different column in the first box.

Step 5: Add more sort levels if needed, and click OK.



By sorting data by Region and then by Salesperson the data will be sorted first by the Region column then the second condition will be by Salesperson.

	A	B	C	D	E	F	G	H
1	<b>Burera Ltd Sales data</b>							
2	<b>Salesperson</b>	<b>Region</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>October</b>
3	Kagabo	Eastern	46,850	27,790	75,490	10,400	100,240	183,890
4	Mukamana	Eastern	44,110	10,420	93,550	11,000	101,850	187,490
5	Rugira	Eastern	25,210	30,720	67,020	21,160	134,520	80,460
6	Rurangwa	Eastern	53,630	5,210	45,050	10,240	35,280	152,750
7	Uwimana	Eastern	23,270	40,520	37,260	11,350	88,170	185,240
8	Abatoni	Northern	42,690	49,310	84,200	13,890	104,680	126,770
9	Berwa	Northern	40,520	34,700	38,620	11,260	55,030	106,860
10	Ishimwe	Northern	39,670	49,060	90,070	21,130	130,900	139,630
11	Kalisa	Northern	38,600	15,620	29,450	11,010	58,500	150,650
12	Mugisha	Northern	56,670	2,883	2,142	1,054	9,543	11,967
13	Muhirwa	Northern	39,470	5,570	38,630	11,170	82,370	86,900
14	Mwiza	Northern	49,640	31,520	116,010	11,220	31,700	107,330
15	Hirwa	Western	5,541	29,230	45,960	20,120	135,470	219,830
16	Umutesi	Western	32,750	34,280	39,730	17,160	48,390	137,140
17	Uwera	Western	47,520	37,550	44,150	10,890	44,040	201,140

Figure 3. 59. Table sorted by Region and by Salesperson columns

Excel sort data in the specified order. As shown in the screenshot above, data is arranged alphabetically exactly as it should: first by Region, and then by Salesperson

### 3.8. Financial functions



#### Application activity 3.8

1. Study the following table and answer the related questions:

No	Items list	Quantity	Unit Price	Total Price
1	HP Com-puter	3	400,000	1,200,000
2	RAM	12	25,000	300,000
3	Keyboard	20	7,000	140,000
4	Mouse	12	4,000	60,000
5	Power ca-bles	8	5,000	40,000

- ii) Display the list of Items by ascending order
- iii) Print the Total price by descending order
- iv) Filter the items whose quantity is 12

Financial [functions](#) refer to the functions used to calculate financial information, such as net present value, future value and payments. For example, you can calculate the monthly payments required to buy a car at a certain loan rate.

### **3.8.1 The Net Present Value (NPV) Function**

Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. NPV is used in capital budgeting and investment planning to analyze the profitability of a projected investment or project.

The NPV Function as an Excel [Financial function](#) will calculate the [Net Present Value \(NPV\)](#) for a series of cash flows and a given discount rate. It is important to understand the [Time Value of Money](#), which is a foundational building block of various [Financial Valuation](#) methods.

The calculation of the NPV requires the identification of the number of periods. For example if there is a monthly cash flow for 5 years, there are 60 cash flows and 60 periods. It also requires to identify the discount rate .

**The syntax of NPV Function is:**

**=NPV(rate,value,[value2],...)**

The NPV function uses the following arguments:

1. **Rate** (required argument) : This is the rate of discount over the length of the period.
2. **Value1, Value2** : Value1 is a required option. They are numeric values that represent a series of payments and income where:
  - Negative payments represent outgoing payments.
  - Positive payments represent incoming payments.

For the example below the required rate of return is 10%. To calculate the NPV, use the formula and press enter key to get a result

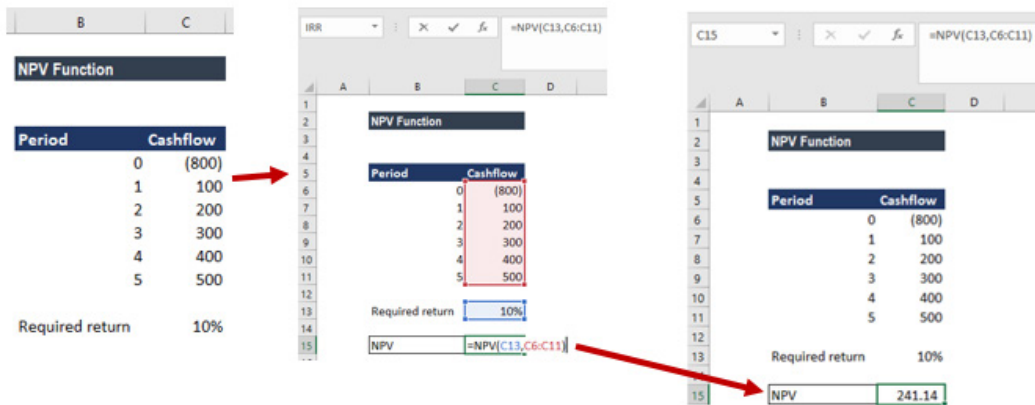


Figure 3. 60. Using the NPV function

The [NPV formula](#) is based on future cash flows. If the first cash flow occurs at the start of the first period, the first value must be added to the NPV result, not included in the values arguments.

### 3.8.2 The Future Value (FV) Function

Value of the money doesn't remain the same; it decreases or increases because of the interest rates and the state of inflation, deflation which makes the value of the money less valuable or more valuable in future. But for financial planning of what we expect the money for our future goals, we calculate the future value of the money by using an appropriate rate in a future formula.

The Future Value formula gives the future value of money for the principle or cash flow at given period.

$$FV = PV(1 + R)^n$$

FV is the Future Value of the sum, PV is the Present Value of the sum, r is the rate taken for calculation by factoring everything in it, n is the number of years

Example of Future Value Formula

In order to have a better understanding of the concept, calculate the future value by using the above-mentioned formula.

**Calculate the future value of 15,000,000 Rwf loaned at the rate of 12 percent per annum for 10 years.**

To calculate the future value,

$$PV = 15,000,000, R = 12 \%, N = 10$$

$$FV = PV (1+R)^n, FV = 15000000 (1 + 0.12)^{10}, FV = 46587720$$

Here the Present Value used is 15000,000, a rate of the period which is in years as 0.12, the number of periods which is year 10 years.

Here 1.12 rate is raised to power 10, which is in years multiplied by the principle 15000,000.

It is very much used in each and every aspect of finance, whether it's investments, corporate finance, personal finance, accounting etc.

The future Value of an investment depends on purchasing power it will be having and the return of investments on the capital.

Now, this cumulative of inflation and investment return is factorized in one term as the rate of return for the period.

Therefore,

**FUTURE VALUE = PRESENT VALUE + INCURRED RETURN ON INVESTMENT**

Now to calculate this future value, we need to understand the value calculated will be used with a compounded rate of return over the years on the present value of the capital.

This can be explained by the example below:

10 percent interest and capital is 1000, so the Future Value will be 1100 equivalent to  $1000 + 100$ . To calculate for 2 years, we can calculate by using  $1100 + 110 = 1210$  which can also be written as  $1000 (1.1)^2$  which will make the calculation to  $1.21 * 1000 = 1210$

This way, calculate the future values of any amount when an interest rate is given by the formula  **$PV \times (1 + r)^n$**

The calculation of Future Value in Excel is very easy and can take many variables, which can be very difficult to calculate otherwise without a spreadsheet.

The syntax of FV function:

=FV(rate, nper, pmt,[ PV])

**Example: What will the amount after the principle of 10000 is invested for 10 years and 1000 is invested every year at the rate of 17 percent per annum.**

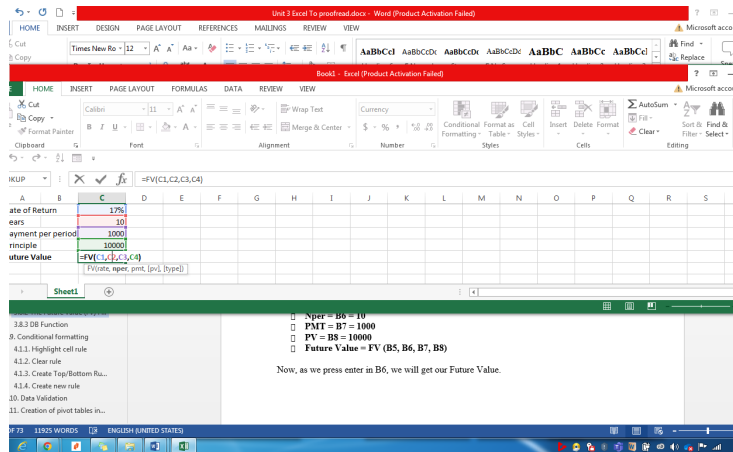


Figure 3. 61. Application of Future Value function

Now, as soon as you put in the FV function and start a bracket, the excel asks you to open the bracket and give rate (rate), a number of periods (nper), payment per term (pmt), Present Value (PV) close brackets.

Now following the problem above: **Rate = B5 = 17%, Nper = B6 = 10, PMT = B7 = 1000, PV = B8 = 10000**

**Future Value = FV (B5, B6, B7, B8)**

### 3.8.3. DB Function

The DB function is an Excel [Financial function](#) which helps in calculating the depreciation of an asset. The method used for calculating depreciation is the [Fixed Declining Balance Method](#) for each period of the asset's lifetime.

**The syntax of DB Function:**

**=DB(cost, salvage, life, period, [month])**

- **Cost** (required argument): This is the initial cost of the asset.
- **Salvage** (required argument): The value of the asset at the end of the depreciation.
- **Life** (required argument): This is the useful life of the asset or the number of periods for which we will be depreciating the asset.
- **Period** (required argument): The period for which we wish to calculate the depreciation for.
- **Month** (optional argument): Specifies how many months of the year are used in the calculation of the first period of depreciation. If omitted, the function will take the default value of

### Activity 3.9



Open Excel and enter data in the table below. Save the File as “Burera Ltd Sales data”

1	Burera Ltd Sales data						
2	Salesperson	May	June	July	August	September	October
3	Abatoni	42,690	49,310	84,200	13,890	104,680	126,770
4	Berwa	40,520	34,700	38,620	11,260	55,030	106,860
5	Hirwa	5,541	29,230	45,960	20,120	135,470	219,830
6	Ingabire	35,020	47,980	22,480	10,580	62,670	129,820
7	Iradukunda	25,860	41,720	38,070	13,480	11,110	100,470
8	Ishimwe	39,670	49,060	90,070	21,130	130,900	139,630
9	Kagabo	46,850	27,790	75,490	10,400	100,240	183,890

Do the followings:

- Using Burera Ltd Sales data, show salespersons who are meeting their monthly sales goals. The sales goal is 50,000 items per month
- Highlight all salesperson whose sales are below the average
- Highlight with blue color all salesperson whose sales are above 80,000

2

### DB Function in Excel

Example 1:

Assume we wish to calculate the depreciation for an asset with an initial cost of 100,000 Rwf. The asset's salvage value after 5 years is 10,000 Rwf. The screenshot below shows how to calculate it. The results are got after hitting the Enter key:

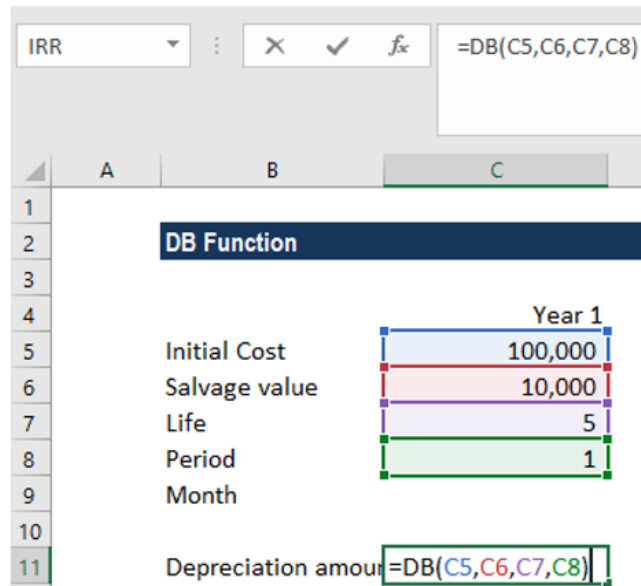


Figure 3. 62. Application of DB Function



### Application activity 3.8

1. Explain all necessary arguments used by DB function

**2. What will the amount be (Future Value) after the principle of 2500000 Rwf is invested for 8 years and 15000 is invested every year thereafter at the rate of 14 percent?**

## 3.9. Conditional formatting

Conditional formatting is an especial feature (formatting feature) of Excel used to find unique and duplicates values by formatting the cells. Conditional formatting allows the users to format the cells and their data based on some conditions specified by the user. Using conditional formatting, you can highlight a cell with a certain color and its content with different font.

Conditional formatting enables spreadsheet users to do a number of things. First and foremost, it calls attention to important data points such as deadlines, at-risk tasks. It can also make large data sets more digestible by breaking up the wall of numbers with a visual organizational component. Among the options provided by conditional formatting are: **highlight cell rules, top bottom rules, customized rules, etc**

### 3.9.1. Highlight cell rule

Conditional formatting can be used to enhance the reports and dashboards in Excel. The conditional formatting statement under the Highlight Cells Rules category allow to highlight the cells whose values meet a specific condition.

The benefit of a conditional formatting rule is that Excel automatically reevaluates the rule each time a cell is changed provided that cell has a conditional formatting rule applied to it. Those rules include: greater than, less than, equal to, between, text that contain, A Date occurring, duplicate values, ...

Here are the steps to apply the highlight cell rule:

**Step 1:** Select the desired cells on which to apply the conditional formatting rule

**Step 2:** From the **Home tab**, click the **Conditional Formatting command**. A drop-down menu will appear.

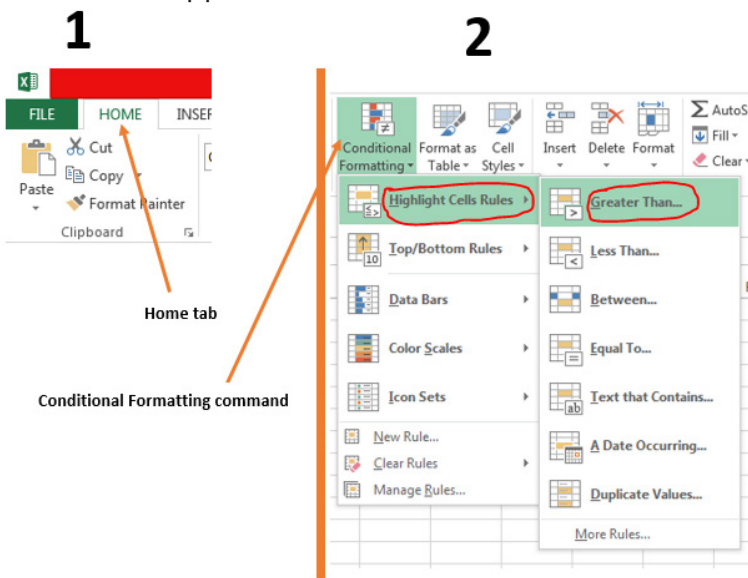


Figure 3.63. Screenshots showing Home tab and Conditional formatting Command

Step 3: Hover the mouse over the desired conditional formatting type, and then select the desired rule from the menu that appears. In the Activity 4.1, we want to highlight cells that are greater than 50,000.

Step 4: A dialog box will appear. Enter the desired value(s) into the blank field. In the case of the activity 4.1, the taken value is 50,000.

Step 5: Select a formatting style from the drop-down menu. In the Activity 4.1, the color to choose is Green Fill with Dark Green Text, then click OK.



	B	C	D	E	F	
<b>Burera Ltd Sales data</b>						
person	May	June	July	August	September	Oct
wa	39,470	5,570	38,630	11,170	82,370	
mana	44,110	10,420	93,550	11,000	101,850	
	25,210	30,720	67,020	21,160	134,520	
	47,520	37,550	44,150	10,890	44,040	201,140
	49,640	31,520	116,010	11,220	31,700	107,330
ana	23,270	40,520	37,260	11,350	88,170	185,240
ve	39,670	49,060	90,070	21,130	130,900	139,630
gwa	53,630	5,210	45,050	10,240	35,280	152,750
esi	32,750	34,280	39,730	17,160	48,390	137,140
	38,600	15,620	29,450	11,010	58,500	150,650

Figure 3. 64. Highlighted cells after setting a formatting cell rule

**Step 6:** The conditional formatting will be applied to the selected cells. In our case, it's easy to see which salesperson reached the 50, 000 sales goals for each month.

	A	B	C	D	E	F	G
<b>Burera Ltd Sales data</b>							
Salesperson	May	June	July	August	September	October	
Muhirwa	39,470	5,570	38,630	11,170	82,370	86,900	
Mukamana	44,110	10,420	93,550	11,000	101,850	187,490	
Rugira	25,210	30,720	67,020	21,160	134,520	80,460	
Uwera	47,520	37,550	44,150	10,890	44,040	201,140	
Mwiza	49,640	31,520	116,010	11,220	31,700	107,330	
Uwimana	23,270	40,520	37,260	11,350	88,170	185,240	
Ishimwe	39,670	49,060	90,070	21,130	130,900	139,630	
Rurangwa	53,630	5,210	45,050	10,240	35,280	152,750	
Umutesi	32,750	34,280	39,730	17,160	48,390	137,140	
Kalisa	38,600	15,620	29,450	11,010	58,500	150,650	

Figure 3. 65. Results of applying highlight cell rule (>50000)

Note: You can apply multiple conditional formatting rules to a cell range or worksheet, allowing you to visualize different trends and patterns in your data.

### 3.9.2. Clear rule

Rules that have been used to highlight cells that meet certain conditions can be removed and have text with no highlight when the rules are no longer needed or when there is a need to set new rules. To clear rules do the following:

Step 1: Select the desired cells for clearing the conditional formatting rule

Step 2: On the Home tab, in the Styles group, click Conditional Formatting (refer to Figure 4.1.)

Step 3: Click Clear Rules then click Clear Rules from Selected Cells

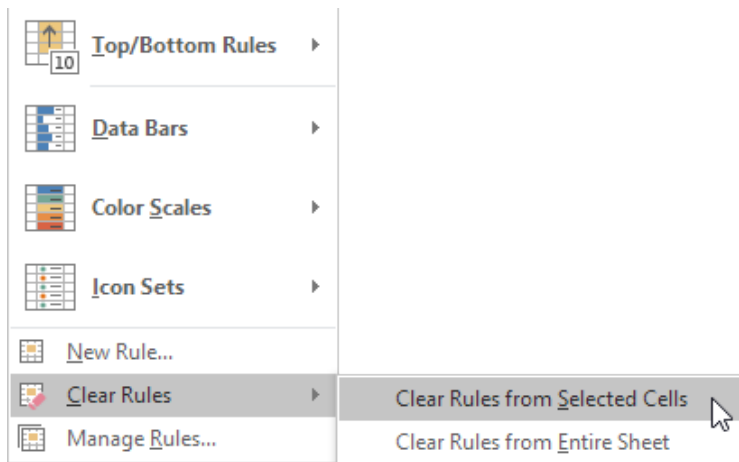


Figure 3. 66. Clear rule options

After clearing rules for selected cells, cells are no longer colored, there is no more formatting in cells.

### 3.9.3. Create Top/Bottom Rules

Top/Bottom rules are another useful Conditional Formatting in Excel. These rules allow users to call attention to the top or bottom range of cells, which can be specified by number, percentage, or average.

**Step 1:** Select the desired cells for the conditional formatting rule

**Step 2:** From the **Home** tab, Select **Conditional Formatting** then **Top/Bottom Rules** then click **Above Average...**

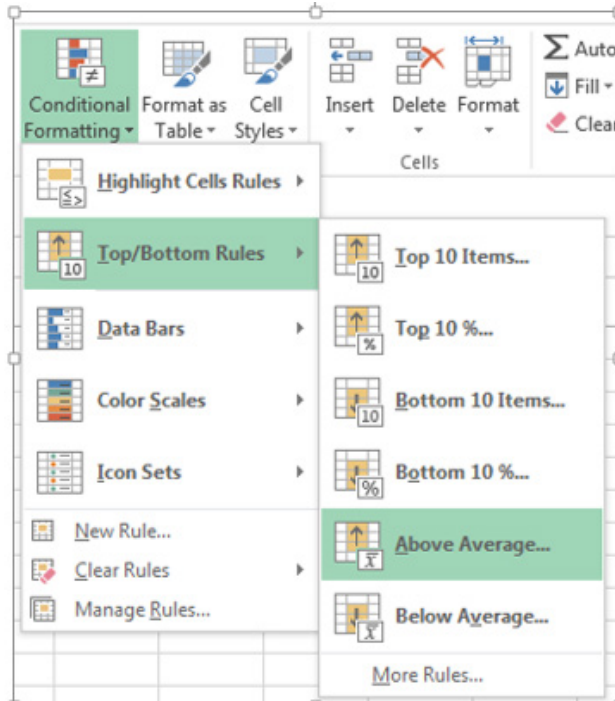


Figure 3. 67.Top/Bottom rules-Above average

Step 3: A dialog box will appear. Choose color format to use like “Light Red Fill with Dark Red text”. After choosing cells format, Press “OK”

	A	B	C	D	E	F	G
1		<b>Burera Ltd Sales data</b>					
2	<b>Salesperson</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>October</b>
3	Muhirwa	39,470	5,570	38,630	11,170	82,370	86,900
4	Mukamana	44,110	10,420	28,550	11,000	101,050	187,490
5	Rugira	25,210	30,720	28,550	11,000	101,050	80,460
6	Uwera	47,520	37,550	28,550	11,000	101,050	201,140
7	Mwiza	49,640	31,520	28,550	11,000	101,050	107,330
8	Uwimana	23,270	40,520	28,550	11,000	101,050	185,240
9	Ishimwe	39,670	49,060	90,070	21,130	130,900	139,630
10	Rurangwa	53,630	5,210	45,050	10,240	35,280	152,750
11	Umutesi	32,750	34,280	39,730	17,160	48,390	137,140
12	Kalisa	38,600	15,620	29,450	11,010	58,500	150,650

Figure 3. 68.Above average rule dialog box

Step 4: Your sheet will now highlight the values above the average

	A	B	C	D	E	F	G
1		<b>Burera Ltd Sales data</b>					
2	<b>Salesperson</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>October</b>
3	Muhirwa	39,470	5,570	38,630	11,170	82,370	86,900
4	Mukamana	44,110	10,420	93,550	11,000	101,850	187,490
5	Rugira	25,210	30,720	67,020	21,160	134,520	80,460
6	Uwera	47,520	37,550	44,150	10,890	44,040	201,140
7	Mwiza	49,640	31,520	116,010	11,220	31,700	107,330
8	Uwimana	23,270	40,520	37,260	11,350	88,170	185,240
9	Ishimwe	39,670	49,060	90,070	21,130	130,900	139,630
10	Rurangwa	53,630	5,210	45,050	10,240	35,280	152,750
11	Umutesi	32,750	34,280	39,730	17,160	48,390	137,140
12	Kalisa	38,600	15,620	29,450	11,010	58,500	150,650

Figure 3. 69. Top/bottom rules: Above average cells highlighted

### 3.9.4. Create new rule

Excel allows to create a formula-based conditional formatting rule. The available options are:

- Formatting cells based on their values,
- Formatting cells that contain certain values,
- Formatting only top or bottom ranked values,
- Formatting only values that are below or above average,
- Formatting only unique or duplicate values and using a formula to determine which values to format.

All those options are presented in the window below:

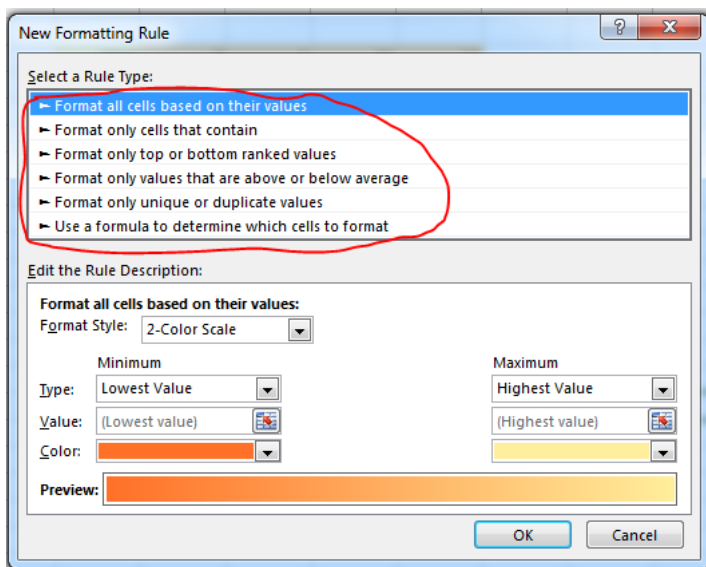


Figure 3. 70. Rule types to choose from while defining a new rule

**Step 1:** Select the cells you want to format. In the Home tab click on **Conditional Formatting** command and click **New rule**

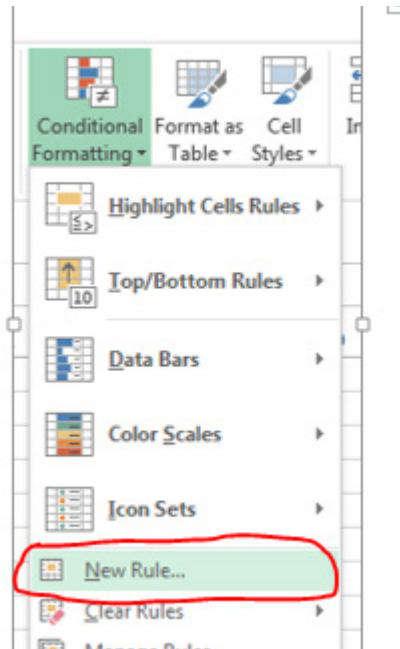


Figure 3. 71. New rule option

Step 2: Create a conditional formatting rule, and select the Formula option then click OK. In the window below the option “Use a formula to determine which cells to format” has been chosen

g) Format all cells based on their values

Step 1: New formatting rule window will be opened.

Step 2: Select Format all cells based on their values option, however this is by default selected.

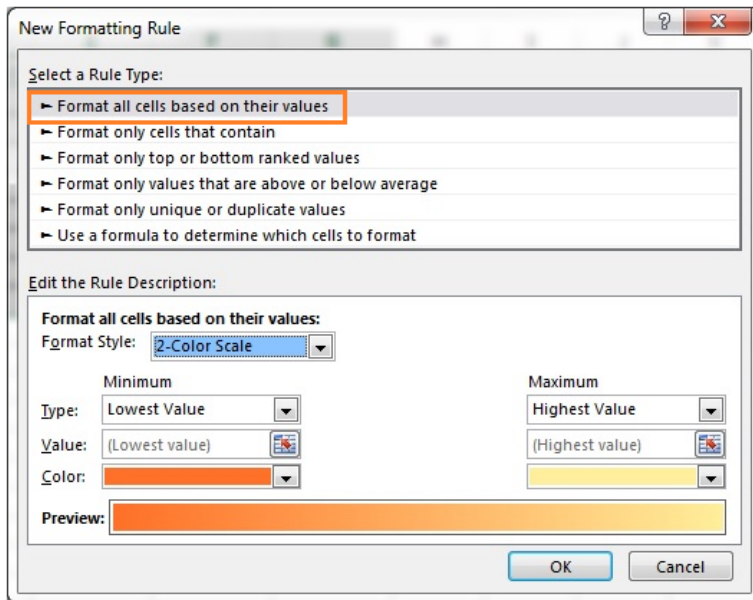


Figure 3. 72.Format all cells based on their values

In this case only 2 options are going to be used: 2-color scale and 3-color scale

## h) 2-color scale

**Step 1:** Choose minimum and maximum values

**Step 2:** Click Ok button to apply this conditional formatting

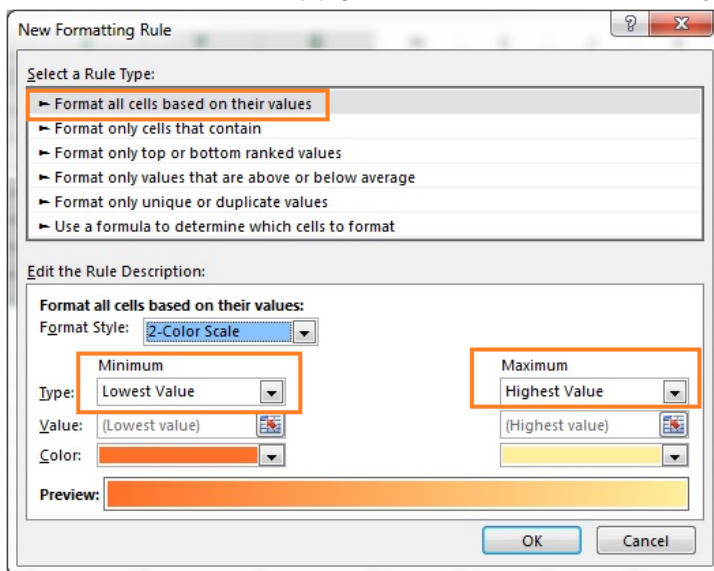


Figure 3. 73.Color scale

**Step 3:** Data set with this condition formatting will look like below

**Note:** we have chosen minimum number to 50,000 and the maximum to 80,000, then selected a colors to separate both values.

1	Burera Ltd Sales data						
2	Salesperson	May	June	July	August	September	October
3	Muhirwa	39,470	5,570	38,630	11,170	82,370	86,900
4	Mukamana	44,110	10,420	93,550	11,000	101,850	187,490
5	Rugira	25,210	30,720	67,020	21,160	134,520	80,460
6	Uwera	47,520	37,550	44,150	10,890	44,040	201,140
7	Mwiza	49,640	31,520	116,010	11,220	31,700	107,330
8	Uwimana	23,270	40,520	37,260	11,350	88,170	185,240
9	Rurangwa	53,630	5,210	45,050	10,240	35,280	152,750
10	Umutesi	32,750	34,280	39,730	17,160	48,390	137,140
11	Kalisa	38,600	15,620	29,450	11,010	58,500	150,650

Figure 3. 74. Color scale results with a conditional formatting rule

### i) 3-color scale

**Step 1:** New formatting rule window will be opened.

**Step 2:** Select Format all cells based on their values option, however this is by default selected.

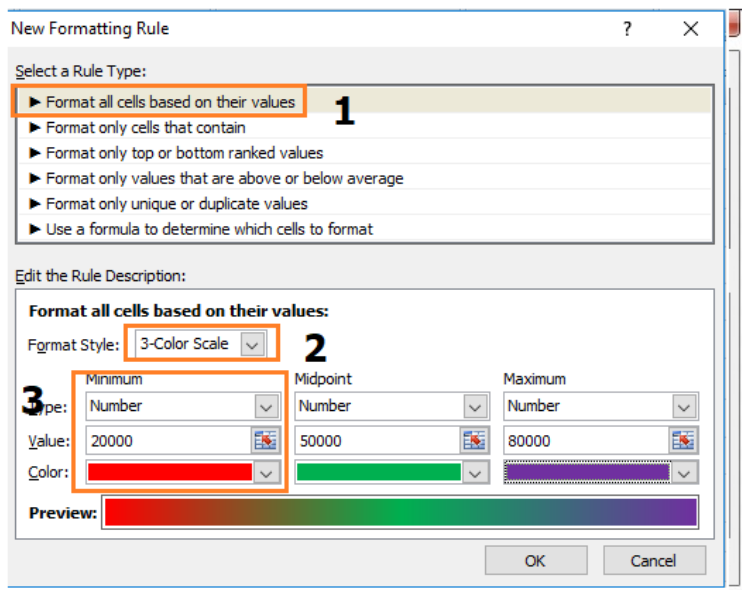


Figure 3. 75. Color formatting style

Below are steps to apply 3 -color formatting style

**Step 3:** select **3 color scale** option in **format style**

**Step 4:** choose the type; here we are taking as Minimum, Midpoint and Maximum

**Step 5:** Put values for number for Minimum, Midpoint and Maximum

Then, results are displayed as follow:

1	Burera Ltd Sales data						
2	Salesperson	May	June	July	August	September	October
3	Muhirwa	39,470	5,570	38,630	11,170	82,370	86,900
4	Mukamana	44,110	10,420	93,550	11,000	101,850	187,490
5	Rugira	25,210	30,720	67,020	21,160	134,520	80,460
6	Uwera	47,520	37,550	44,150	10,890	44,040	201,140
7	Mwiza	49,640	31,520	116,010	11,220	31,700	107,330
8	Uwimana	23,270	40,520	37,260	11,350	88,170	185,240
9	Rurangwa	53,630	5,210	45,050	10,240	35,280	152,750
10	Umutesi	32,750	34,280	39,730	17,160	48,390	137,140
11	Kalisa	38,600	15,620	29,450	11,010	58,500	150,650

Figure 3. 76. Color formatting style result

## 2. Use a formula to determine which cells to format

New rules can be created by customizing own formulas. By using custom made formula, a custom condition that triggers a rule is created and can be applied as the user needs it to be applied. In the data that is going to be used the formula =B3>80000 has been applied for formatting.

To specify the formatting formula click on Conditional Formatting tab then New Rule and choose Use Formula to determine which cells to format as in the window below:



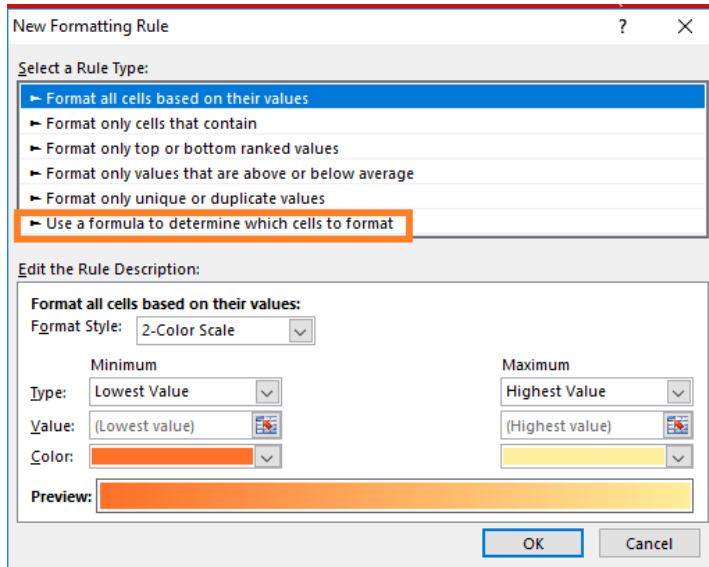


Figure 3. 77.Dialog box for new formatting rule

Step 3: Enter a formula that returns TRUE or FALSE then set formatting options, save the rule and press OK

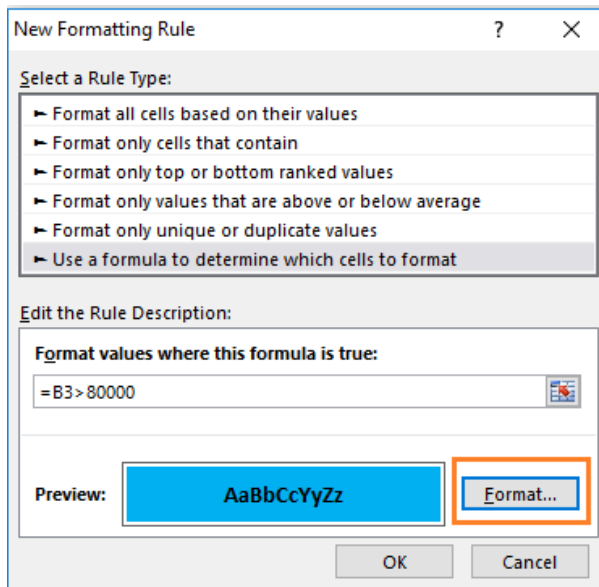


Figure 3. 78.Formatting options

After clicking OK cells that meet the formatting rule are highlighted as specified in the new rule. In the window below cells meeting the criteria are blue colored as it has been specified.

1	Burera Ltd Sales data						
2	Salesperson	May	June	July	August	September	October
3	Muhirwa	39,470	5,570	38,630	11,170	82,370	86,900
4	Mukamana	44,110	10,420	93,550	11,000	101,850	187,490
5	Rugira	25,210	30,720	67,020	21,160	134,520	80,460
6	Uwera	47,520	37,550	44,150	10,890	44,040	201,140
7	Mwiza	49,640	31,520	116,010	11,220	31,700	107,330
8	Uwimana	23,270	40,520	37,260	11,350	88,170	185,240
9	Rurangwa	53,630	5,210	45,050	10,240	35,280	152,750
10	Umutesi	32,750	34,280	39,730	17,160	48,390	137,140
11	Kalisa	38,600	15,620	29,450	11,010	58,500	150,650

Figure 3. 79. Table with highlighted cells according to the new rule

**Note:** Always write the formula for the upper-left cell in the selected range. Excel automatically copies the formula to the other cells. Thus, cell B3 contains the formula =B3>80,000, cell C3 contains the formula = B3>80,000 and etc.

Below are some formulas that apply conditional formatting and return TRUE or FALSE, or numeric equivalents.

=ISODD (A1): The ISODD function is used to check if a numeric value is an odd number. ISODD returns TRUE when a numeric value is odd and FALSE when a numeric value is even. If value is not numeric, ISODD will return the #VALUE error.

SODD (A1) returns TRUE if A1 contains the number 3 and FALSE if A1 contains the number 4. Usually, value is supplied as a cell address.

ISODD is part of a group of functions called the IS functions that all return the logical values TRUE or FALSE.

- 1) =ISNUMBER (A1): The ISNUMBER function is used to check if a value is a number. ISNUMBER will return TRUE when value is numeric and FALSE when not.
- 2) ISNUMBER (A1) returns TRUE if A1 contains a number or a formula that returns a numeric value. If A1 contains text, ISNUMBER will return FALSE.
- 3) AND (A1>100, B1<500): The AND function is used to apply more than one condition at the same time, up to 255 conditions. Each logical condition (logical1, logical2, etc.) must return TRUE Examples
- 4) AND (A1>100, B1<500) test if the value in A1 is greater than 100 and B1 less than 500



### Application activity 3.9

- Given the following data tables :

No	Items list	Quantity	Unit Price	Total Price
1	HP Com-puter	3	400,000	1,200,000
2	RAM	12	25,000	300,000
3	Key-board	20	7,000	140,000
4	Mouse	15	4,000	60,000
5	Power cables	8	5,000	40,000

- Using conditional formatting highlight with red color the total prices which costed between 150,000 and 500,000
- Apply conditional formatting on Total price using data bars
- Apply conditional formatting on Unit price using Color scales
- Apply conditional formatting on Quantity using Icon sets

## 3.10. Data Validation



### Activity 3.10

1. What do you understand by data validation ?
  2. What is the importance of applying data validation?

Data Validation is one of the essential features in MS Excel. When creating an Excel sheet for users or customers, you may often need to restrict the inputs based on different criteria to ensure that all the entries or inputs are correct and consistent. Data Validation is the solution that helps to control user inputs into specific cells or a range according to the specified rules.

Some of the essential tasks (restrictions/ validations) that can be set using the Data Validation are as follows:

- Allow users to put **numeric** or **text** entries only
- Allow entering numbers less than, more than and between a specified **range**
- Allow data inputs of a specific **length**
- Restrict entries to predefined values in a **drop-down list**
- Restrict date and time entries outside or within a specific **range**
- Validate a specific entry based on **another cell**
- Display an **input message** informing users what the corresponding cell accepts when the user selects a cell
- Display a **warning or error message** when the user enters wrong data
- Locate **incorrect or wrong entries** in the validated cells

Applying Data Validation on any cell or range of cells in an Excel sheet restricts the users from entering any undesired entries in corresponding cells based on the validation rules. For instance, if we set validation to accept only numbers or numeric values, other users will not be able to enter any values other than numbers. The Excel data validation window is displayed after clicking on the Data tab then click on Data Validation. After the Data Validation window is available, choose among the different options which are available by clicking on the Setting tab, Input Message tab, Error Alert tab.

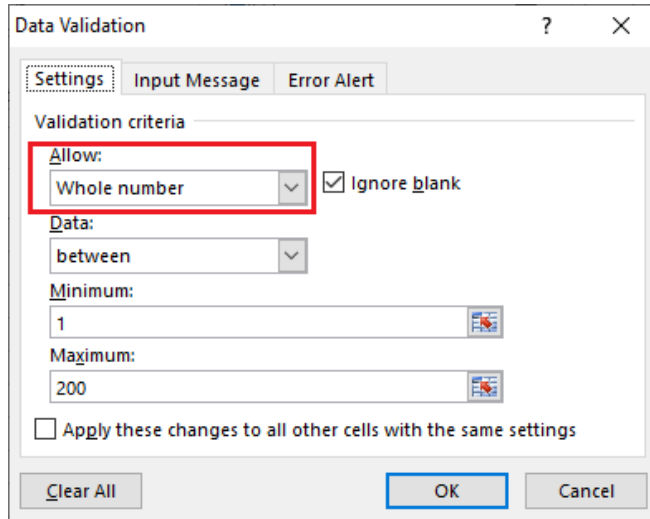


Figure 3. 80. Setting Data Validation in a spreadsheet

Data Validation can be configured to show an input message to users when the respective cell is selected, informing them what is allowed in it, as shown below:

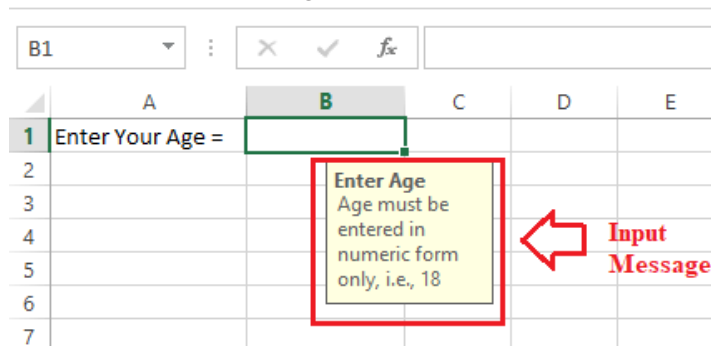


Figure 3. 81. Input message of data validation

As soon as we try to enter any other type of data in restricted cells, Excel instantly displays an error message and even can display which type of data the respective cells can accept. The error message can be of different styles and customized or created manually while setting up the validation rules on the Excel sheet.

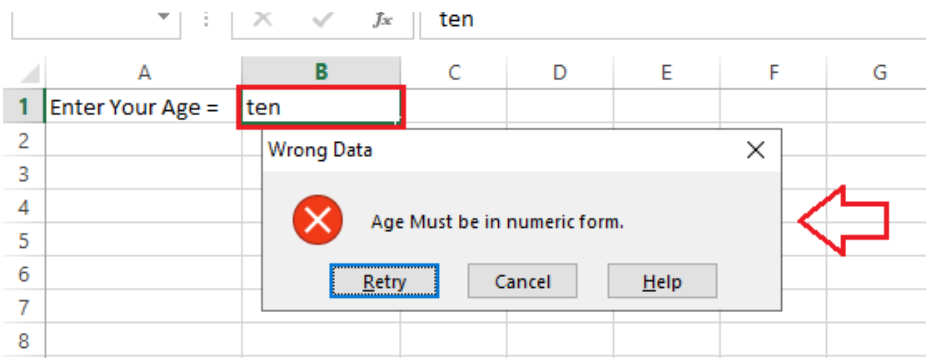


Figure 3. 82.A feedback message of a wrong input

- Data Validation Controls

The Data Validation feature or its controls can be found on the ribbon under the Data tab. By default, it is placed under the category 'Data Tools'.

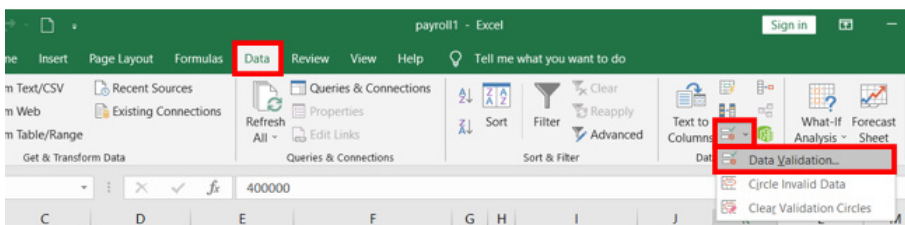


Figure 3. 83.Data validation feature on Data tab

As soon as Data Validation icon is clicked from the ribbon, it immediately launched a **Data Validation dialog box**. In addition to the Data Validation shortcut on the ribbon, the keyboard shortcut '**Alt + D + L**' can be used without quotes. It will launch the Data Validation dialog box instantly.

Using Data Validation Dialog Box to Define Validation Rules

The Data Validation dialogue box contains three essential options/ tabs: **Settings**, **Input Message**, and **Error Alert**.



Figure 3. 84.Data Validation dialog box

## ▪ **Settings Tab**

The settings tab provides us options to set validation criteria. The tab helps us choose the desired validation rules from the built-in options we want to allow in selected cells. Moreover, we can also set custom rules with the customized formula to validate user inputs. The settings tab contains all the **data validation options** present in Excel.

### ▪ **Input Message Tab**

The input message tab has a text box to enter a message displayed as soon as the respective cell is selected. The input message is an optional feature of Data Validation. If we do not define any message as an input message, excel does not show any message when the user selects the respective cell with data validation. It does not affect the working of the data validation and has no effect or control over what the user enters into a cell. However, it can be helpful to inform users about the allowed or expected data values.

### ▪ **Error Alert Tab**

The error alert tab provides options to control the way how the validation is enforced. We can set criteria and then use any desired error style to accept or reject the user inputs accordingly. Additionally, we can also display a message to the user informing what the error is or what values must be entered in corresponding cells.

### ▪ **Adding Data Validation in Excel**

To add a data validation in an Excel sheet, we must perform the following steps:

**Step 1: Launch the Data Validation dialogue Box**

First, select all the cells or a range to which to apply the validation. Next, click the **Data tab. In the Data Tools** group and select **Data Validation** tool to launch the data validation dialo box.

### **Step 2: Set the Data Validation Rule**

After the data validation dialogue box is displayed, go to the Settings tab to define validation criteria. Provide the desired values, cell references, or formulas in the validation criteria.

After all the validation settings have been set, click the OK button to close the validation dialog box or move to the next tab to insert an input message and/or error alerts.

### **Step 3: Create an Input Message to Display (Optional)**

To display a message to the user saying which type of data is supported

or allowed in the selected cell, use the input message tab. Using the input message, the user is informed about the allowed data type format when the user selects corresponding cells.

Once the input message is entered, click the OK button or move to the Error Alert tab further.

#### Step 4: Add an Error alert (Optional)

In addition to an input message, set an error alert to display when the user enters invalid data into the respective cells. Moreover, add a custom error message.



### Application activity 3.6

- a. Apply the following data validations in the table below :
1. If the age is not belonging the range of 60 and 75, error message
  2. If the Date of birth exceed 1960, provide an error message
  3. If the entered country is not RWANDA in UPPER CASE, prompt an error message

No	Names	Age	Date of birth	Country
1	Hagenimana	65	05/08/1950	RWANDA
2	Kajugiro			
3	Gatsinzi			
4	Kabera			
5	Samvura			



### 3.11. Pivot tables in Excel

#### Activity 3.11

By doing a research using the internet or any other resource answer the following questions

1. What do you understand by a pivot table?
2. Discuss the uses of a pivot table
3. Outline different steps of creating a pivot table

A pivot table is a statistics tool that calculates, summarizes, analyzes and reorganizes selected columns and rows of data in a spreadsheet or database table to obtain a desired report. Pivot tables are especially useful with large amounts of data that would be time-consuming to calculate by hand.

#### ▪ Uses of a pivot table

- A pivot table helps users answer business questions with minimal effort. Common pivot table uses include:
  - To calculate sums or averages in business situations. For example, counting sales by department or region.
  - To show totals as a percentage of a whole. For example, comparing sales for a specific product to total sales.
  - To generate a list of unique values. For example, showing which states or countries have ordered a product.
  - To create a 2x2 table summary of a complex report.
  - To identify the maximum and minimum values of a dataset.
- Creating a pivot table in Excel
- Select the cells you want to create a PivotTable from.
- Click Insert tab and then PivotTable.

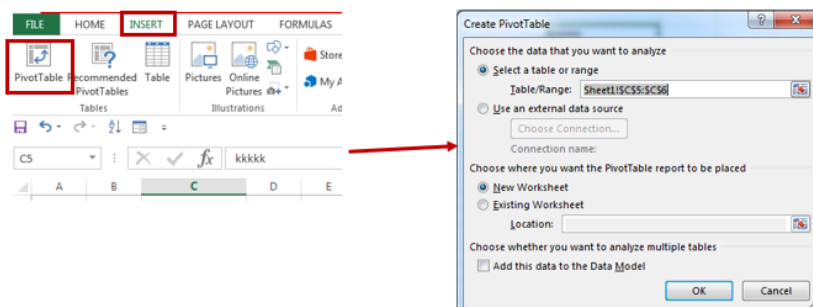


Figure 3. 85. Left: tabs for creating a Pivot table, Right: Dialog box for creating a pivot table.

- Choose where you want the pivot table report to be placed. Select **New Worksheet** to place the pivot table in a new worksheet or **Existing Worksheet** and select where the new PivotTable will appear.
- Click OK.
- Choose the fields to add to a report on right pane of the window
- Drag fields between areas below:
- **Performing the steps of ceating a pivot table**

Go through these steps to create a pivot table:

**Step1:** Select the cells on which to create a PivotTable and click **Insert tab** and then select PivotTable.

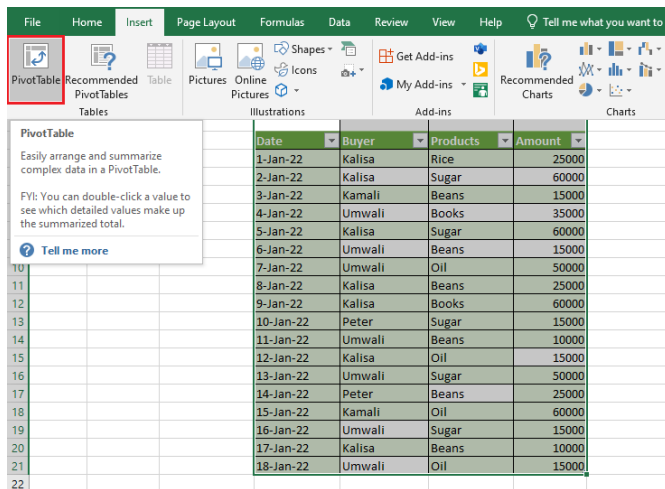


Figure 3. 86. Selecting Pivot table icon under insert tab

**Step2:** This will create a PivotTable based on an existing table or range. By clicking **Pivot table** tool the **Create PivotTable** dialog box appears

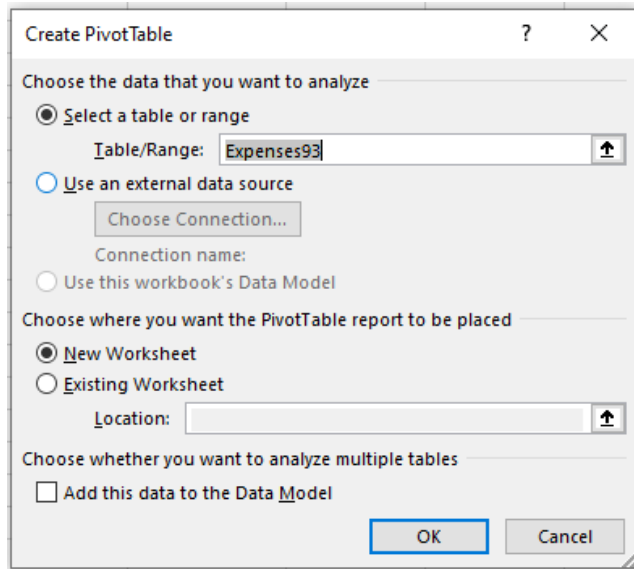


Figure 3. 87. Create Pivot Table dialog box

Step 3: Choose where the PivotTable report will be placed. Select New Worksheet to place the PivotTable in a new worksheet or Existing Worksheet and select where the new PivotTable will appear.

Step 4: Click OK.

Step 5: Choose the fields to add to a report on right pane of the window

Step 6: To obtain a report result, drag product and date fields to values area

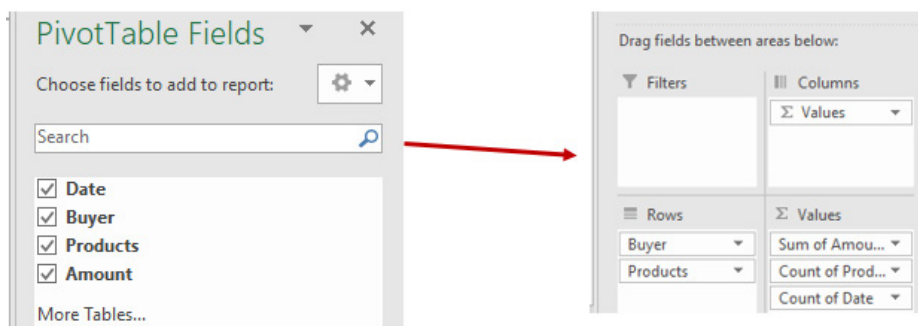


Figure 3. 88. Dragging of fields to Values area

After dragging the fields needed, a pivot table is created automatically as follows:

<b>Kalisa</b>	<b>255000</b>	<b>7</b>	<b>7</b>
Beans	35000	2	2
Books	60000	1	1
Oil	15000	1	1
Rice	25000	1	1
Sugar	120000	2	2
<b>Kamali</b>	<b>75000</b>	<b>2</b>	<b>2</b>
Beans	15000	1	1
Oil	60000	1	1
<b>Peter</b>	<b>40000</b>	<b>2</b>	<b>2</b>
Beans	25000	1	1
Sugar	15000	1	1
<b>Umwali</b>	<b>190000</b>	<b>7</b>	<b>7</b>
Beans	25000	2	2
Books	35000	1	1
Oil	65000	2	2
Sugar	65000	2	2

Figure 3. 89. An example of a created pivot table



### Application activity 3.11

- You have a list of all students of your class. The list contains the gender of each student and the district where he/she came from. You are requested to do the following:
  - Separate the list in different sheets, sheet 1 contains the male students and sheet 2 contains the female students.
  - Show the number of students by the district where they come from.

### 3.12. Excel data entry forms

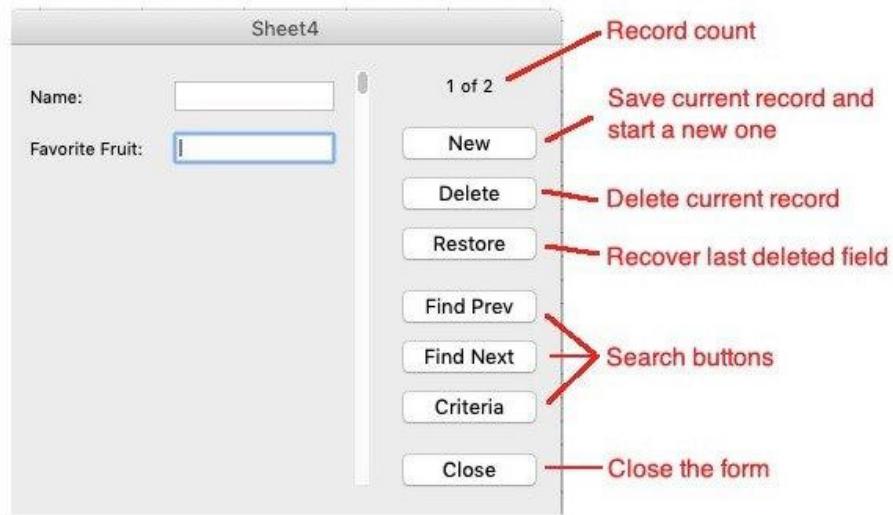
#### Activity 3.12



- 1 What do you understand by data entry form?
2. Using internet search, discuss the process of creating Excel data entry forms?

Excel offers the ability to make data entry easier by using a form, which is a dialog box with the fields for one record. The form allows data entry, a search function for existing entries, and the ability to edit or delete the data.

The example below has two fields per record. The form allows up to 32 fields per record.



Here below are steps to be performed while creating an Excel data entry form:

Step 1: On the chosen sheet, highlight the number of columns needed.

Step 2: Click insert tab and then click table icon

Step 3: In create table dialog box, select My table has headers checkbox and click Ok

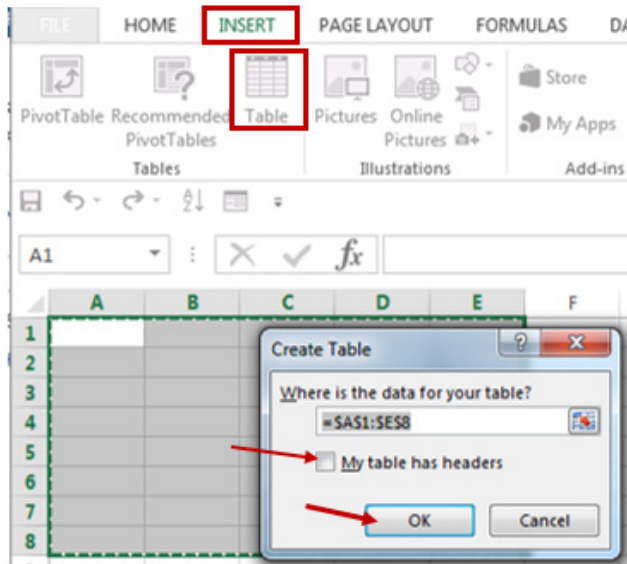


Figure 3. 90. Process to make an Excel data entry form

**Step 4:** Change the default column headers, and adjust the width of columns if necessary.

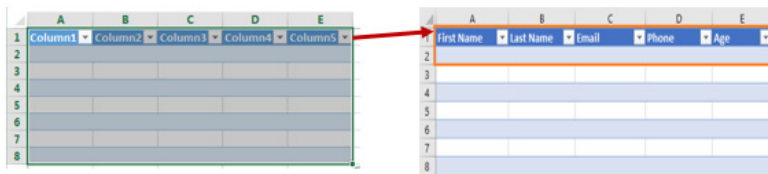


Figure 3. 91. Changing column headers

**Step 5:** Click Form Icon of Customize Quick Access Toolbar

**Step 6:** The form will appear. The number of columns in the table will match the number of fields on the form. The column titles in the table will be the field titles on the form. You are now ready to enter data records into the form.

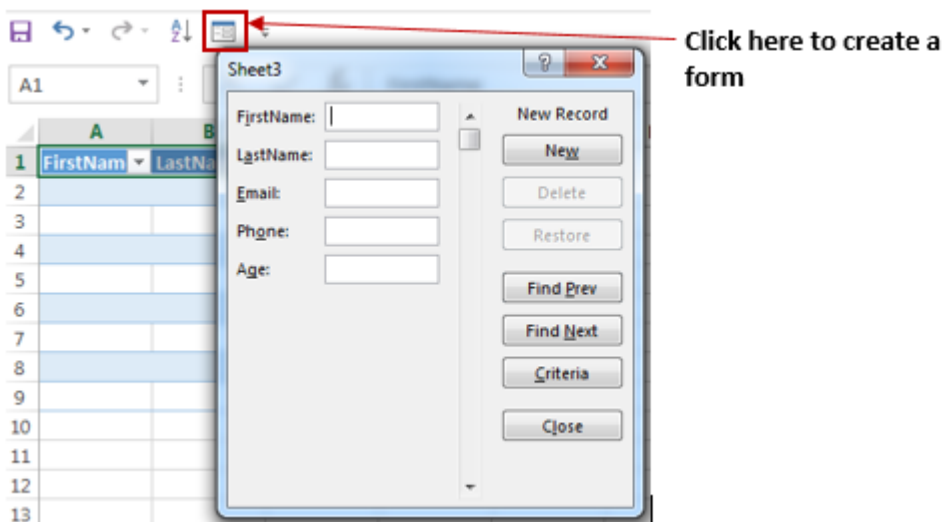


Figure 3. 92. The data entry form ready to be created

**Note that** Form Icon is accessed by performing the following steps:

**Step1:** On Custozie Quick Access Toolbar , click More Commands option

**Step2:** Select Commands Not in the Ribbon and then select Form icon

**Step3:** Select Add Button

**Step 4:** Click Ok Button

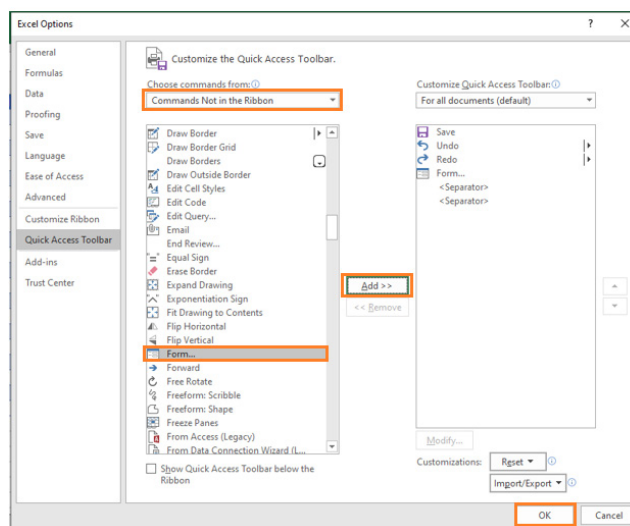


Figure 3. 93.Process of accessing Form Icon on Quick Access Toolbar+



## Application activity 3.12

Study the following Excel data entry form and create it:

The screenshot shows an Excel data entry form titled 'Sheet1'. The form has a title bar with a question mark and a close button. The main area contains six input fields with labels: 'First Name::', 'Last Name::', 'Nationality::', 'IdNo::', 'Phone NO:', and 'Zip Code:'. To the right of these fields is a vertical scroll bar. Further to the right is a 'New Record' section containing several buttons: 'New', 'Delete', 'Restore', 'Find Prev', 'Find Next', 'Criteria', and 'Close'.

### Skills lab 2

The school organizes an event to welcome new students. All expenses of the event will be covered by the school. You are requested to prepare a budget of an event in your class S4. The budget must be done in Ms Excel spreadsheet with the following:

- How many students will attend the event ?
- Categories of expenses and items in event preparation
- Estimated amount to spend on each item of expense and each category of expenses

Use Excel formulas and functions to do different calculations, also use different table styles to make the budget more understandable.





### End of unit assessment 3

**Q1.** Explain the following terms:

- a. Loan amortization
- b. Data Validation

**Q2.** Discuss any two financial functions and write their general formats (syntaxes).

**Q3.** Discuss any four uses of a pivot table

**Q4.** Outline different steps of applying conditional formatting using data bars

**Q5.** On 2<sup>nd</sup> January, Kamali invested 1,000,000 Rwf in a saving account of his BPR account at 8% annual interest rate. Calculate the amount of his savings at the end of year?

**Q6.** On 10<sup>th</sup> July 2019, Mukamana took a loan of 3,000,000 Rwf from Umurenge SACCO.

You are requested to calculate and show the whole process of reimbursement of Mukamana's loan from August 2019 to August 2022 at the interest rate of 18%



### Introductory activity

- 1) Normally, at the beginning of the academic year, when there is student meeting, the head teacher used to present the different topics to the new and old students using different tools. The topic of the meeting includes the school description, school history and how the school perform in National Exam.

According to the above information, answer the following questions:

- a) Which program the head teacher uses to make his/her presentation?
- b) List different tools the head teacher uses during the presentation
- c) The presentation contains which kind of content?
- d) Which are the main things that you can follow to make a good and attractive presentation?
- e) Explain the term audience and presenter

## 1.1 Creating a PowerPoint presentation

### Activity 4.1



The teacher makes a presentation about the use of social media in youth life and ask students to do the following tasks:

1. By using Ms Word, write a composition of 80-100 words about the use of social media in Rwanda.
2. Present the findings from above question to the rest of the class
3. Open PowerPoint and paste the presentation from word to the PowerPoint document
4. Compare the presentation in Word with the one you have created in PowerPoint

#### A. Key Terms

**PowerPoint** is a presentation **software** that allows you to create dynamic slide presentations. Slideshows can include animation, narration, images, videos, and much more.

**A presentation:** A presentation is an organized report or message prepared as talk to an audience, with the help of a computer program such as Microsoft PowerPoint, Harvard Graphics, etc. a **presentation software** is used to create slide shows for that presentation on screen to an audience.

**A slide** is a single page of information in a presentation created with a program such as PowerPoint. A presentation is composed of several slides.

**A slide show** is a collection of pages arranged in sequence that contain text and images for presenting to an audience. It often refers to a Microsoft PowerPoint presentation

A PowerPoint presentation can be used for the following purpose:

- Conveying information about an important issue such as disease control measures.
- Introducing a new idea for a business
- Reporting progress using charts or graphs.
- Training by demonstrating how it is done.

## A. Launching Microsoft PowerPoint Presentation

### STEPS:

1. Click Start button and click all apps.
2. Scroll down and select PowerPoint 2019 or other related versions (or click Microsoft office and the select Microsoft PowerPoint).
3. Select the Blank Presentation as shown in the figure below

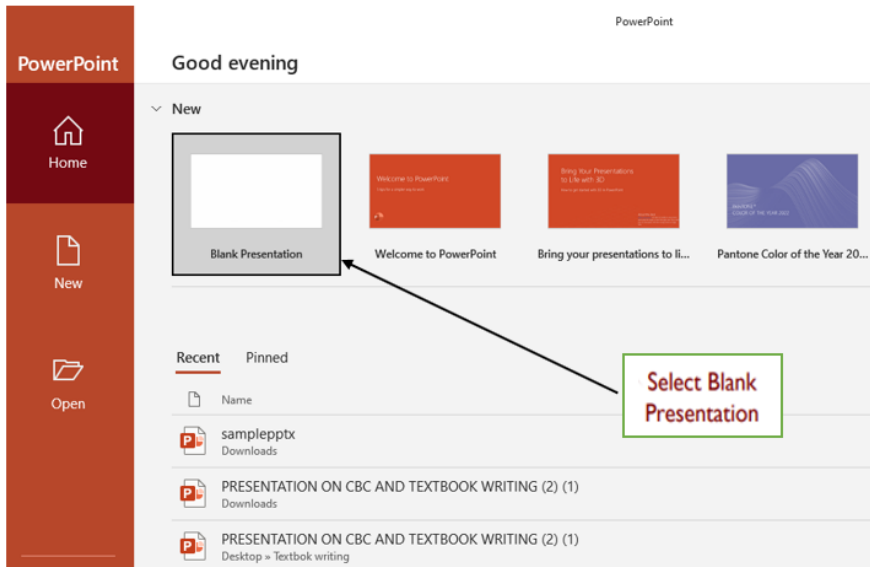


Figure 4. 1 The presentation Gallery

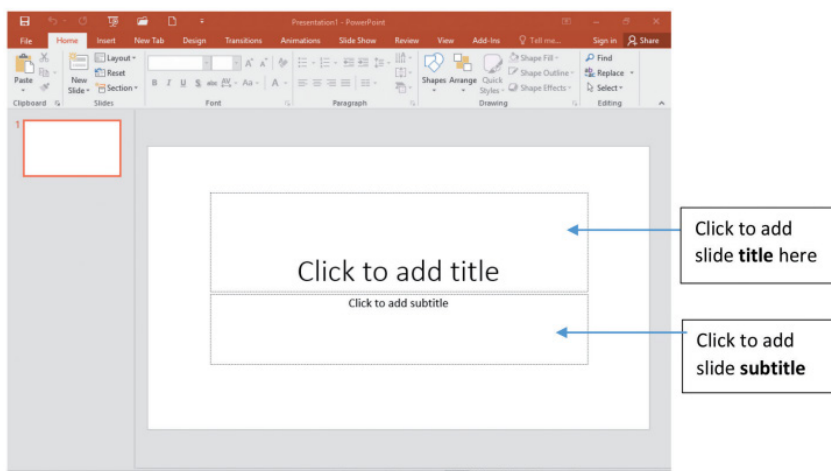


Figure 4. 2 PowerPoint with Blank presentation

## A. Components of PowerPoint environment

There are different tools in the Microsoft PowerPoint environment which help the user perform different actions. Those are shown in the screenshot below:

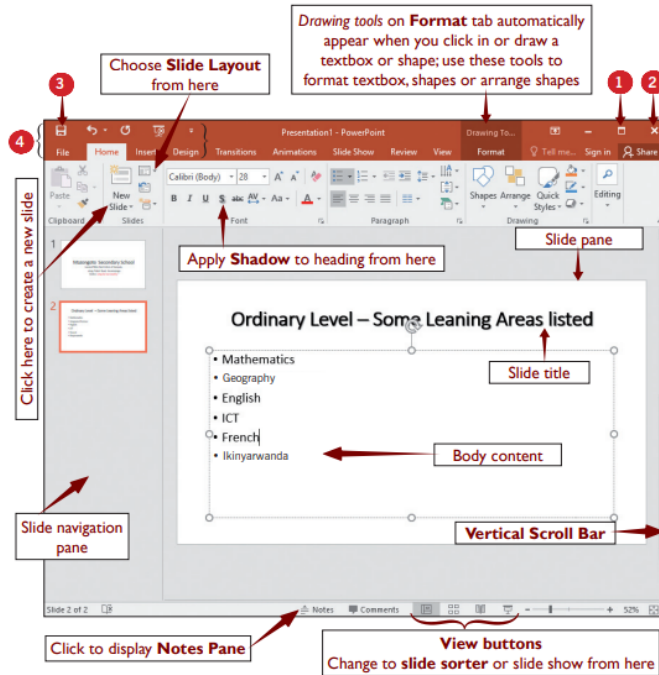


Figure 4. 3. MS PowerPoint window main features

The tools labelled with numbers are the following:

1. Maximize button which makes a window fill the whole screen
2. Close button used to close a presentation
3. The save button
4. The quick access toolbar

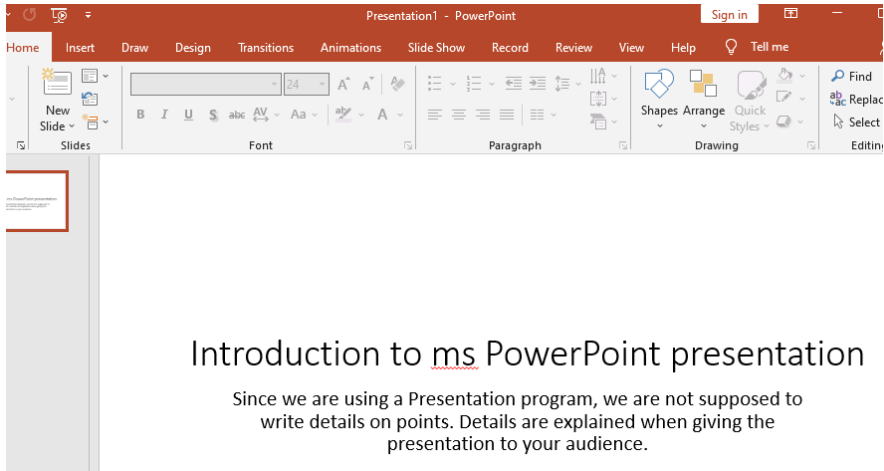


Figure 4. 5 Data has been adding on the first slide

## A. Slide layouts

When a new slide is inserted, it will usually have placeholders to show where the content will be placed. Slides have different layouts for placeholders, depending on the type of information to be included.

### A. Inserting a New Slide

Whenever a new presentation is started, it will contain one slide with the **Title Slide layout**, but there is an option of inserting many slides from a variety of **layouts**. A new slide is created in the following way:

1. From the **Home** tab, click the **bottom half** of the **New Slide** command.
2. Choose the desired **slide layout** from the menu that appears.
3. The new slide will appear. Click any **placeholder** and begin typing to add text. There is a way to click an **icon** to add other types of content, such as a **picture** or a **chart**.

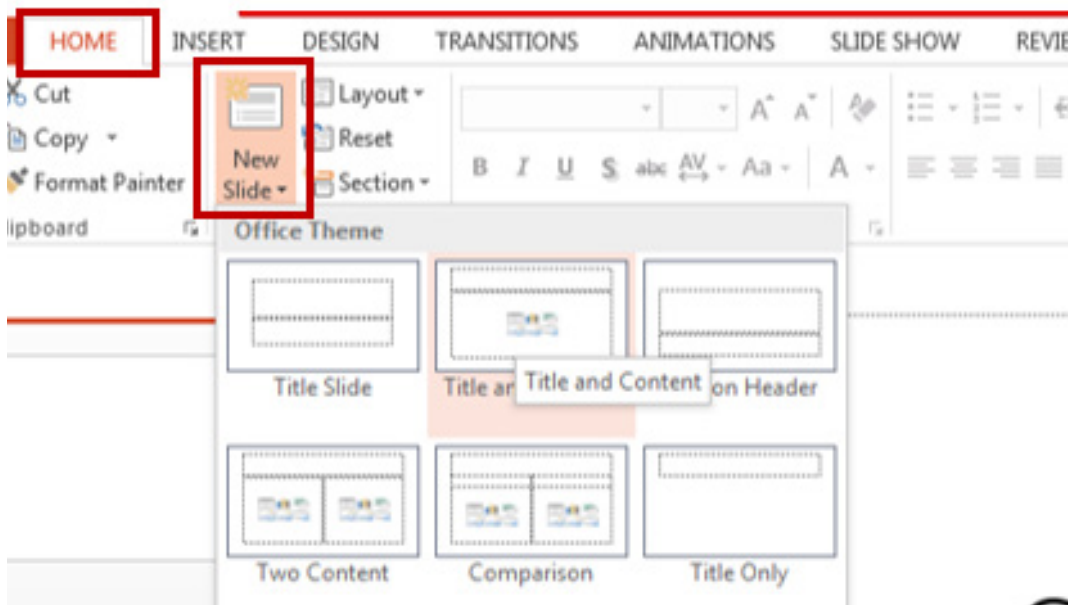


Figure 4. 6 Choose the Layout required, the layouts are pre-set but can be customized as needed



## Application activity 4.1

1. Following slides in that presentation

**Slide 1:** Title as “Causes of Environmental Problems in Rwanda”. The text in this slide should be in bullet style and should contain at least the following main points:

- Population growth and pressure on land
- Declining resources · Over exploitation of natural resources
- Land scarcity

**Slide 2:** Title as “Rwanda Environmental Management Authority (REMA)”. It will contain this text:

- REMA is Government organ responsible for execution of environment related policies and laws in Rwanda.
- REMA designs policies and procedures used to conserve natural resources, preserving the state of current environment and where possible reversing its degradation.
- Add more text to give the vision and mission of REMA and its achievements

**Slide 3:** Title as “How to protect environment in Rwanda” and should contain the text about the following points:

- Harvest rain water and conserve all waters for proper use
- Use biodegradable items and practice re-using packaging products. And others

**Slide 4:** Title as “Rwanda Environmental Features” should contain the text on:

Natural environment e.g., relief, climate, vegetation

- Natural resources and biodiversity

**Note:** You can write more text in the slides apart from the points indicated for each slide



## 1.1 Organizing slides

### Activity 4.2



1. In the presentation created the application activity 4.1. one student wants to change the arrangements of slides so that the last slide becomes the first. Explain how he/she will do it.
2. Use the procedure you gave in question 1 and see if it gives the expected result
3. This same students wants to present that presentation to the class but does not want to show the third slide. Explain how he/she can do it.

PowerPoint presentations can contain one or more slides. The **Slide Navigation pane** on the left side of the screen makes it easy to **organize** slides. From there, you can manipulate your presentation. The following are the different options that can be done using the slide navigation pane:

- **Duplicate slides:** To duplicate a slides, select the slide to be duplicated in the Slide Navigation pane, do a right-click and choose **Duplicate Slide** from the menu that appears. There is also an option to duplicate **multiple slides** at once by selecting them first.
- 
- **Moving a slide:** It is to change the order of slides in a presentation. Select the slide to be moved (a border will appear around the selected slide), and drag it to where to reposition it and drop it there. The slide number sequence will automatically update itself.
- **Deleting a slide:** To delete a slide select it and press the Delete key on the keyboard OR right click on the selected slide and select **Delete Slide** from the menu.
- **Copying a slide:** Select the slide to be copied, right click on the selected slide and select Copy from the menu. The shortcut key Ctrl + C can also be used to copy a selected slide.
- **Pasting a slide:** Position the cursor where to paste the slide in the Slide Navigation Pane and click on **Paste** or on the paste tool icon. It is also possible to use the shortcut key Ctrl + V

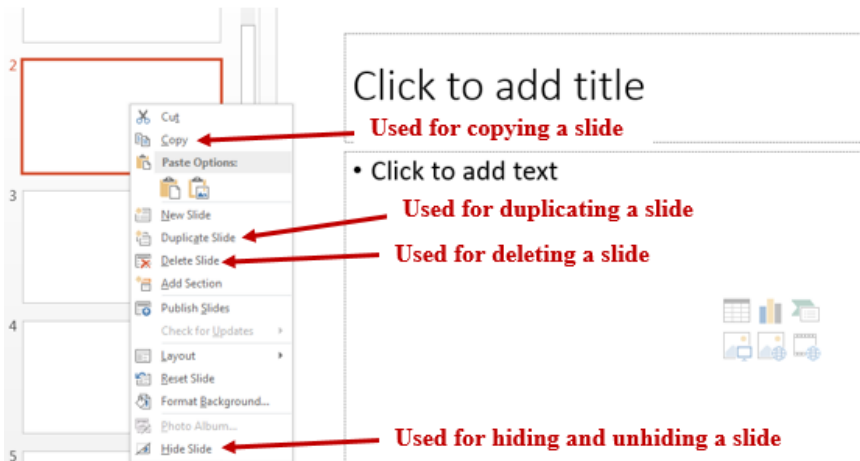


Figure 4. 7. Different menu used for arranging slides

- **Hiding a slide:** When a slide is not currently needed it can be hidden by selecting it then doing a Right click and clicking on Hide Slide. The hidden slide will continue to appear in the slide pane and can be opened by double clicking it but it won't appear if the presentation is opened in the Slide Show mode. To unhide the hidden slide go through the same process.
- **Dividing slides into sections:** Sections are subdivisions in a PowerPoint presentation slide used preferably for bigger presentations that can be logically grouped. Slides in the same group should be logically related so as to facilitate their understanding during presentation or while reading them. Putting slides into sections can also be done when slides are to be presented by different people thus each person presents his/her section.

**To create a section in a PowerPoint presentation, do the following:**

1. Select in between the slides where to insert the section or the slide behind which to insert the section
2. Do a right click and click on **Add Section** in the provided options.
3. Rename the section by selecting its default name, do a right click and click on Rename. The default name of a section is Untitled Section.
4. Write the new name and click on the **Rename** button

A created section can be removed by selecting it, doing a right click and choosing Remove Section. It can be moved by choosing the Move Section Up or Move Section Down option.

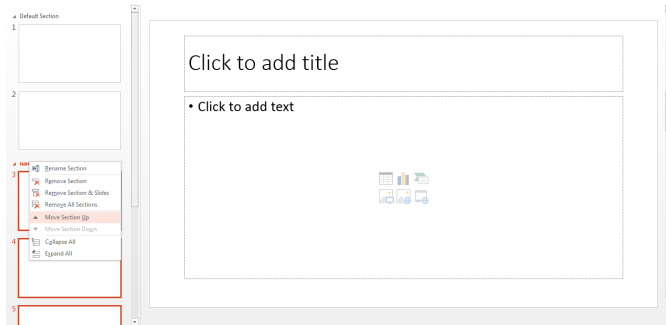


Figure 4. 8. Different options that can be done with a section

**Slide Sorter View** is good to use when organizing your slides. It allows to view all slides in a grid arrangement and therefore makes it easy to find a slide to move (or do any other operation) and easily identify where to place it. To access this view:

- Click on the View tab then
- Click on Slide Sorter tool

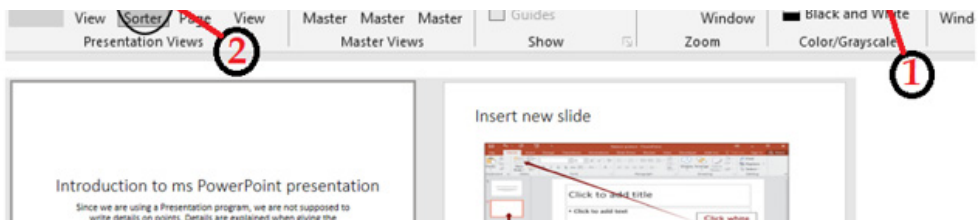


Figure 4. 9. Accessing the slide sorter on the PowerPoint toolbar



### Application activity 1.1

1. Create a PowerPoint presentation on “Computer software” with 3 distinct slides in the presentation where each slide is about the following:
  - a. Word processing software
  - b. Spreadsheets software
  - c. Presentation software
2. Move second slide to the third position
3. Add 2 more slides to your presentation, 1 slide is about the difference between Word Processing and Spreadsheet, the last slide is about the importance of Presentation software.
5. Hide the fourth slide of your presentation
6. Save the presentation as My first presentation

## 1.3 Apply Design themes and format background

### Activity 4.3

Open **My first presentation** created while doing the application activity 4.2. Make it more attractive by applying design. Save changes and run the slide show

### 1.1.1 Apply design theme in a presentation

**A Theme** gives the slides a consistent appearance throughout the presentation. Themes contain color schemes with custom formatting, styled fonts, and layouts. When applying a design template to the presentation, the slide master and color scheme of the template replaces the original blank slide.

1. Select the **Design** tab on the Ribbon, then click the **More** drop-down arrow to see all of the available themes.
2. Select the desired theme.
3. The theme will be applied to the entire presentation.

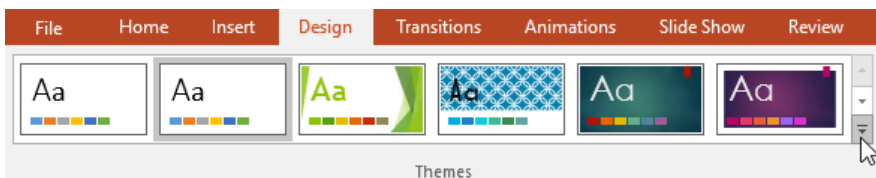


Figure 4. 10 Some of PowerPoint 2019 Design Themes

Once a theme is applied to the slides in presentation, another option is there to select a **variant** for that theme from the **Variants** group. Variants use different theme colors while preserving a theme's overall look.

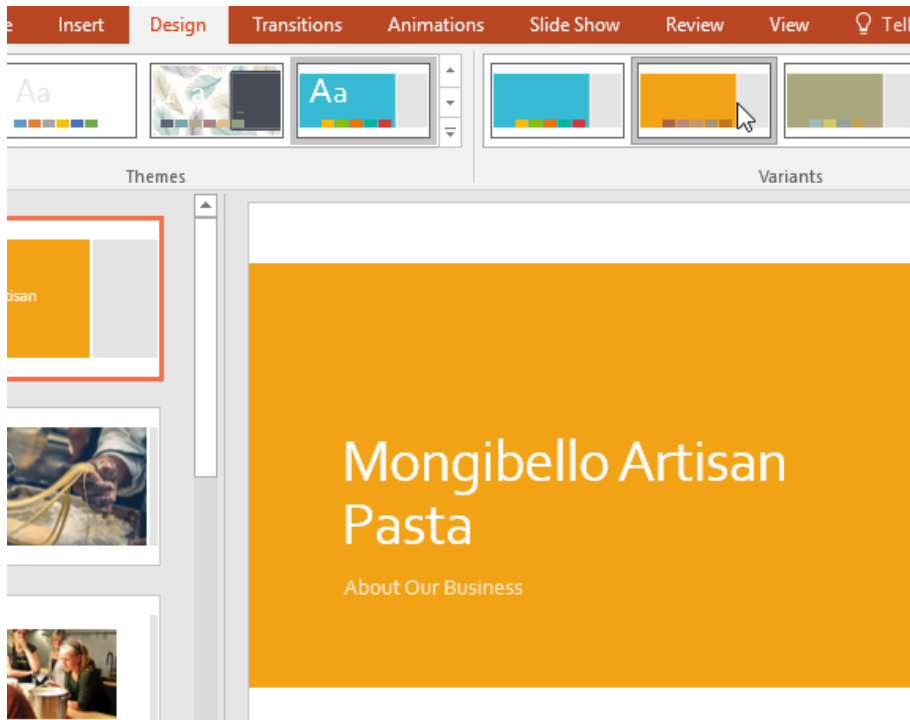


Figure 4. 11. Some of PowerPoint 2019 Design Themes and Variants

The following figure is a sample of a slide on which a design theme has been applied

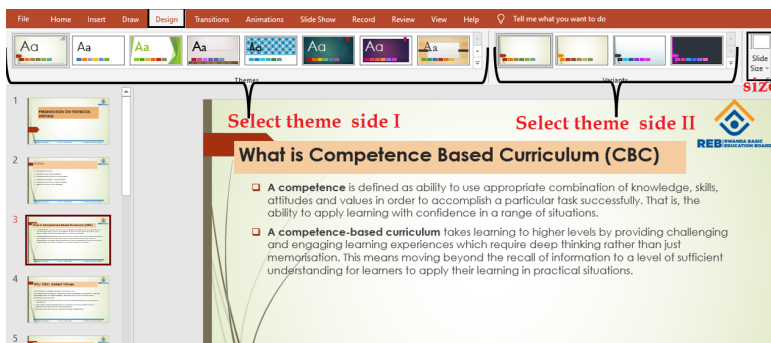


Figure 4. 12 A presentation where design them has been applied

### To format the slide background

To format a slide is to change the appearance of the slide and or its contents.

Backgrounds can have a **solid**, **gradient**, **pattern**, or **picture** fill. Use the steps given below and apply any color you want.

**Step1:** Select the **Design** tab, then click the **Format Background** command.

**Step2:** The **Format Background** pane will appear on the right. Select the desired fill options.

**Step3:** The background style of the selected slide will update.

**Note: Apply to All** means to apply the same background style to all slides in a presentation.

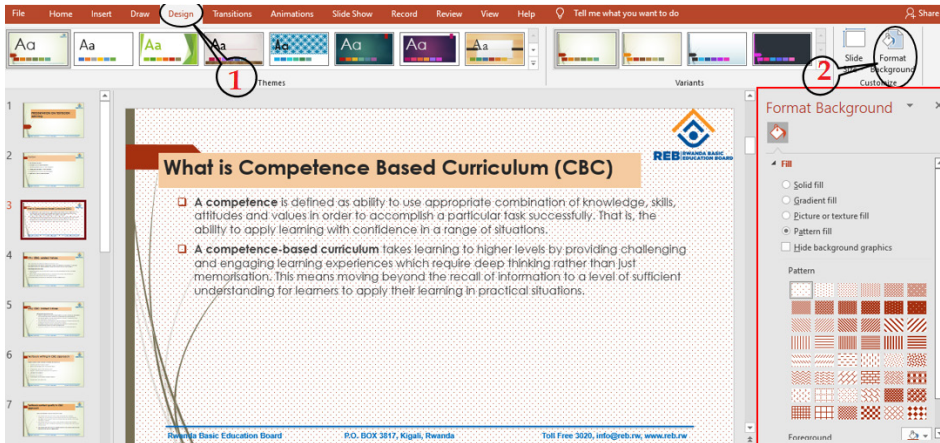


Figure 4. 13.A presentation where slide format has been applied

### 1.1.1. Adding notes and comments, Inserting header and footer

#### i) Adding comment

In PowerPoint presentation, a comment is an explanation that is attached to a text or an object on a slide, or to an entire slide. To add a comment in a slide, go through the following steps:

**Step 1:** On the **Review** tab, click **New comment** command

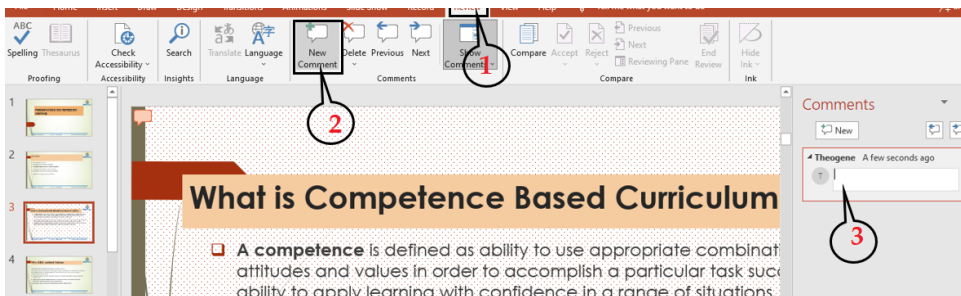


Figure 4. 14 Interface to add a comment to slide

**Step 2.** Write the comments in the provided space as visible in the zone No 3 of the above image

**Note:** Comments can be added to a PowerPoint presentation by using a simple method of clicking at the Comment option located at the bottom middle of an opened PowerPoint window

i) **Adding notes**

In a PowerPoint presentation **Notes** are words added to a presentation as reference and only visible to the one presenting the slides. They serve as additional information for the presenter that can be read for guidance as the presentation goes on

To add **notes** to a presentation, do the following:

1. On the **View menu**, Click **Normal**
2. Select the thumbnail of the slide to add notes to
3. The notes pane will appear under the slide. Click where it says **Click to add notes** and type whatever notes depending on your choice

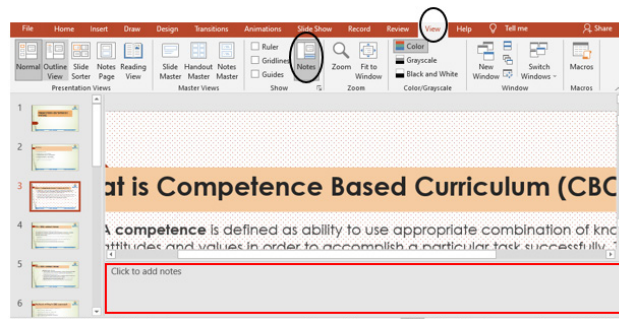


Figure 4. 15. Interface to add note to slide

i) **Insert header and footer**

Header and footer in a presentation is the top and bottom parts of the slides. These include the slide number, text footer and date. To add a header or footer follow these steps:

1. Click **Insert** then go to **Header & Footer**
2. In the box below Footer, type the text to use as footer such as the presentation title
3. Check Date and time to add that to the slides
4. Check Slide number to add to the created slides

5. Click on **Apply** or **Apply to all** if all slides are to have the same header or footer

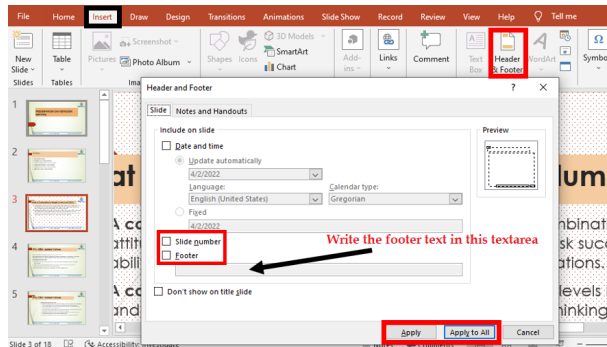


Figure 4. 16 An interface to add footer to slide



### Application activity 4.3

Create a PowerPoint presentation “Understanding Gender Equality” containing at least 5 slides and do the following:

1. Change the theme of the presentation to “Organic”.
2. Give this presentation a picture background
3. Change the background of the presentation to “Pattern Fill”.
4. Create a new section that you name “Gender equality in the development of Rwanda” with 5 slides. This section should have “Main event” as the theme of the presentation.
5. Apply new theme with color and font to the working presentation
6. Add notes and comments to the created slides that will help you while presenting
7. Add header as “Understanding Gender Equality”



## 1.1.Inserting objects in a presentation

### Activity 4.4



1. What are types of objects that can be inserted in a presentation?
2. Give the benefits of adding objects in a presentation
3. Differentiate a presentation with objects to a presentation without objects

### 1.1.1 Inserting a picture

An image is the actual picture or mental picture of something. Adding pictures can make a presentation more interesting and attractive. A picture can be inserted directly from a computer or from the internet.

i) Inserting pictures from the computer

To insert pictures in a slide do the following:

**Step 1:** Select the **Insert tab**, and then **click the Pictures command**.

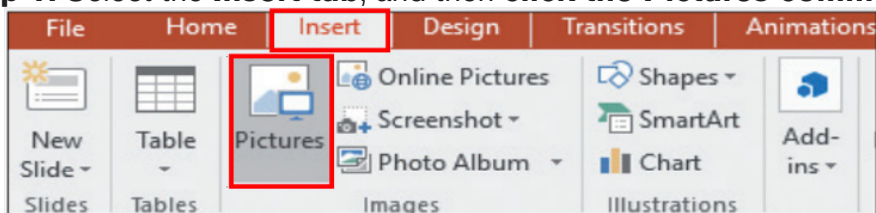


Figure 4. 17 Insert picture dialogue box

**Step 2:** Browse in the computer folders where the image is located and select one image and **click Insert**.

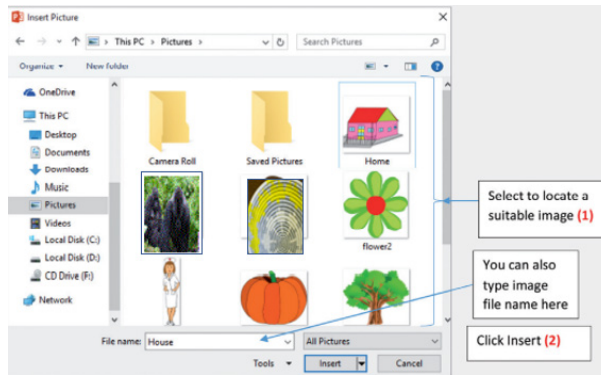


Figure 4. 18. Picture files on computer from which one is to be inserted

**Note:** It is also possible to insert image in a slide by using a Picture placeholder which is found in every slide which is

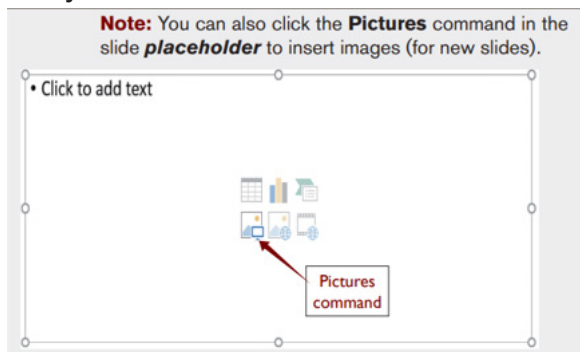


Figure 4. 19 Slide placeholder showing some commands

### i) Inserting online pictures

In case a desired picture is not available on a computer, a suitable picture can be found online and then inserted in a presentation. Online pictures are used instead of ClipArt that exist in earlier versions of the program.

1. Under the **Insert tab**, click on the **Online Pictures** button

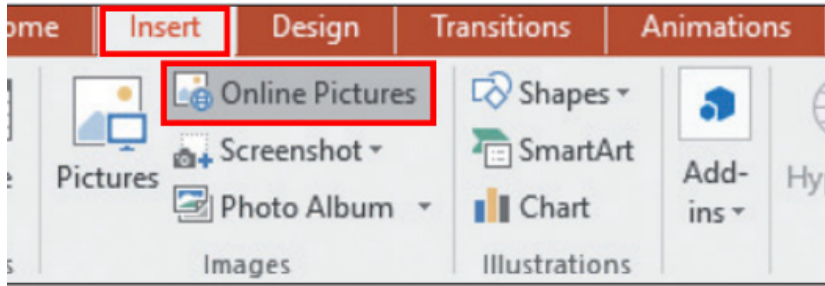


Figure 4. 20. Online Pictures button for inserting online pictures

1. The Bing Image Search window will appear.

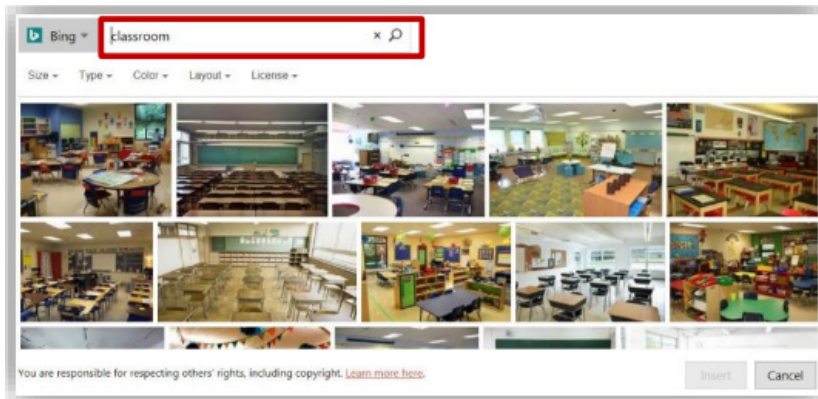


Figure 4. 21. Online pictures to choose from

1. In the Search box, type the word Classroom, and then press the Search icon. A variety of online images associated with the search term classroom»» will appear.
2. Scroll through the Pictures window to find the desired image
3. To insert the image, place the mouse pointer on the image and then click on the left mouse button twice.

### 1.1.1. Inserting a Table

A table is made of rows and columns. Data or information can be arranged using these rows and columns. Two methods can be used:

- Create and format a table within a presentation.
- Import a table from Word or from Excel

Step 1: Select the slide in which the table will be added.

Step2: On the Insert tab, select Table.

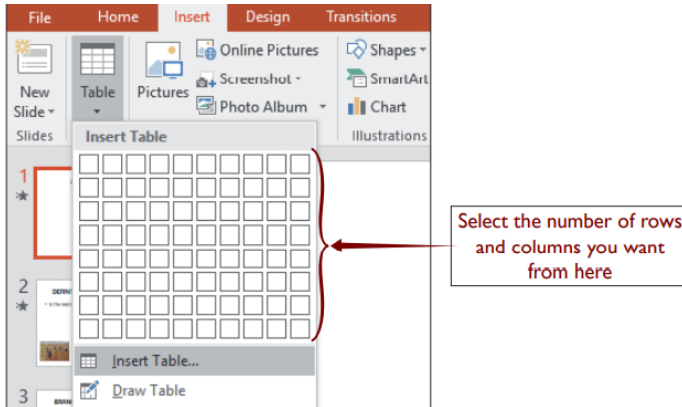


Figure 4. 22 Insert tab for inserting a table in PowerPoint

Step 3: Select the rows and column to insert and click, in this case the table is created.

Or click on the **Insert Table** command that appear below the many cells as shown in the image above then in the dialog box write the number of rows and columns then click **OK**.

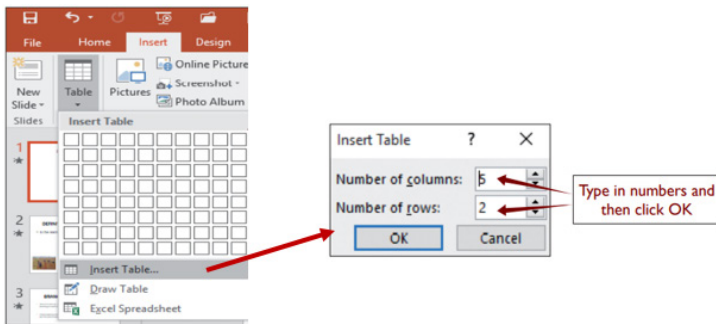


Figure 4. 23 Where to put number of row and column when Insert Table command is clicked

### 1.1.1.SmartArt

**SmartArt** is a picture used to communicate information in many different ways. It is an option that allows the user to create diagrams easily.

Use the steps given below to **insert a SmartArt graphic** to the presentation.

**Step 1:** Open a file presentation and insert a new slide where a SmartArt is needed.

**Step 2:** On the **Insert tab**, in the **Illustrations group**, click **SmartArt**.

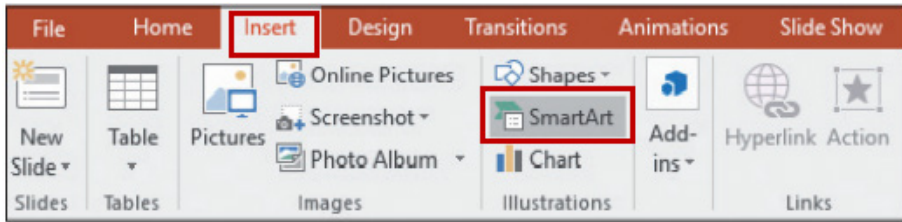


Figure 4. 24 Smart art in insert tab

**Note:** Alternatively insert a SmartArt using the SmartArt Graphic button in the content holder, as shown in picture below:

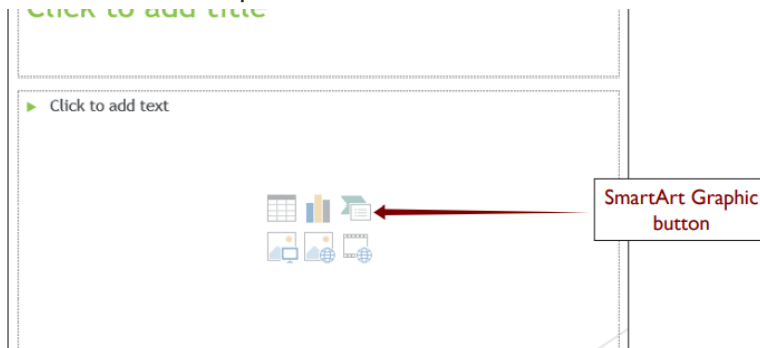


Figure 4. 25. Inserting a Smart art using SmartArt graphic button

**Step 3:** In the Smart Graphic dialog box that displays, click the type and desired layout. In this case, let create a hierarchy of officers for any school.

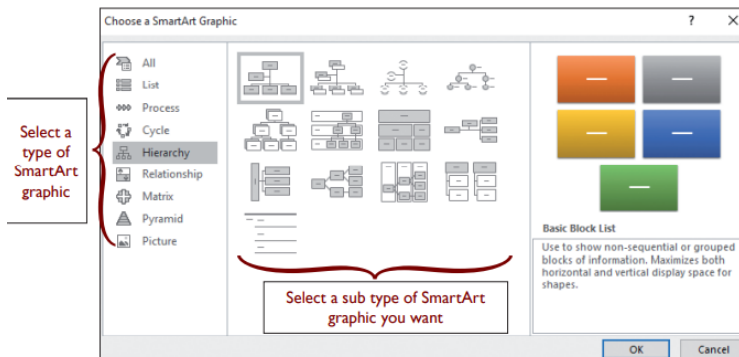


Figure 4. 26. Smart graphic dialogue box

Step 4: Enter the text by either: Clicking in the text pane (left) and then type the text or clicking directly in the Smart Graphic and type the desired text. Afterwards save it.

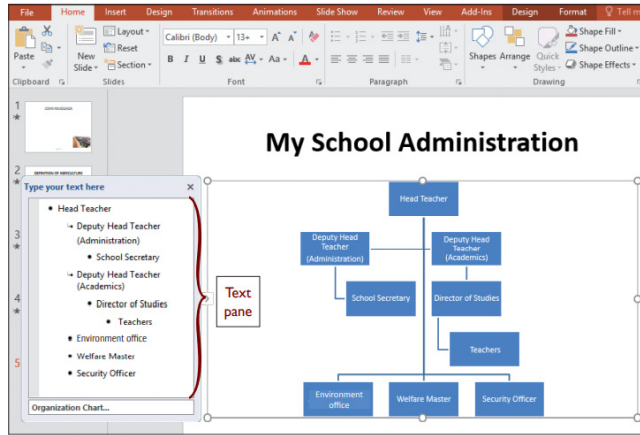


Figure 4. 27. School hierarchy created using smart art objects

### 1.1.1.Shapes

A shape is an outline form of an object. In office applications such as Microsoft PowerPoint, shapes such as boxes and circles can be added to slide show presentation. Use the steps given below and insert any desired type of shape.

**Step 1:** Click on **Insert tab**.

**Step 2:** Click **Shapes** from the **Illustrations group**.

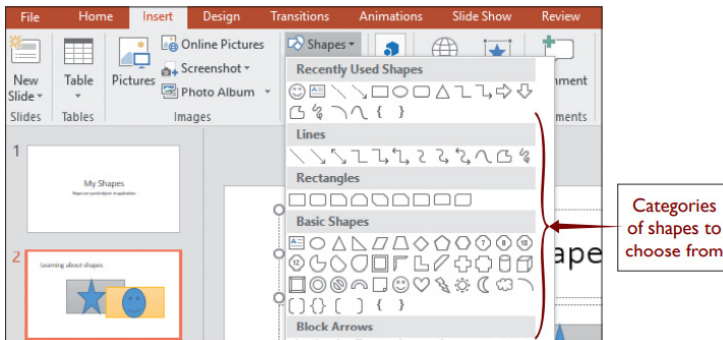


Figure 4. 28. Group of shapes

**Step 3:** Select a shape such as a rectangle and then click and drag to draw the shape in the desired place. After drawing a shape, text, bullets and numbering can be added to it.

The change of fill, outline and other effects can be applied on the Format tab

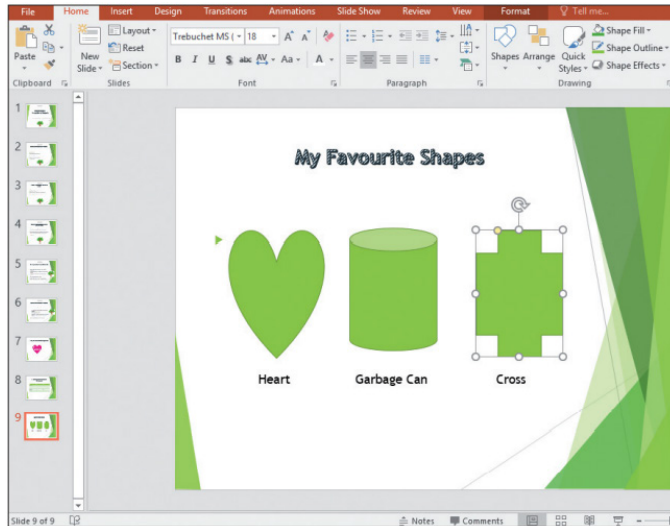


Figure 4. 29. Different shapes inserted in a slide

### 1.1.1.A chart

This is a pictorial representation of numerical data. There are many charts that can be created in a slide, but common charts frequently used are: column charts, line charts and pie charts.

Step 1: Insert a new slide (Title and content layout)

Step 2: Click the Chart icon in the content holder to generate a column chart. Alternatively click on the Insert tab then click Chart tool in the Illustrations group.

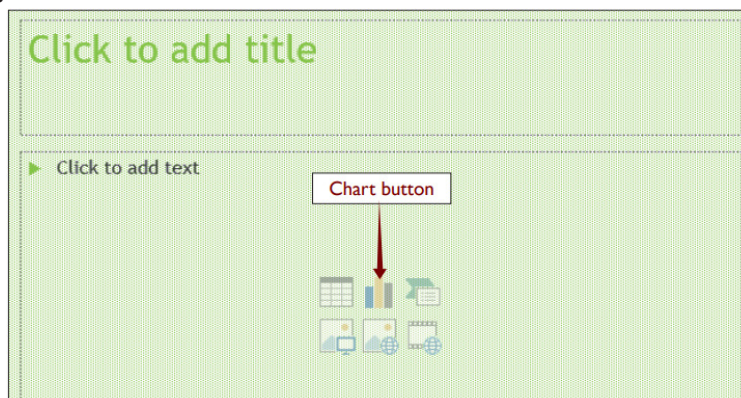


Figure 4. 30. Chart icon used which is clicked when inserting a chart

Step 3: The column chart appears together with a data sheet that can be edited to suit the desired chart.

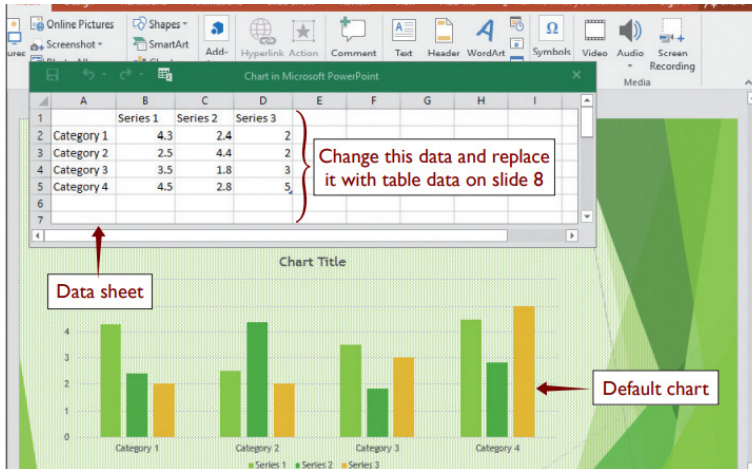


Figure 4. 31 Column chart with data in sheet

**Step 4:** Edit data sheet by replacing default data with desired data.

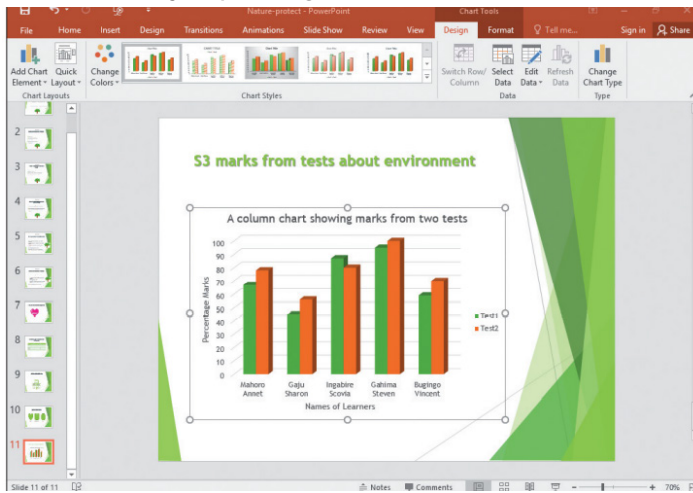


Figure 4. 32. A Pie chart created in a slide

### 1.1.1. Media clips

Media clip is a small segment of an electronic media either an audio clip or a video clip

#### i) Audio clip

To insert audio clip, follow the steps given below:

1. Select the slide where to insert an audio clip.
2. On the **Insert tab**, in the **Media group**, click arrow under Audio, and then click **Audio on My PC**.



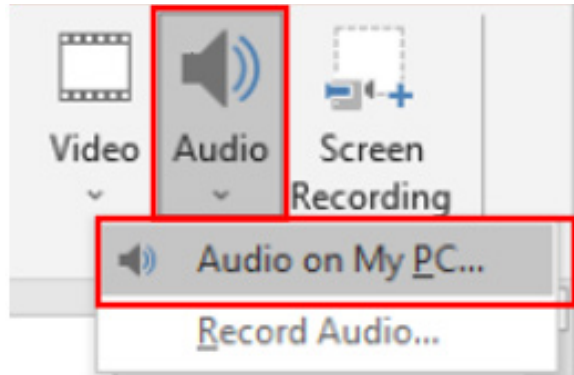


Figure 4. 33. Tools available after clicking on the Insert tab

1. In the Insert Audio dialog box, select a folder with the desired audio then select the file.
2. Click on Insert button to insert the audio.

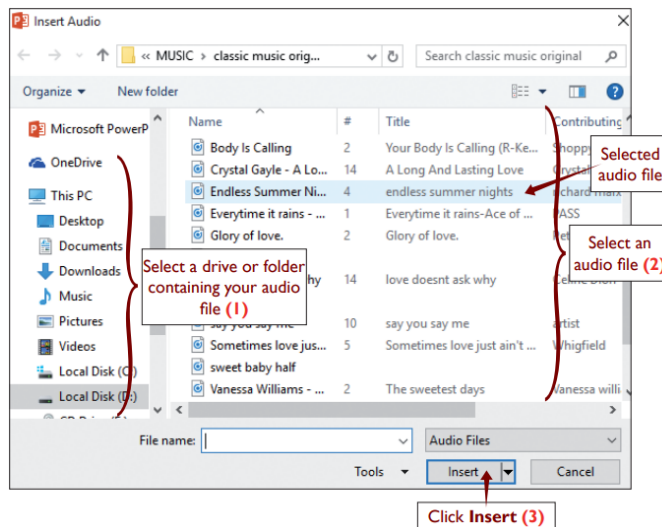


Figure 4. 34. Selecting an audio to be inserted

The slide where audio has been inserted will appear as shown below. Play using the media buttons displayed.

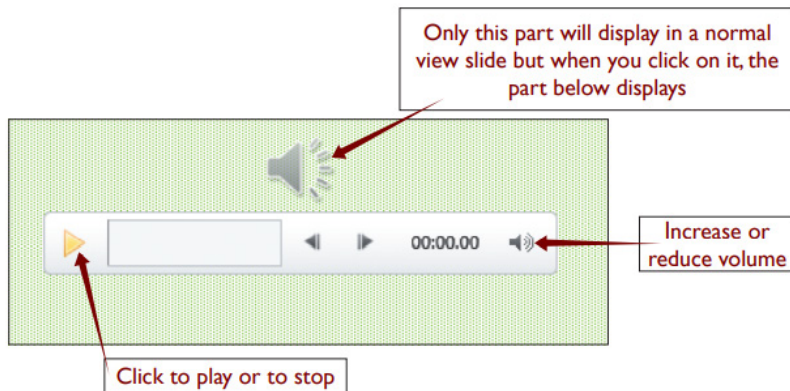


Figure 4. 35. Controls used to play an inserted audio

### i) Video clip

There are two ways to insert video which are by linking and by embedding a video directly from the PC into the presentation. Use the following steps below to insert a video clip in a presentation.

1. Select the slide where to insert a video clip.
2. On the **Insert tab**, in the **Media group**, click arrow under Video, and then click **Video on My PC**.



Figure 4. 36. The tools used to insert a video in a PowerPoint presentation

1. In the Insert Video dialog box, click the desired video from a specific folder. Click Insert.

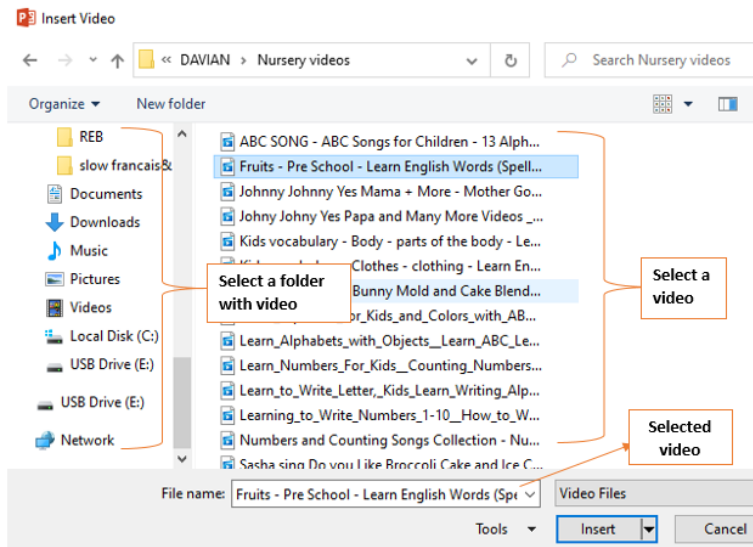


Figure 4. 37 Insert video dialogue box

1. In the Insert Video box, click the **desired** video from a specific folder. Click Insert.

A slide with an embedded video will appear as shown below:

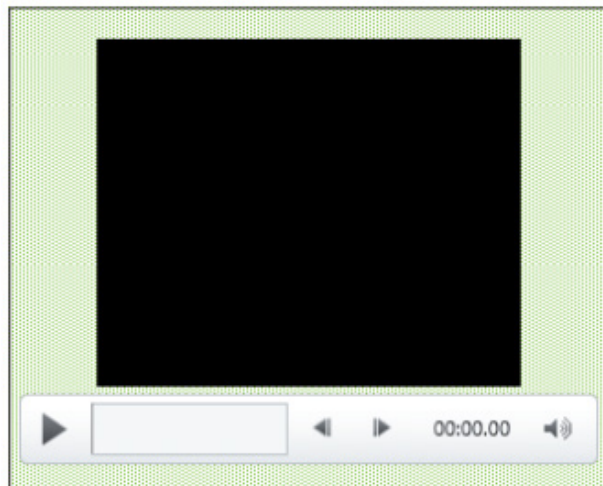


Figure 4. 38. Controls to be used in playing an inserted video



## Application activity 1.1

Create a presentation of your school description. Animate the presentation as follow:

- a) The title to “Fade”,
  - b) The text to “Appear”
  - c) The image to “Pulse”
- 
1. Insert an audio from your computer into the next one slide of your presentation
  2. Add new slide and insert a SmartArt graphic that will present the hierarchy of staff in. your school.
  3. Basing on the information given by the school secretary, insert in the last slide of your presentation, the table showing separately the number of boys and girls in O' level

## 1.1.Applying animation in a presentation

### Activity 1.1

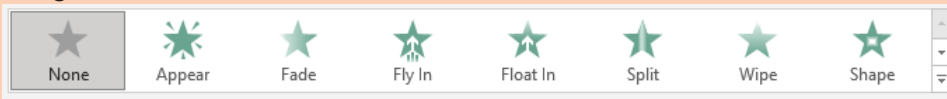


1. Explain the terms animations and transitions in a presentation
- 1) Open an existing presentation from your computer and apply animations to all text and pictures by clicking on the ANIMATIONS tab then clicking on one transition. Examples of transitions are shown in the images below:

Image A



Image B



**Animations** are presentation features that give motion or life to text or object in the slide show. Animation effect can be added to text or graphics objects and if well applied, brings excitement and increase the audience ability to understand a message.

### A. To apply animations to text or objects in PowerPoint presentation

1. Select a text or object to animate.
2. On the **Animations tab**, in the Animation Group, select one desired animation e.g. fade, Fly in, etc. Apply **Timing** to animation, that is, in **Timing group**, increase or reduce the duration or delay of the animation.

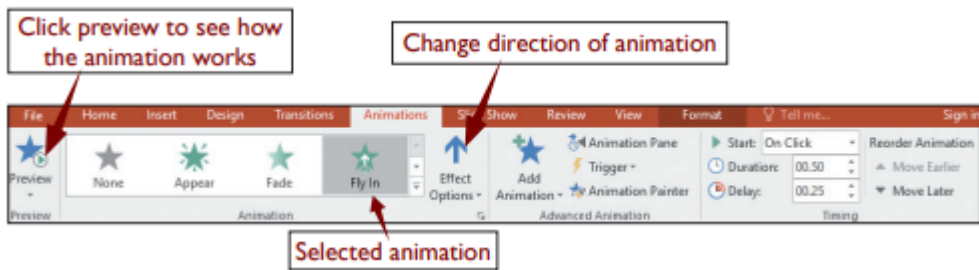


Figure 4. 39. Different animations which can be used in a PowerPoint presentation

## A. Applying slide Transitions in a presentation

Slide transitions are the effects that occur when slides are moving from one slide to the next during a presentation. The presentation creator can control the speed, add sound, and customize the properties of the transition effects.

Types of transitions: In PowerPoint 2019 the main slide transitions are subtle, exciting and dynamic content.

- a) **In Subtle** transition: Simple transitions are used to move from one slide to another
- b) **Exciting**: Additional visual effects are used to catch the eye of the audience
- c) **Dynamic** content will move only the placeholders, not the slides themselves.

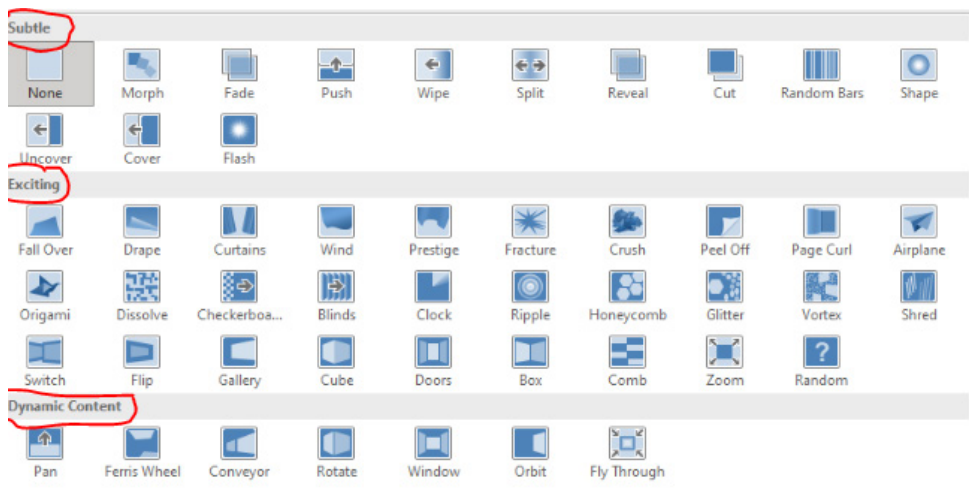


Figure 4. 40. The different types of animations in PowerPoint 2019

Follow the steps given below for applying slide transitions:

1. Select the desired slide from the Slide Navigation pane.
2. Click the **Transitions** tab, then locate the Transition to This Slide group. By default, None is applied to each slide.

1. Click the **More** drop-down arrow to display all the transitions.

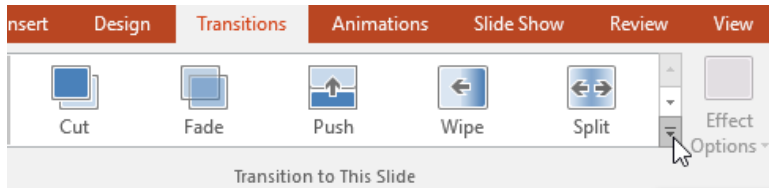


Figure 4. 41. The different types of transitions in PowerPoint 2019

1. Click a **transition** to apply it to the selected slide. This will automatically preview the transition.

**Note:** The **Apply To All** command in the **Timing** group is to apply the same transition to all slides in the presentation. Keep in mind that this will modify any other transitions that had been applied before.

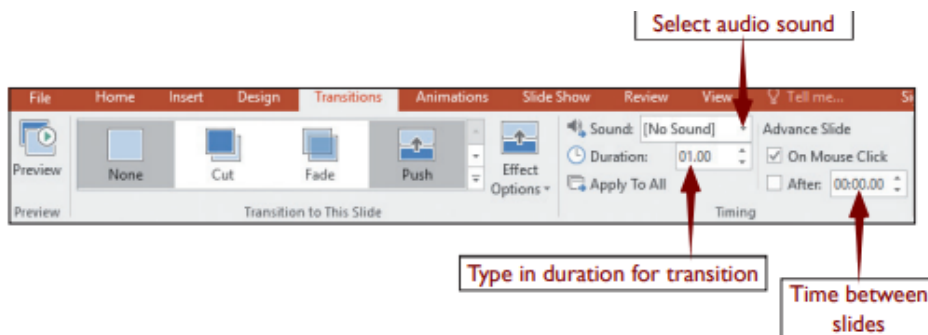


Figure 4. 42. Tools used to set the transition duration

**Preview a transition:** To **preview** the transition for a selected slide at any time use either one of these two methods:

1. Click the **Preview** command on the **Transitions** tab.
2. Click the **Play Animations** command in the **Slide Navigation** pane.

## A. Modifying transitions

- i) To modify the transition effect, follow these steps:
  1. Select the **slide** with the transition to modify.
  2. Click the **Effect Options** command and choose the desired option. These options will vary depending on the selected transition.

1. The transition will be **modified**, and a **preview** of the transition will appear.
- i) To modify the transition duration, follow these steps:
  1. Select the slide with the transition to modify.
  2. In the Duration field in the Timing group, enter the desired time for the transition. In this example, the time will be decreased to half a second or 00.50 to make the transition faster.

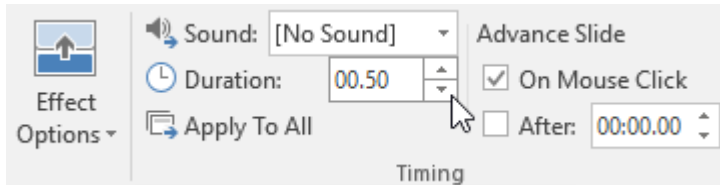


Figure 4. 43. The transition duration is decreased to 0.50 seconds

#### A. To add sound, follow these steps

1. Select the **slide** with the transition to modify.
2. Click the **Sound** drop-down menu in the **Timing** group.
3. Click a **sound** to apply to the selected slide, then preview the transition to hear the sound.

**Sounds** are best used in moderation. Applying a sound between every slide could become overwhelming or even annoying to an audience when presenting the slide show.

#### A. To remove a transition, follow these steps

1. Select the **slide** on which the transition is to be removed.
2. Choose **None** from the **Transition to This Slide** group. The transition will be removed.

To remove transitions from all slides, apply the None transition to a slide, then click the Apply to All command.





### Application activity 4.5

**Create a presentation on «Taxation system in Rwanda» which contain 5 slides and do the followings:**

1. Make the Font type ="Candara" ; Font Size ="24" and Paragraph groups available in PowerPoint
2. Make the slide titles and each bullet in every slide have the **Fly** in animation.
3. If the title of the slide changes, change the sound accompanying the projection of the title (not the whole slide)
4. End the presentation with a visible and audible clap of the hands
5. Change the transition Duration to 2.00.
6. Use the Apply to All command to apply your changes to every slide.
7. Save your work

### Skills lab 3:

#### Skills Lab 3



You are a businessman and wants to engage in a new business. Prepare a business plan for that business and present it to others





## End of unit assessment 4

**Q1.** Create a presentation of six slides on the topic of ICT in Accounting in Rwandan context

**Slide 1:** Should have the title of the topic, and Name of presenter

**Slide 2:** should have the definition of ICT and accounting terms

**Slide 3:** Should have the impacts of ICT in Accounting

**Slide 4 and Slide 5:** should have the list of ICT tools in accounting

**Slide 6:** should have the thanks message

Save the presentation as question 1 and run the presentation

**Q2.** Create a presentation containing the table below in the first slide. In the second slide and put a graph summarizing the data from the table in the first slide. Save the presentation as Question 2

Class	Number of computers used
S1	130
S2	160
S3	200
S4	60
S5	75
S6	90

**Q3.** Create a presentation about **Deforestation in Rwanda** following the procedures below:

- In the first slide: Topic and definition
- In the second slide: Importance of Deforestation

# UNIT 05

## DATABASE MANAGEMENT WITH ACCESS



### Introductory activity

The management of TERIMBERE Sacco cooperative located in GICUMBI District, would wish to hire a qualified consultant in ICT who will design an efficient Database which will help them to shift from a traditional paper-based data recording to a Computerized database management system.

Below are some main services offered and transactions performed by different concerned staff:

- a. Creation of a new custom account using cooperative customer form
- b. Money-deposit by customer using cooperative customer book
- c. Withdraw money from customer account using cooperative customer book

**As a student in ICT in Accounting, you are requested to :**

- i. Suggest different ways that can be used to keep the above information
- ii. What is the benefit of keeping that information in a computer database compared to keeping it on a paper?
- iii. Which Office program to use to create that database?

## 5.1 Understanding database

### Activity 5.1



- 1) What do you understand by the term Database
- b) Give examples of databases you know in the society you live in.

In our information society, record keeping and data processing using database has become an important aspect of every organization such as Hospital, School, Universities and Governments. Databases are used all the time, often without knowing it. **For example**, withdrawing money from the Bank's ATM requires the existence of a database where information about clients and their balance is kept.

### 5.1.1. Database concepts

#### A. Definitions

##### a) Database

A database is an organized collection of related data so that its contents can easily be accessed, managed, and updated. It is considered to be organized because the data is stored in categories that are accessible in a logical manner.

##### b) Data

Data are unprocessed raw facts that include text, number, images, audio, and video. The data are useless for decision-makers until they have been processed or refined in some manner.

##### c) Information

Information is data that has been processed, refined and given in the format that is suitable for decision making or other organizational activities.

**For example:** Report about student fee paid is useful information for finance section.

##### d) Database management

Database management refers to a set of activities performed on the database. Some of these activities are :

**Insertion** of new records in tables are,

**Deletion** of unnecessary records,

**Updating** records if the information is changed,

**Searching** for records according to the given criteria whenever needed.

e) Database Management System (DBMS)

The Database Management System (DBMS) is an application software that enables users to define, create, and maintain the database and which provides controlled access to this database.

The DBMS receives requests (queries) encoded in SQL and translates those queries into actions on the database.

A **database system** comprises of five major components :

1. **Data:** The database contains both the operational data and the meta-data (the data about data).
2. **Hardware:** this consists of the secondary storage (hard disk) on which the database resides together with the associated devices.
3. **Software:** Software refers to the collection of programs used within the database system. It includes the DBMS software the application programs, together with the operating system, including network software if the DBMS is being used over a network. The application programs that allow users to store information in an ordered manner for timely and quick retrieval is called **Database Management System (DBMS)**.
4. **Procedures:** These are the instructions and rules that govern the design and use of the database. This may include instructions on how to log on the DBMS, make backup copies of the database, and how to handle hardware or software failures.
5. **People (users):** This includes the database designers, database administrators (DBAs), application programmers and end users.

Databases are useful. For example many computing applications deal with large amounts of information; they have become an essential component of everyday life in this modern society. Database systems give a set of tools for storing, searching and managing this information

## A. Importance of database

- A database enables to put data on the disposition of users for consulting or updating
- The database should manage the privileges granted to its users.
- A database can be local in one machine just used by one user or distributed in many machines accessible by many users through a network (sharing of data).
- The main advantage of using database is its possibility to be used simultaneously by many users as per the image below :

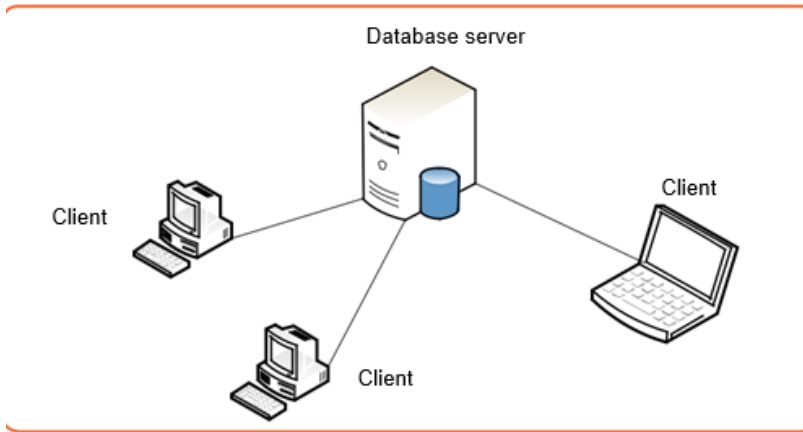


Figure 5. 1.Database server

## 5.1.2. Database Approaches

### A. Paper based database

This is a kind of database where information is kept on papers. Keeping a database on papers makes its management difficult and the size of papers cumbersome.

#### **Paper based database presents the following disadvantages:**

Papers can be lost, damaged over time or due to calamities like fire and flood

If there is change in the stored information the hard copies are hard to update or may even rewriting the information on a new copy having the new updates.

Compared to information kept in a computer, paper-based databases are difficult to copy and search.

Papers need a lot of space to store, can be misplaced hence difficult to find.

## A. Computerized database

When a database is stored electronically on a computer and can be manipulated using a computer, it is called a computerized database. Computerized databases can be of different types:

### a) Traditional File Processing Systems (TFPS) approach

This is an approach which was used before the invention of modern Database Management Systems (DBMS) but this approach was difficult to use as

It required advanced knowledge and to use it one had to have advanced programming knowledge which was not easy for a common user. Users had to write application programs to store data in form of files on the computer permanent storage device (Hard Disk) and each application program written by a user had to define and manage its own data.

Compared to manual management of information, the Traditional File Processing presents the following advantages:

- **Simplicity:** the design of file processing is more simple than designing a database
- **Efficiency:** file processing cost less and can be more speedy than database
- **Customization:** you can customize file processing more easily and efficiently than database because files are related with the application and it has all the data needed for that application.

In File-based processing, for each database there is a separate application program as shown by the following figure:

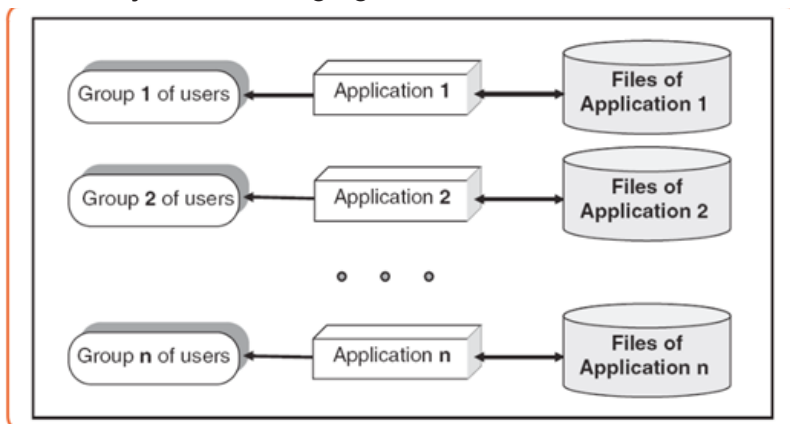


Figure 5. 2. Traditional File Processing System approach



Traditional File Processing System presents the following disadvantages :

- **Separation and isolation of data** : as data is isolated in many files, it is not easy to have access to data.
- **Duplication of Data** : because of the decentralized management, data may be scattered on different computers and this has as consequences a misuse of storage space as data is repeatedly stored in different locations (This is known as Data Redundancy) and a loss of data integrity as data is stored in different locations and the different copies may be slightly different.
- **Wastage of storage space**: Duplication of data leads to wastage of storage space. If the storage space is wasted it will have a direct impact on cost. The cost will increase.
- **Loss of data integrity** : Data integrity means **data consistency**. Duplication of data can also lead to loss of data integrity; the data are no longer consistent.
- **Data dependence**: in traditional file processing, the structure of data files is embedded in the application programs, so any changes to the structure of a file may require changing all programs that access this file. Therefore, data dependence means the application program depends on the data. This means that if some modifications have to be made on data, then the application program has to be rewritten.
- **Incompatible file formats**: the structure of files is embedded in the application programs and therefore structures are dependent on the application programming language.

The many difficulties attached to using Traditional File Processing Systems prompted researchers to invent another way to use in order to make data management more effective. This came up with another approach which is DATABASE and Database Management System (DBMS)

## ii) **Database Management System (DBMS) approach**

DBMS is a software that provides a set of primitives for defining, accessing, and manipulating data. In DBMS approach, the same data are being shared by different application programs. As a result, data redundancy is minimized. The DBMS approach structure is shown in the following figure.

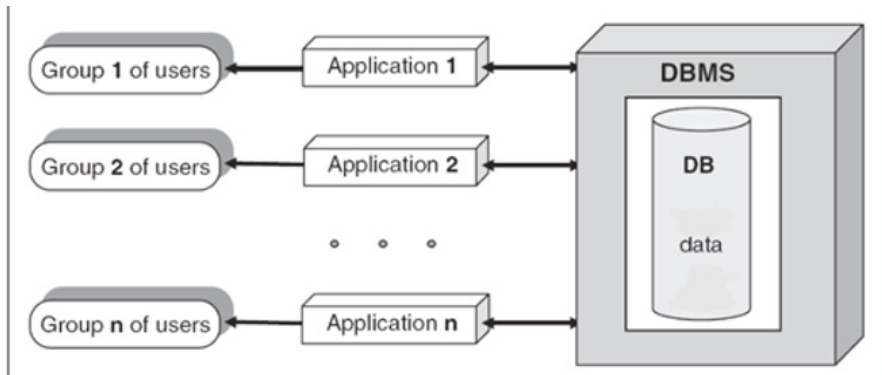


Figure 5. 3. Structure of a Database Management System approach

## Advantages of DBMS

There are many advantages of database management system.

- **Centralized Data Management :** In DBMS all files are integrated into one system thus reducing redundancies and making data management more efficient. One user can know data in another department without moving from one department to another. This is called **data integration**.
- **Data Independence :** Data independence means that programs are isolated from changes in the way the data are structured and stored.
- **Data consistency :** In DBMS, data inconsistency is avoided. Data inconsistency means different copies of the same data will have different values.

For example : Consider a person working in a branch of an organization. The details of the person will be stored both in the branch office as well as in the main office. If that particular person changes his address, then the “change of address” has to be maintained in the main office as well as the branch office. In case the “change of address” is maintained in the branch office but not in the main office, then the data about that person is inconsistent. DBMS is designed to have data consistency which makes DBMS have the quality of increased data integrity.

- **Data sharing :** Due to the fact that data is centralized, many different users from different locations can share data.
- **Data recovery after a crash :** After a break down, DBMS allows to recover data after a crash. The crash may be caused by power failure or hardware failure.
- **Concurrent transaction control :** A transaction means a collection of operations that perform a single action in a database. Example : Transferring money from one account to another.

Concurrent transactions mean that many transactions are being done simultaneously or concurrently.

Concurrent transaction problem occurs when multiple users want to access data in the database at the same time like for example when someone wants to withdraw money from his/her account while at that time there is someone else who is using ATM card to withdraw money from the same account. DBMS ensures that many users are accessing data and these problems are controlled.

**Increased Data security and safety:** DBMS allows data to be highly protected against unauthorized access.



### Application activity 5.1

1. Differentiate paper-based database from a computerized database and give examples
2. Outline advantages of DBMS
3. List any three examples of DBMS

## 5.2. Key terms used in Database

### Activity 5.2



By doing a research explain the term database and identify the key terms that are used in the database field and explain them

### 5.2.1 Relational Database

There are different types of database but the most common type is the one that use tables commonly known as Relational Database.

A relational database is the one having one or many Relations which are the mathematical concept representing physically a table

In this kind of database, the table also known as an Entity may have two or many columns also known as Attributes or Fields and details on items are stored in rows also known as Tuples or records. A certain column has some values that is allowed to accept and those are called Domain.

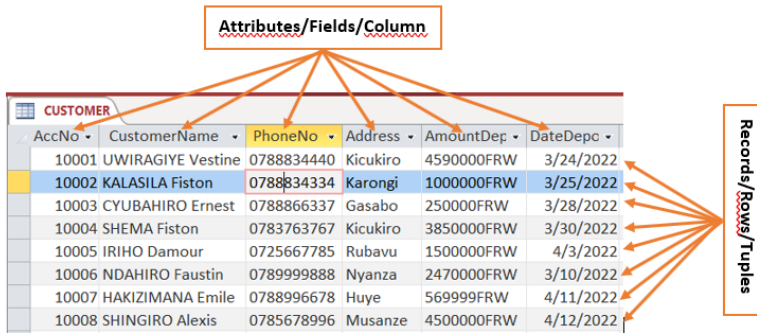


Figure 5. 4.Relation with rows and columns

**Cardinality** refers to the number of rows in a table. In the above table cardinality is 6

**Degree of a relation** (table) equals to the number of its attributes (columns/properties/fields). For example, in the above table, degree is 5.

### Properties of Relations in a relational database

- A table (relation) in a relational database has properties which have to be met
- The relation has a name that is distinct from all other relation names in the database
- Each cell of the relation contains exactly one atomic (single) value
- Each attribute has a distinct name
- The values of an attribute are all from the same domain. The domain is the type of data acceptable in a column. For example, Name column should not accept only numbers data
- Each tuple is distinct; there are no duplicate tuples The order of attributes and tuples has no significance

#### A. Primary Key

In a database table, a primary key is a column or combination of columns that uniquely identifies table records. This column does not accept null values and all its values are unique. The primary key column can be created by the database manager or can be generated by the database according to the defined sequence.

A table can have only one primary key, which may consist of single or multiple fields. When multiple fields are combined and used as a primary key, they are called a **composite key**. If the primary key is already defined, it is not possible to have two records having the same value in that field.

The figure below shows an Access table in which an **AccNo** column plays the role of a primary key. The values in that column are unique, no value is like another and no cell is empty (no null values).

Field of primary key

CUSTOMER					
AccNo	CustomerName	PhoneNo	Address	AmountDep	DateDepc
10001	UWIRAGIYE Vestine	0788834440	Kicukiro	4590000FRW	3/24/2022
10002	KALASILA Fiston	0788834334	Karongi	1000000FRW	3/25/2022
10003	CYUBAHIRO Ernest	0788866337	Gasabo	250000FRW	3/28/2022
10004	SHEMA Fiston	0783763767	Kicukiro	3850000FRW	3/30/2022
10005	IRIHO Damour	0725667785	Rubavu	1500000FRW	4/3/2022
10006	NDAHIRO Faustin	0789999888	Nyanza	2470000FRW	3/10/2022
10007	HAKIZIMANA Emile	0788996678	Huye	569999FRW	4/11/2022
10008	SHINGIRO Alexis	0785678996	Musanze	4500000FRW	4/12/2022

Figure 5. 5.A Primary key column

### A. Foreign Key

A **foreign key** is a field or collection of fields in one table that refers to the primary key in another table. The table containing the foreign key is called the **child table**, and the table containing the candidate key is called the **referenced table, parent table or master table**.

The image below shows a table with a unique value column whose values are those from the master table, the **AccNo** is the primary key of the **CUSTOMER** table while in the **LOANS** table the **AccNo** is the foreign key. All values in the Master table don't need to be in the child table.

CUSTOMER table Primary key

CUSTOMER					
AccNo	CustomerName	PhoneNo	Address	AmountDep	DateDepc
10001	UWIRAGIYE Vestine	0788834440	Kicukiro	4590000FRW	3/24/2022
10002	KALASILA Fiston	0788834334	Karongi	1000000FRW	3/25/2022
10003	CYUBAHIRO Ernest	0788866337	Gasabo	250000FRW	3/28/2022
10004	SHEMA Fiston	0783763767	Kicukiro	3850000FRW	3/30/2022
10005	IRIHO Damour	0725667785	Rubavu	1500000FRW	4/3/2022
10006	NDAHIRO Faustin	0789999888	Nyanza	2470000FRW	3/10/2022
10007	HAKIZIMANA Emile	0788996678	Huye	569999FRW	4/11/2022
10008	SHINGIRO Alexis	0785678996	Musanze	4500000FRW	4/12/2022

Figure 5. 6.Primary key field

**LOANS table** **Foreign Key**

LoanID	AccNo	LoanAmount	LoanDate
1	10001	3500000FRW	3/30/2022
2	10002	800000FRW	3/31/2022
3	10005	1600000FRW	4/20/2022
4	10008	5000000FRW	4/29/2022

Figure 5. 7.Foreign key field

## D. Candidates keys

All attributes that can uniquely identify an entity are called candidates keys. They are never NULL and cannot allow duplication of values. When multiple possible identifiers exist, each of them is a candidate key.

### 5.2.2 Relational Database Management System (RDBMS),

RDBMS serves as an interface between the database and end users or application programs to make sure that data is well organized and remains easily accessible.

DBMS helps provide concurrency, security, data integrity **and** uniform data administration procedures. Advanced query languages such as SQL are used along with the DBMS package to interact with a database.

Some DBMS examples include MySQL, SQL Server, Oracle, dBASE, FoxPro, Access, etc

#### A. Table

Tables are database objects that contain all the data in a database. In tables, data is logically organized in a row-and-column format similar to a spreadsheet. Each row represents a unique record, and each column represents a field in the record.

#### B. Record

A record is simply **a set of data stored in a table**, for example, a customer record. A record in a database is an object that can contain one or more values. Groups of records are then saved in a table; the table defines the data that each record may contain.

Below is the CUSTOMER table:

CUSTOMER					
AccNo	CustomerName	PhoneNo	Address	AmountDep	DateDepc
10001	UWIRAGIYE Vestine	0788834440	Kicukiro	4590000FRW	3/24/2022
10002	KALASILA Fiston	0788834334	Karongi	1000000FRW	3/25/2022
10003	CYUBAHIRO Ernest	0788866337	Gasabo	250000FRW	3/28/2022
10004	SHEMA Fiston	0783763767	Kicukiro	3850000FRW	3/30/2022
10005	IRIHO Damour	0725667785	Rubavu	1500000FRW	4/3/2022
10006	NDAHIRO Faustin	0789999888	Nyanza	2470000FRW	3/10/2022
10007	HAKIZIMANA Emile	0788996678	Huye	569999FRW	4/11/2022
10008	SHINGIRO Alexis	0785678996	Musanze	4500000FRW	4/12/2022

Figure 5. 8.Customer table

## A. Field

Field is the component that provides structure for a table. A table without fields does not exist. For instance, a database creator can create an empty table that has fields defined but no rows (records).

## A. Data type

A data type is a description of the kind of data in a table column. Each database system recognises its own set of datatypes, although some are common to many.

Examples :

Data type	Explanation
char(size)	Fixed-length character string. Size is specified in brackets.
varchar(size)	Variable-length character string. Maximum size is specified in brackets.
integer(size)	Number value with a maximum number of column digits specified in brackets.
Date	Date value

## Table 5.1 Data type descriptions

Below are different data types of table CUSTOMER in design view:

Field Name	Data Type
AccountNo	Number
CustomerName	Short Text
PhoneNo	Large Number
Address	Short Text
AmountDepo	Currency
DateDepo	Date/Time




Figure 5. 9.Data type for Customer table

### A. Relationship

Database relationships are **associations between tables that are created using join statements to retrieve data.**

#### ▪ Types of relationship

There are three types of relationships between the data that are likely to encounter at this stage in the design : **one-to-one, one-to-many, and many-to-many.** To be able to identify these relationships, it is needed to examine the data and have an understanding of what business rules apply to the data and tables.

#### a) One-to-one (1-1)

A one-to-one relationship is **a link between the information in two tables, where each record in each table only appears once.**



Figure 5. 10.Example of one to one relationship

Another example, there might be a one-to-one relationship between employees and the cars they drive, because only one driver can drive a car.

#### a) One-to-many (1-M)

In a relational database, a one-to-many relationship exists **when one row in table A may be linked with many rows in table B, but one row in table B is linked to only one row in table A.** It is important to note that a one-to-many relationship is not a property of the data, but rather of the relationship itself.



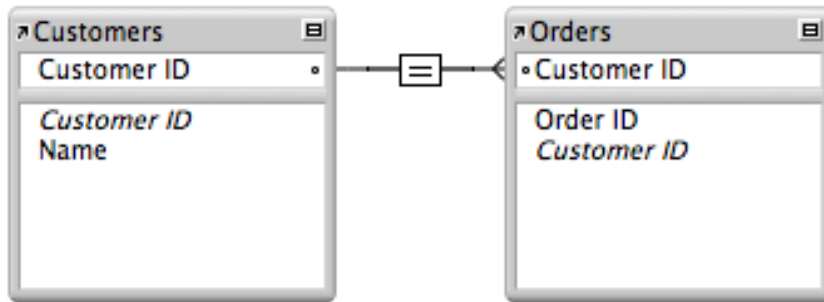


Figure 5. 11.Example of one to many relationship

Note : One customer can make many orders

### a) Many-to-many (M-M)

A many-to-many relationship refers to a relationship between tables in a database when a parent row in one table contains several child rows in the second table, and vice versa.

## 5.2.3 Structured Query Language (SQL)

SQL is a programming language used for managing data in a relational database. SQL can be used to create a database and tables inside that database, insert and delete data in tables, query the database and whatever other task to be done on a database.

SQL statements look like ordinary English though the words may appear straight or are in a shortened form. Below is a statement in Access that displays all information from the table CUSTOMER.

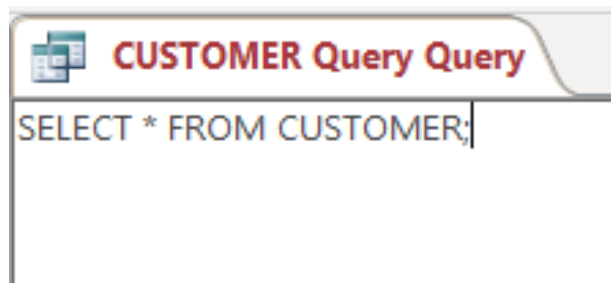


Figure 5. 12.Query to display all information from Customer

When the SQL statement above is run, it displays all the records in the table CUSTOMER.



## Application activity 5.2

1. What do you understand by the relational Database
2. Explain the following terms:
  - a) Field
  - b) Table
3. Differentiate candidate key from foreign key
4. By using examples, distinguish the types of data relationship
5. Enumerate the properties of relation in relational database
6. Given the table below; identify the primary key, foreign key and records

LoanID	AccNo	LoanAmount	LoanDate
1	10001	3500000FRW	3/30/2022
2	10002	800000FRW	3/31/2022
3	10005	1600000FRW	4/20/2022
4	10008	5000000FRW	4/29/2022

### 5.3. Database design process

#### Activity 5.3



1. Having hired as a database designer at your school, explain different steps you will go through to design a database that will manage your school library.
2. Discuss the benefits for your school when students, teachers and librarian will start using the new computerized database of the library.

The most important thing to do to start designing a database is to plan ahead. When a case that needs a database creation is presented, before switching on a computer and starting creating the database it is better to think about the type of information to work with and the types of questions that the database should answer, what information needs to be stored and what specifically are the links between them. The next phases are to verify all requirements specifications, to represent the data with diagram, and to plan the database.

When data is more complex, there are more needs to plan. Even the simplest database should be thought thoroughly on paper before being created using Database Management System such as Microsoft Access, SQL, MySQL, etc.

A well-designed database performs well and adapts to future needs by giving users access to essential information. Poor planning often results in a database that fails to meet the current needs or the needs that may arise in the future cannot easily be integrated in the existing database

In planning the database, regardless of its size and complexity, the following basic steps are used :

- Gathering information (investigation)
- Identify the objects (Important Entities and their Attributes).
- Model the objects.
- Identify the types of information for each object.
- Identify the relationships between objects.
- Database optimization through normalization.
- Data entry and manipulation

### **5.3.1. Gathering information**

Before creating a database, there is a need to understand the problem that the database is expected to solve. If the database is to replace the traditional method, file based approach method, then the existing system will give most of the information needed.

In this step there is a need to work with everyone involved in the existing system which can be a paper based database, an old database or no database at all. Gathering techniques include collecting copies of customer information, management reports, and any other documents that are part of the existing system or interviewing staff who are familiar of the work done in that institution, the staff who are expected to use the new database or who use the old one. This step is useful in designing the database and the interfaces.

The output of this step is information on how the business of an institution is carried out and this can be analyzed to derive the different tables (entities) that will be needed.

### **5.3.2. Identifying the important entities and their attributes**

During the process of gathering information, the key objects or entities that will be managed by the database must be identified. The object can be a tangible thing such as a person (for example student, employee, and patient), a product, or it can be a more intangible item, such as a department in an institution, a Combination in a school. Each distinct item in the database should have a corresponding table for which column titles are attributes of the entity

### 5.3.3. Identifying the Relationship between entities

It is good to relate or associate information about various items in a database. Identifying the relationship between entities in the design process requires looking at the entities and determining how they are logically related and adding relational columns (foreign key) that establish a link from one table to another. After identifying the relationship between entities an Entity Relationship (E-R) Diagram is created using appropriate symbols.

### 5.3.4. Modeling the objects

As the objects in the system and their attributes are identified, they are recorded in a way that represents the system visually. They are recorded using Relational model and Entity Relational model.

### 5.3.5. Identifying the types of information for each object

After identifying the primary objects/entities in the database as candidates for tables, the next step is to identify the types of information that must be stored for each object.

These are the columns in the table of the object. Fields/columns should be kept simple, the more atomic are the fields the more flexible will be the database.

For example, in a database of **names and addresses**, it is better to keep each part of the person's name as a separate field.

### 5.3.6. Database optimization through normalization

One of the most important step to consider when designing a database is database definition. If tables are not set up properly, it can cause a lot of headaches at the time of extracting/retrieving required data.

Normalizing a database eliminates redundancy, and other anomalies that may arise as the database is being used. Redundancy means that the same data is saved more than once in a database.

Those anomalies are: insertion anomalies, deletion anomalies and updation anomalies. Normalization will be developed in details in the subsequent sections.

**Update anomalies:** If data items are scattered and are not linked to each other properly, then it could lead to strange situations where one row is updated but others are left with old values leading to inconsistency in database.

**Deletion anomalies:** As data may be scattered somewhere else, in a database that is not normalized when one record is deleted, other related records may remain in the database.

**Insert anomalies:** In a very long table which is not normalized, one may need to insert some values but may not have values to insert for some columns which may lead to tables in which some cells are filled while others are empty.

Normalization is a method to remove all these anomalies and bring the database to a consistent state.

A Properly normalized design allows to use storage space efficiently, eliminate redundant data, reduce or eliminate inconsistent data and ease the database maintenance

### **5.3.7. Data entry and manipulation**

When the database is completely designed the last step is using it by putting in it the data. Data can be manually entered from hard copy forms or it can be imported from other files like excel or other files supported by the current one.

While entering data or importing it from other files make sure the data is valid because if the database has strong validation rules, which is an ideal, it will not accept those data.



#### **Application activity 5.3**

1. Explain clearly the role of gathering information before desing a database.
2. What do you understand by database normalization?
3. With an example, differentiate upade and deletion anomalies in Databse optimization

## 5.4. Creating, Saving, Closing and Opening a database

### Activity 5.4

Create a database to manage the stock of your school kitchen:

1. Create the following three tables:
  - a. Foods
  - b. StockIn
  - c. StockOut
2. Identify for each table the name of the column that will have unique values (values that don't resemble and no duplicate values in the whole column and that cannot contain null values)

### Activity 5.4



Create a database to manage the stock of your school kitchen:

1. Create the following three tables:
  - a) Foods
  - b) StockIn
  - c) StockOut
2. Identify for each table the name of the column that will have unique values (values that don't resemble and no duplicate values in the whole column and that cannot contain null values)

### 5.4.1 Database creation

A database is a collection of information. In Access, every database is stored in a single file and has to have a name and different objects.

Different objects in an Access database are tables, queries, forms, reports, macros, and modules.

- Tables : They store information. A database can have as many tables as are needed.
- Queries : They let database users perform actions on tables which can be data definition queries or data manipulation queries.

- Forms : Those are attractive windows created by the database user and provide a way to view or change information in a table
- Reports : They are summary of the information contained in different tables which have a common characteristic.

To create an Access database first start Microsoft Office Access by clicking on the start button then on Access 2019, in the window that will appear write the database name and click on Create.

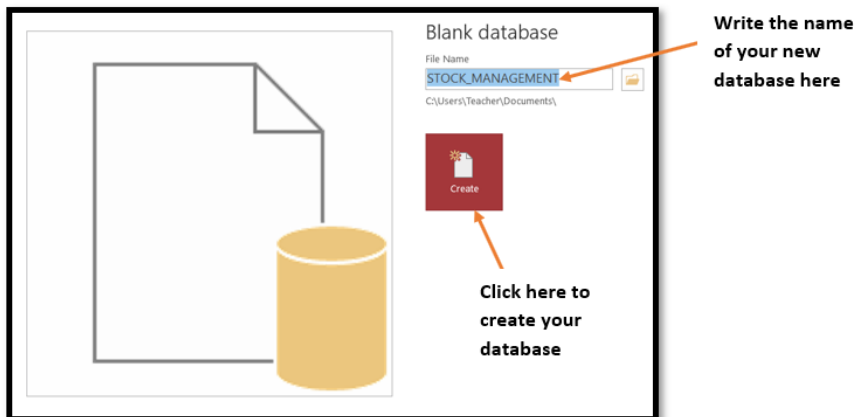


Figure 5. 13. Access window for naming and creating a database

The new database is now created but has no table. Tables can be created using one of the available options : Datasheet view, Design View

### i) Creating a table in Datasheet view

When the database is created, the default option to create tables is using the Datasheet view. The Datasheet view is the option which allows to view many rows in a table at the same time. This option also allows to filter and sort data using the built in sorting and filtering options. This view is also useful for quickly viewing the details of many records, adding new records and deleting records from a table.

To create a table in Datasheet view, do the following :

Click on Create menu then on the table icon. New table with two columns and one row appears

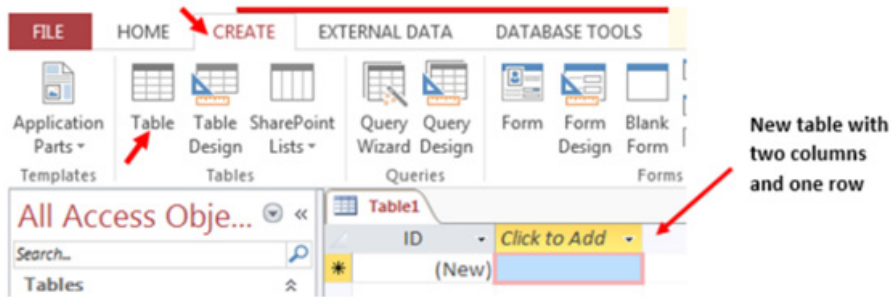


Figure 5. 14. New mini table in Datasheet view

- To add new columns to the existing table in the image above click on the drop down arrow next to **Click to Add**. In the list of data types that will appear choose one suitable to the information to be kept in the column.
- Write the name of the new column. Repeat the same steps of choosing the data type and renaming the column up to when you have all the needed columns.
- Save the table by clicking on the save icon write the table name and click on OK.

## ii) **Creating a table in Design view**

A table can also be created in Design view and this provides additional options compared to the Datasheet view like adding/changing the primary key and changing the column data type. In Design view, the table structure is created but entering data requires using the Datasheet view

To create a table in Design view go through these steps :

- On the Create tab, in the Tables group, click Table Design or in the Views group click on the View tab then choose Design View.
- In the new window that will appear, specify the field names, Data types and the descriptions of the fields (optional) and set the primary key by selecting the field name then clicking on the Key icon. The primary key column will then have a key icon in front of it
- Save the new table by clicking on the save icon and specifying the name.



CUSTOMER	
Field Name	Data Type
AccNo	Number
CustomerName	Short Text
PhoneNo	Long Text
Address	Short Text
AmountDepo	Long Text
DateDepo	Date/Time

**Primary key**

**Figure 5. 15.Window to create a table in Design View**

### 5.4.2 Opening and closing a database

A database created can be closed by clicking on the close icon of the Access window in which it is opened. This same database can also be opened by first opening Microsoft Office Access then going to the File tab then choosing the Open option and browsing the database to open.

Once the database is opened, it will show its different objects (Tables, Queries, Forms, Report), choose the one you want to have access



#### Application activity 5.4

1. Using Access, create a database named “Payroll” and save it on the desktop.
- 2) a. Create two tables which will keep respectively Staff identification and their Salary.  
b. Indicate the primary key for each table.

## 5.5. Creation of tables relationship

### Activity 5.5



1. What do you understand by relationship in relational database?
2. With examples, explain different types of tables relationship

Table relationship is the backbone of database management as it helps in making the many tables seem one. Without this option it would not be possible to retrieve data from different tables at the same time but every table would be taken as a separate entity.

For tables to be logically related they have to have a common column which binds them; this is the foreign key.

A relationship is established between two tables when one table uses a foreign key that references the primary key of another table. This is the basic concept behind the term relational database.

#### **Here is in brief why table relationships are needed:**

As most of the time a database has more than one table to work while running queries it is necessary that tables be related as the query works by matching the values in the primary key field of the first table with a foreign key field in the second table.

While designing a form or a report, MS Access uses the information it gathers from the table relationships already defined to present you with informed choices and to prepopulate property settings with appropriate default values.

These foreign key-primary key pairings form the basis for table relationships and multi-table queries.

#### **A. Different relationships**

There are three main relationships in database tables namely one to one, one to many (or many to one) and many to many.

##### **i) One to one (1:1)**

In a one to one relationship one record in one table can be related to only one other record in the other table. This kind of relationship can be implemented in a single table and therefore does not use a foreign key which is needed only when two tables are to be related.

This kind of relationship is not so common as the data stored in table B could just have easily been stored in table A. However, there are some valid reasons for using this relationship type like security purposes, the need to diminish the number of columns in a table and slash it into smaller tables, and various other specific reasons.

These are examples of One to One relationships in real life:

- In a marriage, each spouse has only one other spouse.
- A son has only one mother
- A car can be driven by one driver at a time
- A President and a country

### **ii) One to many /many to one (1:M / M:1)**

A one-to-many relationship allows a single record in table A to be related to multiple records in table B but a record in table B can have only one matching record in table A. This is the most common type of relationship and it is used to relate one record from the 'primary' table with many records in the 'related' table.

Examples :

Consider a business with a database that has Customers and Orders tables. A single customer can purchase multiple orders, but a single order could not be linked to multiple customers.

- A mother can have many children
- A businessman can have many cars
- One federate country can have more than one state

### **iii) Many to many (M:M)**

Two tables have a many-to-many relationship when a single record in the first table can be related to one or more records in the second table and a single record in the second table can be related to one or more records in the first table.

Briefly two tables A and B are said to have a many-to-many relationship when A record in Table A can have many matching records in Table B, and a record in Table B can have many matching records in Table A.

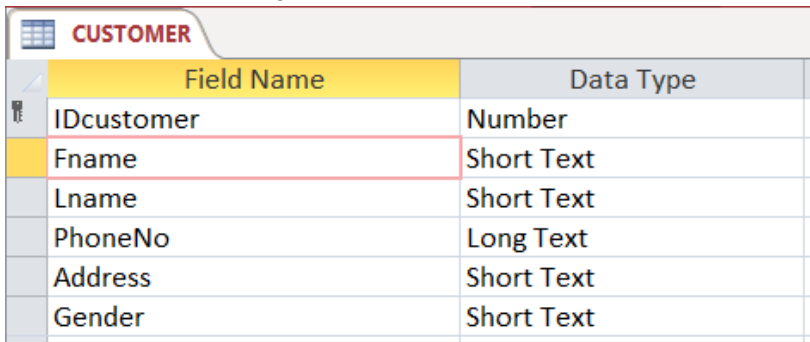
Examples :

The relationship between TEACHER entity and STUDENT entity is an example of many-to-many relationship. One teacher teaches many students and one student is taught by many teachers.

- Many students are taught by many teachers
- Many customers may buy many products

## CUSTOMER table

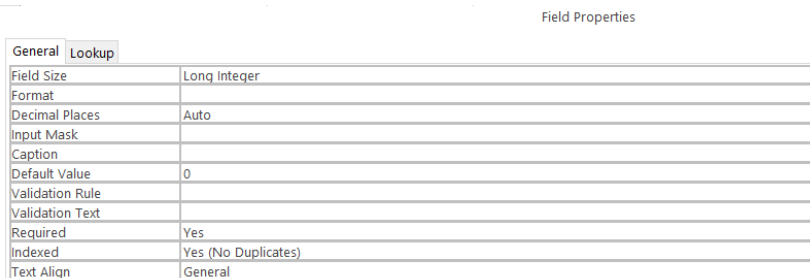
The CUSTOMER table will have 6 columns namely IDcustomer, Lname, Lname, PhoneNo, Address and Gender. The data types for all the columns is Short Text. The Sex column will allow only two values: male and female.



Field Name	Data Type
IDcustomer	Number
Fname	Short Text
Lname	Short Text
PhoneNo	Long Text
Address	Short Text
Gender	Short Text

Figure 5. 16. Creation of the table CUSTOMER

The IDcustomer field does not need to be too long, that is why we specify its length as Long Integer. The length of a field is specified in the **Field Properties** shown in the image below which is the part of the window for fields definition.



Field Properties	
General	Lookup
Field Size	Long Integer
Format	
Decimal Places	Auto
Input Mask	
Caption	
Default Value	0
Validation Rule	
Validation Text	
Required	Yes
Indexed	Yes (No Duplicates)
Text Align	General

Figure 5. 17. Field Properties by fields specifications

Using this same Field Properties window, one can specify different properties of the table fields like a customized error message when wrong data type is entered in a table and validation rules.

## ACCOUNT\_NO table

This table will contain information about Customers account number.

The values of Idcustomer column will be those that exist in the CUSTOMER table Idcustomer column while those in the AccNo column are those that exist in the ACCOUNT\_NO table AccNo column.

ACCOUNTS_NO	
Field Name	Data Type
AccNo	AutoNumber
IDcustomer	Number
AccType	Short Text
AccDate	Date/Time

Figure 5. 18.ORDERS table Structure

### The DEPOSIT table

The DEPOSIT table has 4 rows namely IDDeposit which uniquely identify every Customer deposit (primary key), the AccoNo, Amount and DateDeposit.

DEPOSIT	
Field Name	Data Type
IDDeposit	AutoNumber
AccNo	Number
Amount	Number
DateDeposit	Date/Time

Figure 5. 19.BOOKS table Structure

### WITHDRAW table

The WITHDRAW table has 4 columns namely IDwithdraw which uniquely identify every Customer withdraw (primary key), the AccoNo, Amount and Datewithd.

WITHDRAW	
Field Name	Data Type
IDwithdraw	AutoNumber
AccNo	Number
WithdAmount	Currency
DateWithd	Date/Time

Figure 5. 20.WITHDRAW table structure

### LOANS table

The LOANS table has 4 columns namely LoanID which uniquely identify every given loan to a customer (primary key), the AccoNo, LoanAmount and LoanDate.

LOANS	
Field Name	Data Type
LoanID	AutoNumber
AccNo	Number
LoanAmount	Short Text
LoanDate	Date/Time

Figure 5. 21.LOANS table structure

## BALANCE table

The BALANCE table has 4 columns namely IDBalance which uniquely identify customer balance (primary key) whenever he/ or she deposits or withdraws money, the IDdeposit, IDwithdraw and Balance.


BALANCE	
Field Name	Data Type
IDBalance	AutoNumber
IDdeposit	Number
IDwithdraw	Number
Balance	Currency

Figure 5. 22.BALANCE table structure

## B. Creating relationships

As it has been seen tables which are not normalized present many anomalies which make such a database very bad. When database is normalized, its tables are broken down into smaller tables which help eliminate redundancy but there must be a mechanism to link those tables so that they can be queried as one. The mechanism used is to relate different tables by using foreign keys.

A relationship between tables is built like this :

- Under the Database Tools tab click on Relationships tool  , drag and drop the tables between which to create a relationship from the left pane to the relationships area. Tables are dragged

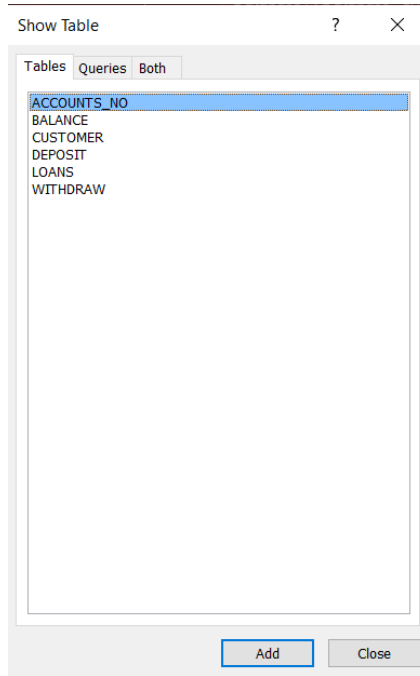


Figure 5. 23.window for adding tables used to create a relationship

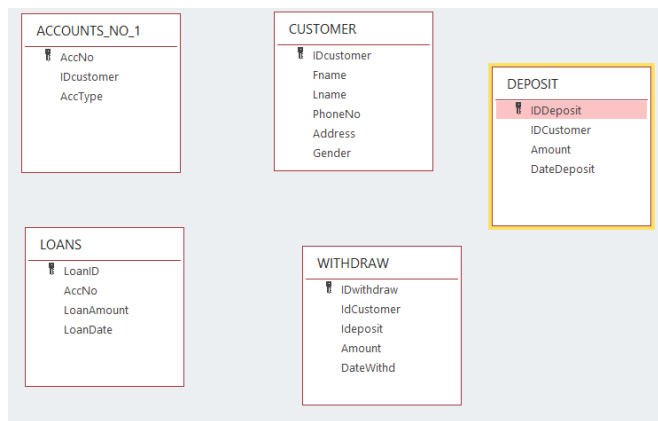


Figure 5.23.Added tables before creating a relationship

- Arrange the tables properly so as to make an easy to read diagram once the relationship is created.
- Click and hold down the column name from which the relationship is to be established and move the cursor (from left to right) to the other related column in the other table. The window below that will appear will help in editing the relationship.

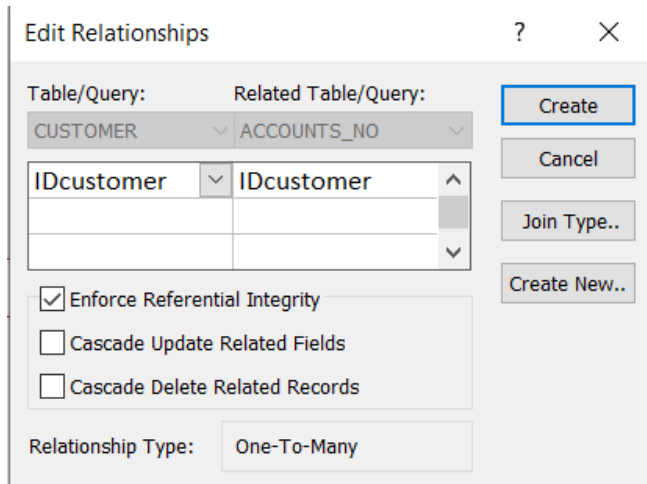


Figure 5.23. Options for establishing table relationship

- Continue the process in the above bullets until all the tables to be linked are linked.

Note that the columns to link have to be of the same data type and of the same length if not so the attempt to create a relationship will result in an error.

After linking all the tables, the relationships between the library database tables will look like in the image below:

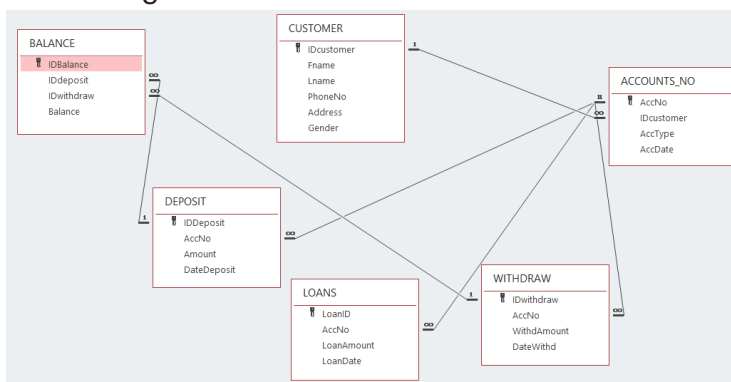


Figure 5.24. Case of bank data base management with table relationship





### Application activity 5.5

1. Create a database with the following tables then create a relationship:
  - a. ITEMS (Iditem, itemname)
  - b. ORDER (Idorder, Iditem, quantity,dateorder)
  - c. STOCKIN (Idstockin, Idorder, quantity, datestockin)
  - d. STOCKOUT (Idstockout, quantity,datestockout)

## 5.6. Adding Data to a database

### Activity 5.6



1. Using your own words, explain what is data entry in database
2. Discuss different ways that can be used to add data to an Access database
3. Differentiate back-end from front-end

### Adding Data to a database (Data Entry)

Data entry is a direct input of data in the appropriate data fields of a database through the use of a human data-input device such as a keyboard, mouse, or touch screen, or through speech recognition software.

Before doing a data entry be aware of fields to enter and the validation rules associated with those fields. This will help in avoiding to enter a wrong data type in a field and knowing that the database will not accept that data type, it will take time to figure out the right data to enter. Know which fields get data from other fields (lookup), fields that have specific values (like yes/no). In short, study the table/form before entering data.

Adding data to an Access database can be done in 3 main ways :

- Data entry through a front end interface
- Entering data in a Datasheet view table
- Entering data using an Access form

## 5.6.1 Data entry through a front end interface

In programming and development, a front-end is a term that describes a user interface that is used to interact with the database instead of working directly with the database.

For example, a website front-end developer handles the visual aspects of how the web page looks and responds to the visitor. The front end interacts with the back end (database) which may be on the local computer or remotely placed on a server.

The front end provides forms which are developed using different languages like HTML (HyperText Markup Language), HTML5 and programming languages to link the webpages to the database like PHP.

The forms provided by the front end has different fields which correspond to the fields in the database and alert the data entry clerk whenever form validation rules are not followed. They also provide a “submit” button on which to click for sending data in the database.

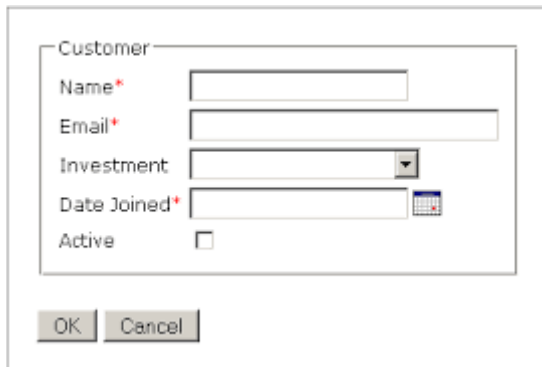


Figure 5.25. An example of a form that can be used to enter data into the database

## 5.6.2 Entering data in a Datasheet view table

Datasheet view is one of the table viewing in Access which allows a user to enter directly data in a table.

IDcustomer	Fname	Lname	PhoneNo	Address	Gender
10001		UWIRAGIYE Vestine	0788834440	Kicukiro	F
10002		KALASILA Fiston	0788834334	Karongi	M
10003		CYUBAHIRO Ernest	0788866337	Gasabo	M
10004		SHEMA Fiston	0783763767	Kicukiro	M
10005		MUKOBWAJANA Jane	0725667785	Rubavu	F
10006		MUKAMURENZI Aline	0789999888	Nyanza	F
10007		HAKIZIMANA Emile	0788996678	Huye	M
10008		MUTIMUCYEYE Solange	0785678996	Musanze	F
*					

Figure 5.26. An example of an Access table in Datasheet view


To add records to a table in datasheet view in Access, click into this row and enter the new record. The asterisk will then change to a picture of a “pencil” as data is being entered. The pencil will let know which record that is being edited. Another new “**New Record**” row also appears once it is done with the current row.

While entering data in an Access table, it is necessary to follow the validation rules of the table because when they are not respected, the data will not be accepted.

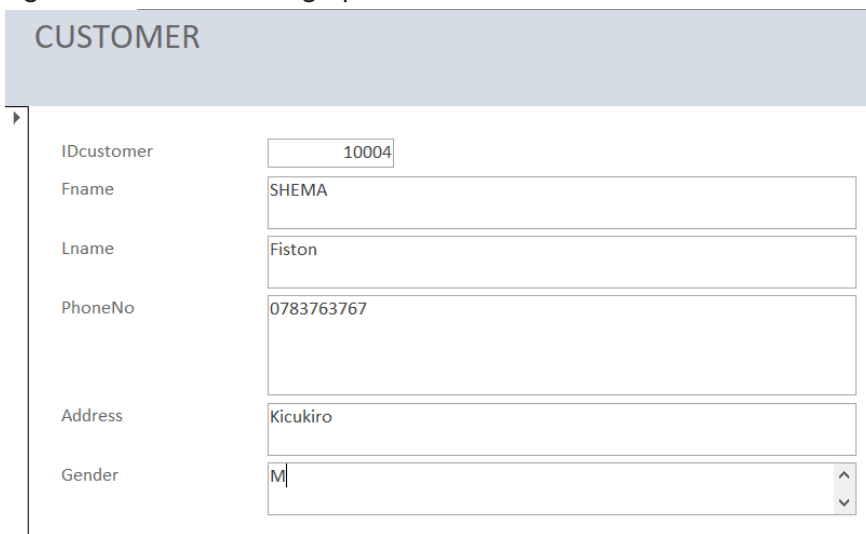
### 5.6.3. Entering data using an Access form

Microsoft Access 2019 provides different objects the common ones being tables, queries, forms and reports.

Access forms are accessed by clicking on the Create tab then select one of the form options provided in the Forms group.

The Form tool is used to view table data in a form format and is accessed just by opening the table and clicking on the Form tool .

To navigate in the form’s data or to enter new data use the tools available on Record tools group. By using the tools in this group one will be able to move to the next row, move to the last row, empty the form so as to enter new data and searching for a row containing specific text.



CUSTOMER	
IDcustomer	10004
Fname	SHEMA
Lname	Fiston
PhoneNo	0783763767
Address	Kicukiro
Gender	M

Figure 5.27. Form used to display data from a database table

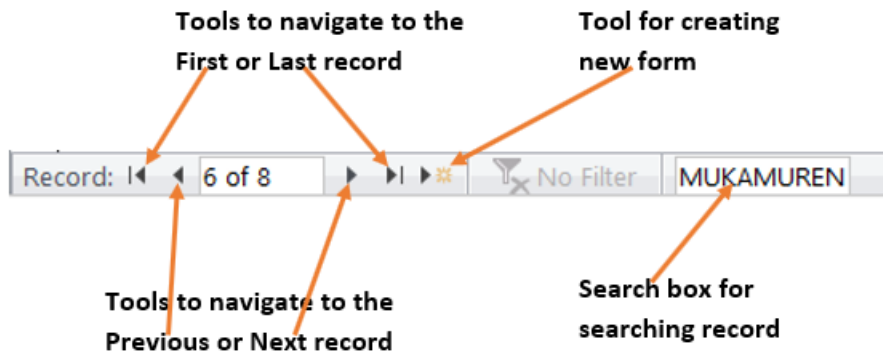


Figure 5. 28. Different tools to navigate in an Access form

## A. Designing a form from scratch

A form can also be designed from scratch and not created from an existing table. The created form will then create a table to which it will be linked.

**To create a form from scratch go through these steps :**

- Under the Create tab click on the Form Design tool
- In the form area drag and drop the form design tool to use but before this name your form by using the Title tool found in the header/footer group. If needed also set the form's logo.

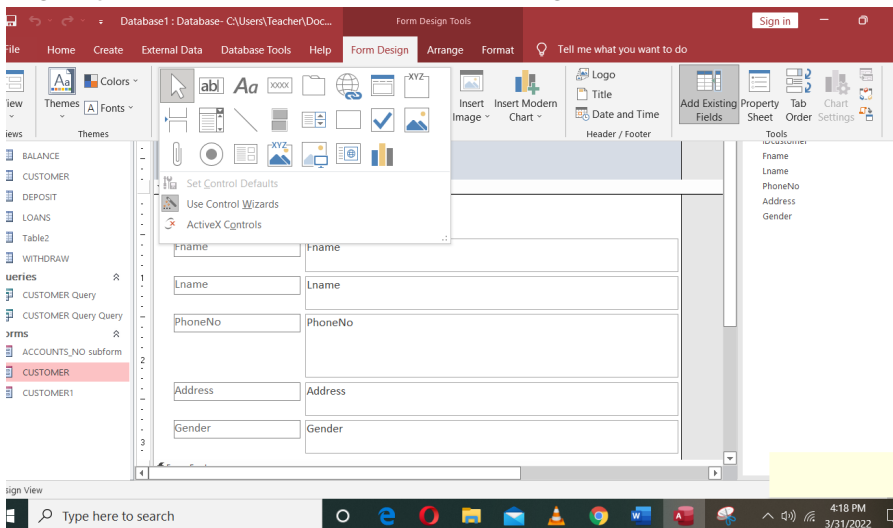


Figure 5.29. Access tools used to create a form from scratch

From left to right the different tools to choose from are: Select tool, Text Box, Label, Button, Tab Control, Hyperlink, Web Browse Control, Navigation Control, Option Group, Insert Page Break, Combo Box, Chart, Line, Toggle Button, List

Box, rectangle, Check Box, Unbound Object Frame, Attachment, Option Button, Subform/Subreport, Bound Object Frame and Image.

### B. School library form

Here is a form created from scratch which accepts data and submits it to the database table. It has been created by taking the different tools available for building a form. The different tools dragged from the Form Layout tool are: Logo, Title, Text Boxes, Option Group and Button.

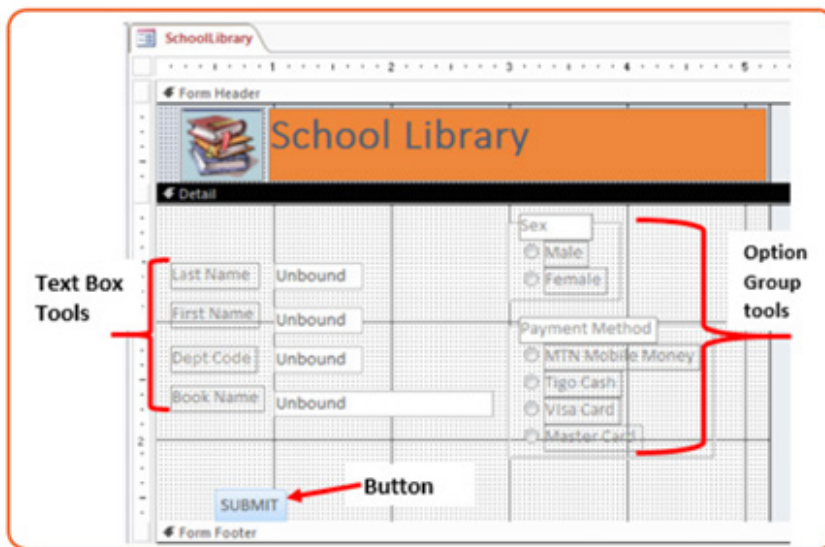


Figure 5.30. School Library form in the Design View

The above Form viewed in the Form view looks like this :

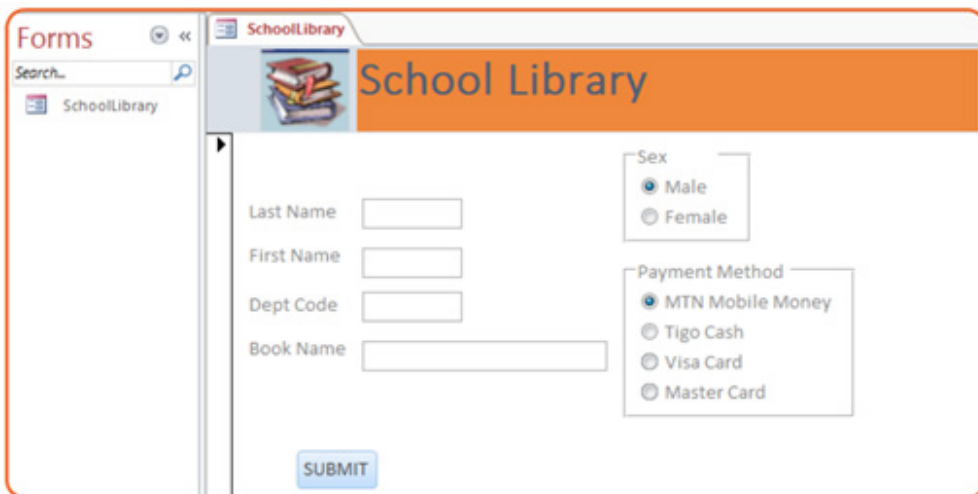


Figure 5. 24.School library form to enter data in a library table



## Application activity 5.6

- Design the form below that can be used to enter student registration information in the database.

### ONLINE STUDENTS REGISTRATION

FIRST NAME	<input type="text"/>	(max 30 characters a-z and A-Z)
LAST NAME	<input type="text"/>	(max 30 characters a-z and A-Z)
DATE OF BIRTH	Day: <input type="text"/> Month: <input type="text"/> Year: <input type="text"/>	
EMAIL ID	<input type="text"/>	
MOBILE NUMBER	<input type="text"/>	(10 digit number)
GENDER	Male <input type="radio"/> Female <input type="radio"/>	
ADDRESS	<input style="width: 100%;" type="text"/>	
CITY	<input type="text"/>	(max 30 characters a-z and A-Z)
PIN CODE	<input type="text"/>	(6 digit number)

- Add your school logo.
- Make sure the table/form is validated to accept only valid data.

## 5.7. Querying a Database in design view



### Activity 5.7

- Create the following **ACCOUNTSNO** table as below:

AccNo	IDcustomer	AccType	AccDate
1	10001	Saving	12/13/2021
2	10002	Saving	7/12/2021
3	10001	Ordinary	4/1/2022
4	10003	Ordinary	3/29/2022
5	10001	School fees	12/16/2021
6	10007	Saving	3/30/2022
7	10005	Ordinary	4/1/2022
8	10007	Ordinary	3/28/2022

- Display all accounts numbers which have been created in 2021.
- Display all customers accounts.

A query is a request for data results, and for action on data. A query can be used to answer a simple question, to perform calculations, to combine data from different tables, or even to add, change, or delete table data.

A query is a request to the database tables for data results or for action on data. This query can help answer a question, combine data from multiple tables, perform calculations, change or delete table data.

**In Access, querying a database can be done in two ways:** by writing a query in a language that is understandable to the database that is known as SQL query or by designing or by using the Design View approach. This section is going to talk about querying an Access database in Design view.

### **5.7.1 Benefits of using queries**

The benefits of using queries are so multiple :

- As the table increases in size and may have thousands of records, it is so difficult to spot one record by scrolling through the database. The query approach solves this problem by spotting the needed records and performing needed actions on them
- A query can help in applying a filter on table's data and get only what is needed
- When one same action is to be performed on many records, it would be a loss of time to repeat every action on every record. Doing it automatically in a query quickens the process

### **5.7.2 Types of queries in Access**

There are mainly two types of queries in Access:

- Select queries which are used to display data from tables or to perform calculations
- Action queries which are used to add, change or delete data

#### **A. Select queries**

A select query is the one which displays records from one or more tables of a database The SQL SELECT statement returns a result set of records from one or more tables. A SELECT statement retrieves zero or more rows from one or more database tables or database views basing on the selection criteria if there is one.

## A select query on one table

To design a select query, do the following:

- Under the Create tab click on Query Design
- In the “Show Table” window that will appear choose the table on which the query is to be run and click on Add. In this case the table BOOKS was chosen

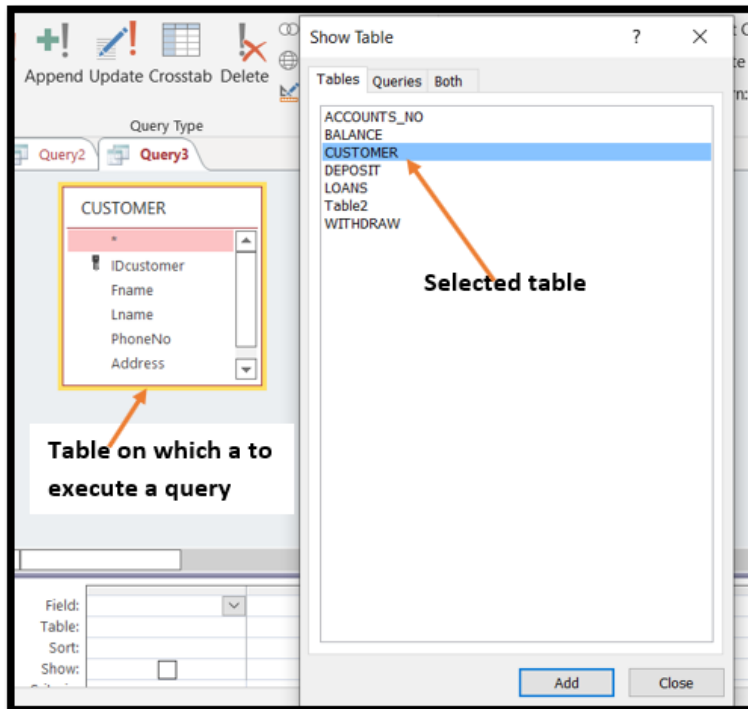


Figure 5. 25. Window to select the table on which to run a query

- After selecting the table click on **Close** to close the window
- In the table, select the columns to appear in the result. In this case only these columns were selected: Fname, Lname, Address, and PhoneNo.



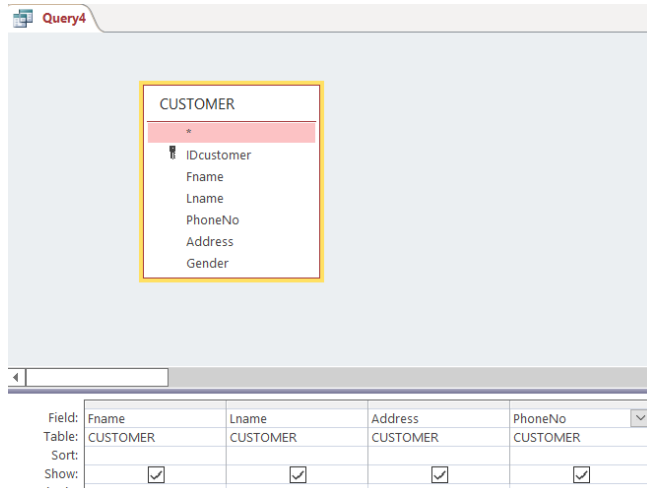


Figure 5. 26.Options to select columns to appear in results of a query

- If there is a criterion for selection specify it and if there is not one leave the criteria field empty. In this case only books in the science category are going to be displayed
- Click on **Run** to get the results of the query

Fname	Lname	Address	PhoneNo
UWIRAGIYE	Vestine	Kicukiro	0788834440
KALASILA	Fiston	Karongi	0788834334
CYUBAHIRO	Ernest	Gasabo	0788866337
SHEMA	Fiston	Kicukiro	0783763767
MUKOBWAJANA	Jane	Rubavu	0725667785
MUKAMURENZI	Aline	Nyanza	0789999888
HAKIZIMANA	Emile	Huye	0788996678
MUTIMUCYEYE	Solange	Musanze	0785678996
KANAKUZE	Wivine	Karongi	0788546732

Figure 5. 27.The results of the query on Customer table

### Select query on multiple tables

In a normalized database it is possible to link more than two table in order to get a more revealing display (report). For example, in the table that have been used one may need to know the names of students who borrowed science books and their combinations.

To answer such a question requires to combine columns from three tables and thanks to the foreign keys in the tables this combination is possible. The tables to combine are: CUSTOMER, ACCOUNT\_NO and DEPOSIT

To make such a query do the following :

- Under the **Create** tab click on **Query Design**
- Chose the table that are to be used in the new query. Here select all the tables (CUSTOMER, ACCOUNT\_NO and DEPOSIT)
- Select the columns that will appear in the results. Those columns are: Fname, Lname, AccNo, Amount and DateDeposit.

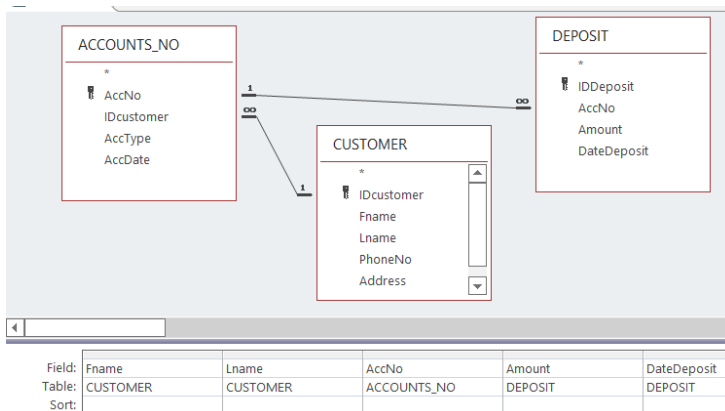


Figure 5. 28. Access Select query which displays columns from many tables

- Run the query by clicking on the **Run** tab which is found under the **Query Tools**

Fname	Lname	AccNo	Amount	DateDeposit
JWIRAGIYE	Vestine	1	500000	2/3/2022
KALASILA	Fiston	2	65900	3/29/2022
UWIRAGIYE	Vestine	1	35000	12/8/2021
UWIRAGIYE	Vestine	3	1110000	1/5/2022
CYUBAHIRO	Ernest	4	55000	4/1/2022
MUKOBWAJANI	Jane	7	150000	3/3/2022

Figure 5. 29. Sample results that will be returned by the select query

Note that this kind of query that combines many tables is possible only if tables are related by the use of foreign key.



### Application activity 5.7

Using the four tables (CUSTOMER, ACCOUNT\_NO, DEPOSIT, and LOANS) create queries in Design View that do the following:

- Customers whose gender is Female
- Customers whose name start with letter "M"
- All loans that have been given to different customers in the year of 2022



**Q1.** Explain the following terms:

1. **Database**
2. **Field**
3. **Table**
4. **Query**

**Q2.** Give the difference between primary key and foreign key

**Q3.** Explain why it is necessary to have a normalized database

**Q4.** Outline the advantages of DBMS

**Q5.** Using the four tables (STUDENTS, BOOKS, ORDERS, and COMBINATIONS) used through this section create queries in Design View that do the following:

- a) Students whose sex is Male
- b) Students whose name start with letter "U"
- c) Books which are in the Mathematics category
- d) Students who study in MPC option in 2010

**Q6.** GIRUBUZIMA is the PHARMACY that orders, stores and sells drugs to patients. You are requested to create the database through doing the following different activities:

- a. Propose the name of database and create it
- b. Identify and create the necessary tables(entities) and their corresponding fields, their primary keys and foreign keys.
- c. Create a relationship between the tables
- d. Create forms that will allow GIRUBUZIMA PHARMACY Pharmacist to record all orders, to store and sell different kinds of drugs.
- e. Write SQL query which displays all drugs in the stock that have been manufactured before end of the year 2020

## Skills Lab 5



You are a business owner. Create a database that will help in the daily management of that business. The database created should include at least the following:

- Tables with primary keys and foreign keys
- Forms to provide interface
- Automatically produce reports
- Has features like automatically calculating taxes, etc

# UNIT 6

## ONLINE BUSINESS CORRESPONDENCE



### Introductory activity

Mr. Mugenzi is a businessman who buys goods from China. Those goods consist of machineries, clothing items and foodstuff. As his business activities are many, he is sometimes required to spend a lot of time in China while inquiring from different sellers and completing all the formalities necessary for his goods to be shipped to Rwanda. On average, for every year he spends more than 100 days in China.

- 1) Analyse this situation and explain how it hinders Mr. Mugenzi's business
- 2) If Mugenzi flies to China at least 50 times, estimate the price of airfare he spends

Explain what Mugenzi would do to reduce the number of days spent in China but get all the goods he wants

### 6.0. Introduction

Business correspondence is a process by which parties in a business exchange information in a written format for the purpose of business activities. This information exchange can take place between organizations, between customers or between customers and organizations.

Business correspondence can be done for the purpose of inquiring from the selling institution for necessary information needed by a customer, receiving information from the selling institution about the goods the customer sought information, ordering goods, sending an invoice, response on the goods received.

Online business correspondence is the one which is done using online means of communication mainly the internet. The most common online business correspondence is through emails but selling institutions may have their customized channel of communication.

## 6.1. Emails

### Activity 6.1



- 1) Explain how sending and receiving mails via post offices operates
- 2) Contrary to post offices, mails can be sent and received using computers.
  - a) Explain how a person can send and receive an email using a computer
  - b) Give at least 2 examples of emails service providers
- 3) You are a sales manager in one important factory in Rwanda, explain how using emails will make your work easy.

### 6.1.1. Understanding email

E-Mail refers to a system of exchanging messages electronically over a computer network between two or more email service users. These users must have e-mail addresses which are hosted by an email service provider like Gmail, Yahoo Mail, etc. An email service provider has a big server on which users who have emails have dedicated space in which their email will be saved. It is like a Post Office where every customer has a box in which all his/her mails are dropped and withdrawn.

The email client comes in two forms, a web-based version like **Gmail**, where users must log in through their browser to access their emails, or a client-based version such as **Outlook**, where users install software to access emails from their local computer. For emails to arrive at the correct destination there are protocols which handle this task.

#### ▪ Email format

The following is a sample format of an e-mail address :

username@hostcomputer.domainname

## Explanation :

- username: It identifies the owner of the e-mail address.
- @ (“at” sign): Separates the username from the rest of the address parts.
- hostcomputer: The name of the remote server on which the e-mail account is hosted. For example gmail, yahoo, and hotmail among others.
- .(dot): Separates the domain name from the other part of the e-mail address.
- Domain name : It identifies the type of institution offering the services.

For example, nkeza@gmail.com, nkeza is the username, gmail is the host computer and .com is the domain name for a commercial organization.

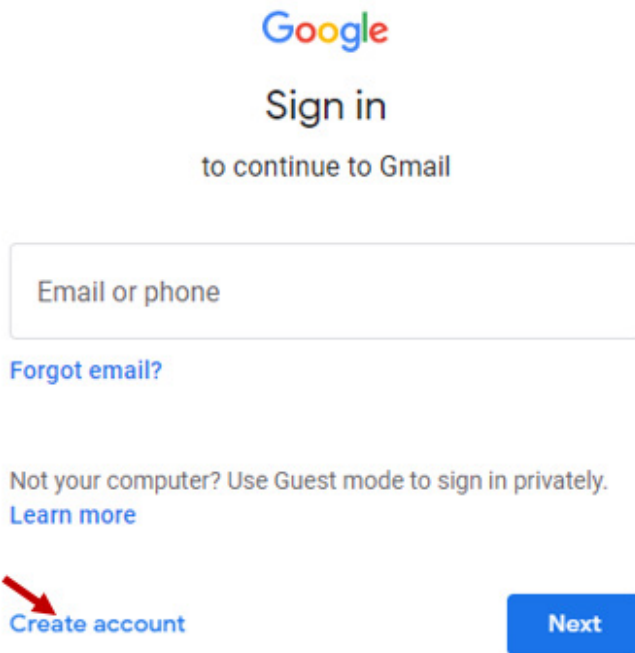
### 6.1.2. Creation of emails

In general to create an email the user will have to first write the email service provider address in the browser’s address bar then fills the provided forms in which personal information are filled. When one form is well filled, the user is allowed to move to the next step until the email is created.

#### a. Creating a Gmail account email

Gmail is an email service provider belonging to google. To create an email account on gmail follow these steps :

- i) Open the gmail application software using a web browser by writing gmail.com in the browser’s address bar
- ii) In the windows that appears click on **Create account**



*Figure 6. 1. Create New Account window for Gmail*

- i) In the next window that appears, fill details including your names, the email account to create and the password to be used for the new email account. Once done with all those details click on **Next**
- ii) Continue to the next windows in which details namely your phone number, recovery email address, date of birth and gender will be filled. After filling those details click on **Next**.

As the creation of an email is near completion, you may be required to confirm your email by entering a google code sent to the provided phone number.



The image shows two side-by-side screenshots of the Google account creation interface. The left screenshot is titled 'Create your Google Account to continue to Gmail'. It contains input fields for 'First name', 'Last name', 'Username' (with a placeholder '@gmail.com'), 'Password', and 'Confirm'. Below the password fields is a checkbox for 'Show password' and a note: 'Use 8 or more characters with a mix of letters, numbers & symbols'. At the bottom left is a 'Sign in instead' link, and at the bottom center is a blue 'Next' button with a red arrow pointing to it. The right screenshot is titled 'UWIMANA, welcome to Google' and shows the user's email 'thclarisse2023@gmail.com'. It has a 'Phone number (optional)' field with a dropdown for country code (showing the Ghana flag), a 'Recovery email address (optional)' field, and a 'Your birthday' section with 'Month', 'Day', and 'Year' dropdowns. A 'Gender' dropdown is at the bottom. A link 'Why we ask for this information' is present. At the bottom right is a blue 'Next' button with a red arrow pointing to it.

Figure 6. 2. Left: Window for filling Names, username and password. Right: window for filling phone number, date of birth and gender

### a) Rules to follow while choosing a password

- Passwords are case sensitive.
- Always use a combination of characters that are easily to remember.
- Avoid using characters that can be guessed.
- Passwords are always encrypted for security purposes.
- Use a combination of capital and small letters, numbers and special characters to create a strong password
- Advantages of emails
  - i) It allows sending of one mail to many recipients at the same time.
  - ii) It is cheaper compared to traditional mails which are handled by post offices
  - iii) It is fast and efficient as it allows instant sending and receiving of mails from
  - iv) Anywhere in the world.
  - v) E-mails can be saved for future retrieval in another computer.
  - vi) It is easier to reply and forward mails.
  - vii) Allows sending and receiving of any form of information.
  - viii) Disadvantages of emails
  - ix) Use of email requires computer literacy.
  - x) E-mails are not accessible to everyone due to internet connectivity problems.
  - xi) (iii) There are security concerns. Hackers are able to gain authorised access to users'
  - xii)

Accounts and, for example, solicit for money.

xiii) Allows spread of viruses such as hoax.



### Application activity 6.1

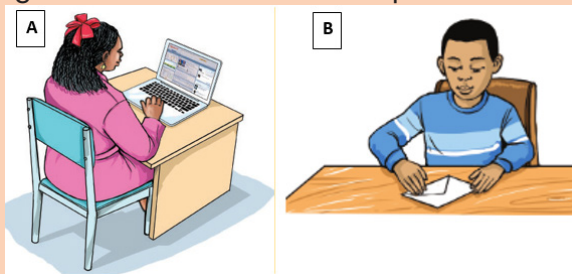
- 1) Create email accounts. The email account you create should contain your name or part of your name
- 2) Search the Internet for information on the effects of the emails on global economy
- 3) Explain the meaning of the parts in this email address:  
[murwanashyaka@gmail.com](mailto:murwanashyaka@gmail.com)

## 1.2.Sending and receiving email



### Activity 6.2

Observe the images below and answer the questions



- 1) What are the methods being used in images A and B to send or receive a mail?
- 2) Among the two methods which one is more efficient? Explain.
- 3) Describe how withdrawing a mail as shown in image B is done?

Email accounts allow the sending and receiving of emails. These emails are sent and received using a computer using a computer. For a user to receive or send an email he/she has first to login in order to have access to the email functionalities.

### 1.1.1.Gmail environment

Once the email account holder logs in, the window below will be displayed :

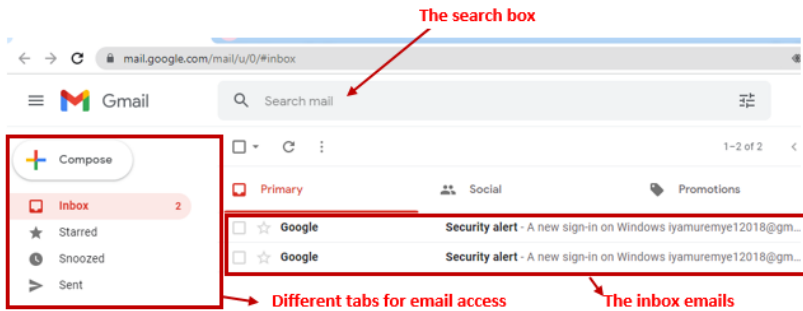


Figure 6. 3.Gmail environment options

The gmail window environment has different tabs including **Compose, Inbox, Sent, Drafts, Spam** and **Trash**. In order to have access to the options provided by those tabs click on them. The use of each tab is summarized below :

No	Tab	What happens when clicked
1	Compose	It displays a window allowing to write and send emails
2	Inbox	It displays all the received emails the email account holder received
3	Sent	It displays are all the emails the account holder sent to other recipients
4	Draft	It displays all the emails that written but were not. The account holder can send them any time he/she wants
5	Spam	It displays all emails that were received from suspicious emails accounts. Gmail does this automatically to prevent emails that may contain malicious content
6	Trash	It displays the emails that were deleted by the account holder

### Sending emails and attaching files

To send an email first click on **Compose** found in the Gmail window then follow the following steps :

1. In the window that appeared, go in the **“To”** text area and write the recipient email,
2. If there are other people who will receive copies, click in **“Cc”** text area and write the email which will receive a copy
3. If there is an email to receive a blind copy Click in **“Bcc”** text area and write that email. When the Blind copy option is used, the list of all the recipients is hidden from the other recipients of the mail.

4. Write the subject of the email to be sent by clicking in the “**Subject**” text area
5. Write the text for the email
6. If there is a file or folder to be attached and sent with the text, click on the **Attachment** icon and browse the file to be attached
7. Click on the **Send** button

The steps above described are shown in the window below :

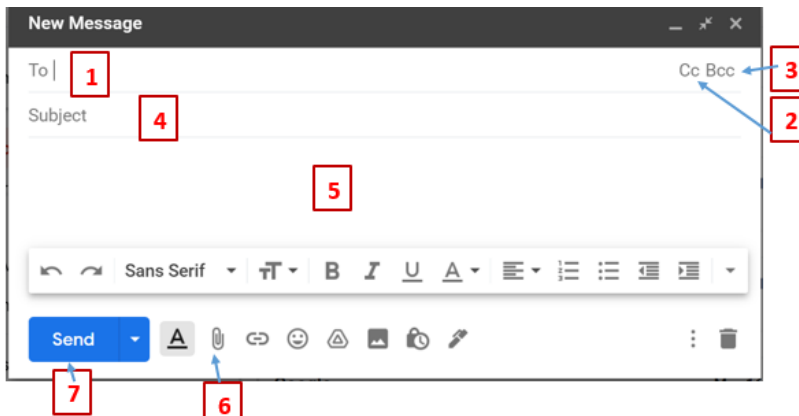


Figure 6. 4.Gmail window for sending an email

### 1.1.1. Receiving emails and downloading attachment

Upon signing in, the user’s inbox is automatically opened. The messages are displayed in three columns showing the name of the sender, the subject and the Date/Time when the email was sent.

To read a message, click on the Subject. Once the message is read the user can decide download the available attachment by just double clicking on it. In the email received, the user can also select one of the following options available on the message window : Reply, Reply to All, Forward and Delete among others.

- **Reply** : This option is selected if the user desires to respond to the read mail.
- **Reply to All** : This option is selected if the user desires to respond to all the addresses listed in the Cc, Bcc and To box. Both Cc and Bcc forward a copy of the message to everyone listed as a recipient. The difference between Cc or Carbon Copy and Bcc (Blind Carbon Copy) is that, with the latter, the recipients do not get to know each other. Note that the **Reply to All** option is not available when an email is received by just one person (email)
- **Forward** : This option is selected if the user desires to send the same

message to other e-mail addresses.

- **Delete** : This option is selected if the user desires to erase the mail. Note that deleting the message only sends it to the Trash folder. The user can retrieve the message from this folder if so desired. To permanently delete the message, empty the trash folder.

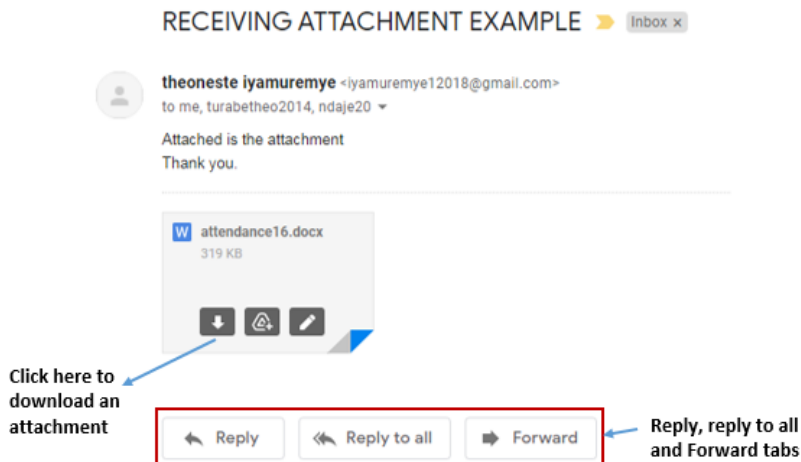


Figure 6. 5.A Window for a received email with an attachment

### 1.1.2. Advantages of online communication using emails

- From what can be done using emails, it is obvious that online communication using emails has many advantages. Those advantages are outlined below :

- **Flexible access to participate whenever and wherever convenient**

Communication using emails can allow participants to communicate wherever and whenever they are and the price of this communication is not dependent on the distance and time. A person can send an email during the night, can send an email when he/she is in a foreign country while this may not be possible for some old communication means.

- **Real time and quick response**

If two parties are using the required devices, communication can be done in the real time and the response can be immediate. This is not possible for example in the Post Office system where a mail envelope has to pass through many carriers until it is dropped in the recipient box.

- **Cost Effective**

When communication is done through emails, no cost is required for travelling from one city to another or one country to another. All to be done is just sign up and create your account. It saves both money and time.



## Application activity 6.2

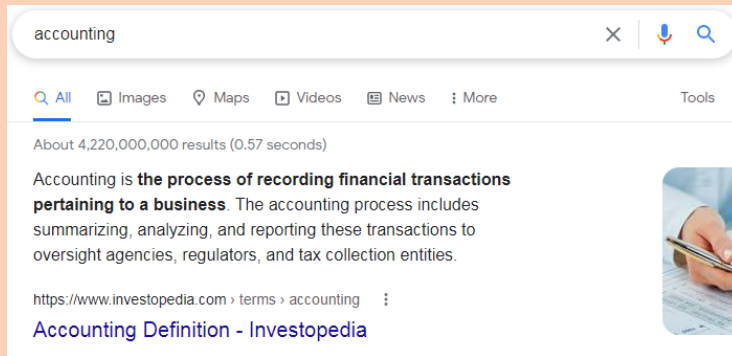
- 1) Exchange emails with your colleagues asking them about your lessons
- 2) While writing an email what is the use of the tools Cc and Bcc
- 3) State at least 2 disadvantages that come with the use of emails.
- 4) What are 3 advantages of email over traditional mail?

### 1.1.Search engines

### Activity 6.3



Observe the screenshot below got as a result for the search conducted by a Senior 4 student in Accounting who searched from the internet for information about **Balance Sheet**.



Answer the questions below:

- 1) What is the topic entered by the student in the search box?
- 2) Did the student find the information about Balance Sheet that he/she wanted? If No explain why it was not found.
- 3) Write in the google search box the keywords Balance Sheet.in finance. Describe the accuracy of the information you get.
- 4) Now write the keywords Balance Sheet in finance inside quotation marks.
- 5) Compare the results found in question 3 and 4 by filling the table below:

Keyword entered	Number of search results	Which results are more accurate ?

Search Engines are programs that help the user look for and identify items that corresponds to keywords or phrases specified from the World Wide Web. Examples include Yahoo, Google, Bing and Ask among others which are accessed respectively using the URLs yahoo.com, google.com, bing.com and ask.com. As an accountant search engine are important when searching from the internet information related to goods and services to buy, new clients, etc.



Figure 6. 6. Google search engine search box

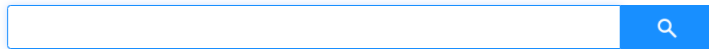


Figure 6. 7. Yahoo search engine search box



Figure 6. 8. Search box for Ask search engine

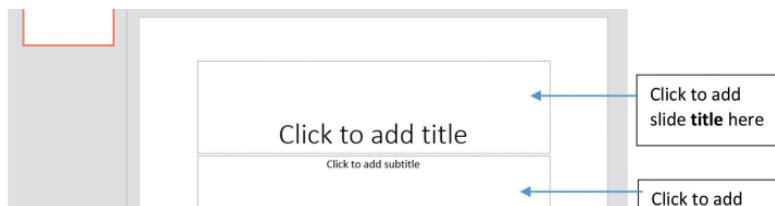


Figure 6. 9. Search box for Bing search engine

### 1.1.1. Strategies to find specific information using search engine

When conducting a search using a search engine one can get millions of search results and find that none of those results is related to what should be expected. What is need is therefore the ability to refine the search to get exactly what is needed. Some search engines also help find less results compared to others so change a search engine in order to get more accurate results. Below the strategies for better search results are developed.

#### a) Simplify the Search Terms

Some engines include Stop words in their searches. These are frequently used words such as prepositions (in, of, on), conjunctions (and, but) and articles (a, the), which means that the search results have more pages of search results than



needed. It is always good to eliminate stop words from the internet searches. However, if the search is aimed at searching for a specific title or name that includes them, they should then be included in the search term.

### a) Use Quotation Marks

Enclosing a search term within quotation marks prompts the search engine to search for that specific word or phrase. If the term is a single word, using quotation marks will unnecessary variations which increase the number of search results. For example, if searching for the word **director**, the researcher likely receives a lot of results for direct, direction, directions, and so on. Typing **“director”** with quotation marks, ensure that only results for that word are displayed.

If the search term is a phrase, the search will be for that specific phrase, rather than for all the component words as individual items. For example, if searching for the phrase **director of**

**human resources**, without quotation marks, the search returns results based on all of the words in the phrase. Thus, surrounding the term with quotation marks, will generate results that feature this specific phrase.

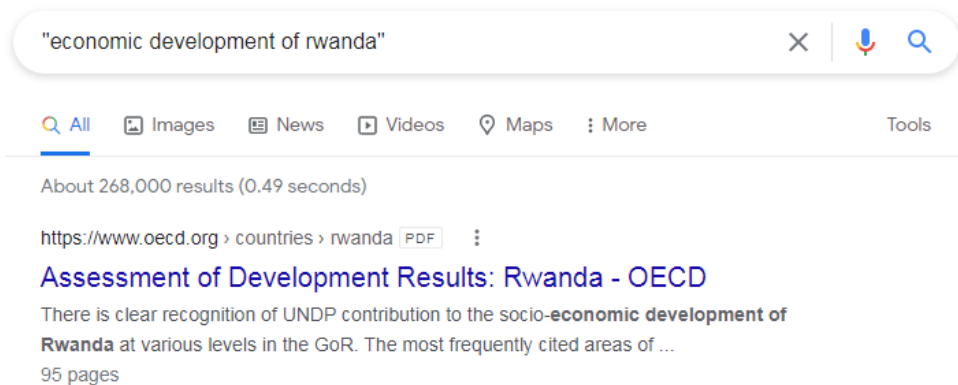


Figure 6. 11. Example of google search using quotations

### a) Remove unhelpful words

The use of a hyphen, small dash or minus sign immediately before a word excludes it from a search. For example, typing in marketing -digital will exclude digital from the search engine, making it easier to find the information searched for. Typing marketing -digital -social would allow researcher to get rid of both marketing and social terms.

## b) Refine the search using operators

Other characters, known as operators allow to narrow down the internet search in more precise ways. A few of those are explored here below:

- **Wildcard searches:** Use wild card character to represent any other word to search for. In this case use the \* symbol to represent any other word. For example, searching for **\*man in the world** returns results for the richest man in the world, the tallest man in the world, the oldest man in the world, and so on. Wildcard searches are also useful for example when researcher do not know the full text to search for.
- **Combination searches:** This is a technic by which the searcher combines search terms using boolean operators **AND, OR, NOT, NEAR**. These operators enable user to search for two or more terms simultaneously and is most useful when those terms are very similar. For example, typing selling OR retailing, will return pages where either of the terms is used, without both needing

to be present. The AND operator ensures that the searcher receives only search results that include two or more terms. Apart from these operators one can also use NEAR

- **Search in a specific Site:** Typing the URL of the website that the searcher wishes to search and a search term limit the search to a single website. For example, typing in the search box: reb.rw” Director General” will return all the pages from reb.rw that contain the term “Director General”
- Advanced search techniques using tilde sign (~)

When the tilde operator is placed in front of a keyword, it also searches for words that are synonyms of that keyword. The searcher can use the tilde operator (~) to get Google or other search engines to expand the search with related keywords. This is helpful when one does not know the entire search query to use.



### Application activity 6.3

Using the different search technics you have learned, search for the following by making sure that you get more accurate results:

- 1) How taxes are collected in East Africa
- 2) Causes of economic crises

## 6.4. Online sales and purchase process

### Activity 6.4



Mushoramari wants to start a new business in which he will be selling car spare parts to clients around the country. He wants to use emails in most communications to replace physically meeting his clients so as to reduce some costs to clients.

Explain how the sale and purchase process will be conducted in regard to these concepts: inquiry, quotation.

Online sale is the use of internet and other electronic means to sell goods and services to clients who are not physically present at the selling agent. For these sales to be possible sellers use web sites, search engines, social media, e-mail and other electronic means to request or provide information from sellers. Online sale goes together with online purchase. Online purchase allows consumers to directly buy goods or services from a seller using the same channel as in online sale.

Online sales and purchase goes in a certain process in order to ensure that when the seller and buyer conclude their deal both are satisfied. An online sale and purchase using email can be conducted by following the process outlines below:

#### **A) Inquiry**

Inquiry is a process by which a person asks and gets information from someone having more knowledge therefore resolving doubt. While doing an online purchase inquiry can be conducted from the seller in order to know the kind of products sold. In this phase, the buyer who may have a big idea of the product to buy will ask for additional information like the product specification, price, possibilities of a discount, packaging options, delivery methods and duration, etc. After the buyer and the seller have agreed on the product, the seller sends quotation to the buyer.

Exercise 1: Role play

You are an investor specialized in hospitality specifically hotels and you want to buy plates for one of your hotels in Rwanda. Write to an industrialist involved in manufacturing asking him/her about plates you want to buy. Use your Gmail account to do this.

## A) Quotation

A quotation is a document that a seller provides to a buyer to offer goods or services at a stated price, under specified conditions. Quotations are used to let a potential buyer know how much goods or services will cost before they decide to buy. A quotation should include among other **the price, an expiration date, your company details** and **your customer's details**.

A quotation also represents the brand identity and professionalism. If it looks not attractive and not well-structured, the potential buyers will assume that the business is not well run while if this quotation is well presented this can be a sign of attention to details and the value of service provided.

Qualities of a good quotation

For a quotation to be an incentive for buying, it should meet the following :

- **Visual content** : Images convey easily a message than words. It is therefore good to make the service more visual by including reference images, videos and graphs that best reflect the process and the results. Visuals will help to paint a clearer picture of what will be working on and enable to demonstrate all unique features of product/service in a clear fashion.
- **Design and format** : It is good to have quotations which are in an attractive design. To be attractive, these quotations should also have appropriate and attractive colors.

### Exercise 2: Role play

1. You are the hotelier in Exercise 1 and you have got satisfying information from the industrialist manufacturer. Now write to him/her requesting for a quotation for the plates you want to buy.
2. You are the industrialist manufacturer. Send to the hotelier the requested quotation using your Gmail account.
3. You are an investor specialized in hospitality specifically hotels and you want to buy plates for one of your hotels in Rwanda. Write to an industrialist involved in manufacturing asking him/her about plates you want to buy. Use your Gmail account to do this.

## A) Order

Writing an order for goods and service is done when the customer has been satisfied with the information provided in the quotation. An order should among others include a list of items required with the quantities.

### Exercise 3: Role play

- a) You are the hotelier (in Exercise 1 and 2). Write an order of the plates you want to buy.
- b) You are the Industrialist, respond to the customer from which you have received the order.

#### a) Invoice

An invoice is a commercial document issued by the seller to the client about a sell transaction. This document shows the products, quantities and the price that were agreed on between the seller and the buyer.

### Exercise 4: Role play

- 1) You are the industrialist manufacturer who received an order (in Exercise 3). Write an invoice to your customer.

#### A) Goods delivery note

A goods delivery note accompanies the goods sent to the buyer. It shows a list of the products and the quantity of the goods included in the delivery.

### Exercise 5: Role play

You are the industrialist who sent the goods that were ordered by the hotelier. Now send the goods delivery note to the customer.



### Application activity 6.4

Divide in two groups and play the role of buyer and seller then:

- 1) Imagine you are an owner of a company that sell planes
- 2) As customer and buyer interact so as to show all the process involving inquiry, quotation, order, invoice, Goods delivery note

You may use internet to get information to help you do this role play.

## 6.5. E-commerce

### Activity 1.1



Kamikazi wants to buy a Management Accounting book. She visited many libraries in the country but she could not find the title she wanted. She decided to search for the book using google.com but she could not also find it. Finally, she realized that the book is available online on amazon.com and the price is at 15\$. She therefore decided to buy it from amazon.com which is located in US.

- 1) What is the common name for that selling and buying business done online?
- 2) Discuss the process Kamikazi will go through in order to buy that book and have it delivered to her
- 3) Brainstorm the other local and global e-commerce platforms that can be used to buy goods and services online

### 6.5.1. Introduction to E-commerce

E-Commerce or Electronic Commerce also known as e-Business, is the buying and selling of goods, products, or services over the internet using electronic means of payment like credit cards.

The history of e-commerce dates back to the invention of the very old notion of “sell and buy”, electricity, cables, computers, modems, and the Internet. E-commerce became possible in 1991 when the Internet was opened for commercial use.

At first, the term e-commerce meant the process of execution of commercial transactions electronically which gives an opportunity for users to exchange business information and do electronic transactions. The ability to use these technologies appeared in the late 1970s and allowed business companies and organizations to send commercial documentation electronically.

### 6.5.2. E-commerce models

Electronic commerce can be classified into four main categories. The basis for this simple classification is the parties that are involved in the transactions. The four basic electronic commerce models are:

### **a) Business to Business**

In a business to business model companies are doing business with each other. The final consumer is not involved. So, the Online transactions only involve the manufacturers, wholesalers and retailers, etc.

### **b) Business to Consumer**

Here the company will sell their goods and/or services directly to the consumer. The consumer can browse their websites and look at products, pictures, read reviews. Then, they place their order and the company ships the goods directly to them.

### **c) Consumer to Consumer**

Consumers are in direct contact with each other. No company is involved. It helps people sell their personal goods and assets directly to an interested person.

### **d) Consumer to Business**

The consumer provides goods or services to the company.

## **6.5.3. Online shopping malls**

Around the world and in Rwanda there are different companies which sell goods online. Some of them are Alibaba, Amazon, Kikuuu, Vuba Vuba. For every online shopping mall buying goods is done in this way:

- The client creates an account on the online shopping mall. This account will allow the client to be uniquely identified in the mall's online system. In order to create an account, open a web browser and enter the address of the mall in the address bar of that browser and follow the directives found on that platform,
- The client with an account uses his/her account credentials to login in the system. The credentials most of the time consist of user name and password,
- Now that the client has logged in the system, she/he chooses the goods to buy. In the mall's system, goods are shown with their names, images and prices. The price to pay add up as the client selects more goods to buy.
- The client chooses the payment methods like MTN Mobile Money, Tigo Cash. There are also other payment methods which can be used like credit/debit cards, bank transfers, etc

## a) Local online shopping malls

Kikuu is one of the e-commerce platforms available in Rwanda with which one can buy available goods and have them delivered to his/her preferred location in Kigali. When a client wants to buy from Kikuu he/she visit the platform kikuu.com or rw.kikuu.com whose screen is displayed below:

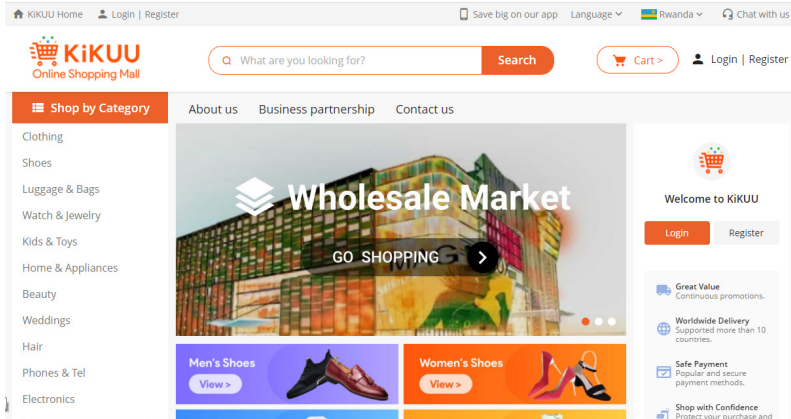


Figure 6. 12. Home page of the Kikuu online shopping mall

Vuba vuba is an online shopping mall which is specialized in the selling of food, supermarket goods and party groceries delivery service with Vuba vuba. This platform is accessed through the link vubavuba.rw. However this platform is used on telephone and their corresponding apps are downloadable through Google Play or App Store.

## a) Other online shopping

### Application activity 6.5

- 1) What is e-commerce
- 2) With an example explain business to consumer e-commerce model
- 3) State e-payment methods that are used when buying goods and services online.
- 4) Discuss the major benefits of E-commerce over traditional commerce?



## 6.6. E-procurement, E-tax and E-payment

### Activity 6.6



Do a research and explain how procurement, tax collection and fee payment were done in Rwanda in the years 1980.

- 1) What were the disadvantages of that system?
- 2) Briefly explain how procurement, collection of taxes and fee payment is done nowadays

### 6.6.1. E-procurement

#### ▪ Definition

E-procurement is the buying and selling of goods and services using internet through dedicated web applications. E procurement is designed to centralize and automate interactions between organizations, customers and other parties in the procurement so as to increase the speed and efficiency of this process (procurement).

- The benefits of e procurement include :
  - Automation of tasks which otherwise would be laborious. Those tasks are like document management for purchase orders, evaluating and selecting suppliers, storing supplier contracts, etc
  - The procuring process becomes less centralized meaning that both the client and the procuring entity can view the status of the procurement anywhere and anytime
  - Reduces the risk of corruption and document loss as every action done in the procurement system is recorded. It is not possible for example to remove a submitted file and pretend that it was not submitted but this can be done in a paperbased procurement.
- Procurement web application in Rwanda

As many sectors are being computerized, procurement was not left behind. That is why there is in place a system [umucyo.gov.rw](http://umucyo.gov.rw) which is used in procurement in order to make it quick and easy. The features of this system can be accessed when the user is not logged but personified features are accessed when the user is logged. When not logged one can have access to the list of procurement plan both in the current financial year and the old financial years.

### 6.6.2. E-tax

In Rwanda, taxes are collected by Rwanda Revenue Authority while there are also taxes collected at the local level. These taxes are collected using the RRA website which is linked to an application to allow tax declaration. There is also a Rwanda Trade Portal ([rwandatrade.rw/](http://rwandatrade.rw/)) which is used to calculate import duties and taxes. This application is connected to the Rwanda custom database which makes it calculate accurately the taxes to be paid.

### 6.6.3. E- payment

- E-payment is a way of carrying out transactions or paying for goods and services using an electronic medium without using the traditional way of payment involving cash or check. This payment can be between people, between people and institutions, between institutions.
- Inside the country the e-payment between people can be done using MTN Mobile Money, Airtel Money or Tigo Cash. The e-payment from institutions to people can be done using different application which allows a depositing of money from the institution account to the people's accounts. For example the payment of salaries to public servants is done using MINECOFIN system.

#### ▪ Exercise:

Do a research on how public institutions pay their staff using e-payment means. Your findings should include: the name of the system, the process of payment and how to prevent fraud in the payments.

#### ▪ Characteristics of an e-payment system

As E-payments systems are used for managing the payment of money, no error is allowed. The main characteristics of an epayment system in order to prevent errors to the maximum are the following :

- **Security:** Because e-payment systems involve actual money, it is more likely that criminals will attack these systems. Therefore these system must be protected against any cyber attack.
- **Reliability:** As more services adopt e-payment, all the life in a country will depend on the epayment systems. Therefore any problem encountered by that system will greatly impact the whole country. This explains why e-payment systems should be always available and should not fail.
- **Scalability:** The internet is growing rapidly and people migrating from the old way of payment to e-payment increase rapidly. An e-payment system must be able to accomodate an increase in number of people

using it and must not crash, be unavailable or lose its performance because the number of transactions has increased. Therefore an epayment system must support the addition of infrastructure without stopping the service.

- **Anonymity** : There are transactions for which the identity of the parties to the transaction should be protected. An epayment system should therefore allow this anonymity when it is needed.



### Application activity 6.6

Visit the web applications that are used for procurement, tax calculation, e-payment.

- 3) What is the feature found in the e-procurement application?
- 4) Describe what you can do when using the e-tax application. What are its advantages compared to when there was not a web application to do it?
- 5) Do a research and enumerate services in Rwanda which are paid using epayment systems. For each service show the system used.



### End of unit assessment 6

1. Give examples of services that can be paid electronically in Rwanda
2. Differentiate credit card and debit card?
3. Discuss techniques you would use to get accurate search results when searching using a search engine
4. Discuss the advantages of using emails in carrying out communication
5. Differentiate Cc and Bcc as two options which are provided while writing emails.
6. Explain the different e-commerce models

# UNIT 7

## INTRODUCTION TO WEB DESIGNING



### Introductory activity

1. Analyses the following statement and decide which is true by “**T**” and not true by “**F**”
  - a) Today’s world, it is the rare person who has not had some exposure to the **Internet** and the World-Wide Web.
  - b) If you are buying a computer, make sure that it can be connected to a wireless network.
  - c) you will need to pay to get a connection in your house which will allow you to access the internet.
  - d) once you have an internet connection then you’ll need to have an internet browser on your computer. This browser allows you to browse websites.
1. Do you know a web site? the answer is yes, continue on next questions if is no skip the next questions about website
2. State three names of websites you know
3. Can you change or delete an information from a website? Explain your answer.
4. Discuss on advantages and disadvantages of a website
5. What is a home page on web site?

## Activity 7.1



What do you understand by the terms below?

- i) Internet
- ii) Network
- iii) WWW
- iv) Web application
- v) Browser
- vi) Web server
- vii) Static web page and Dynamic web page

### **1.1.1. Understanding web design**

Today's world, it is the rare person who has not had some exposure to the Internet and the World-Wide Web. Many people have not only used the Internet but have also created web content in some form or other. Individual is using websites to communicate company information and manage their projects.

People are now reconnecting with their friends and family members on social media such as Facebook, Twitter, Instagram, YouTube etc.

The purpose of this Unit, is to provide you with a brief introduction to web and how to access and use it via a web browser and other basic concepts relating to web designing such as website, web page, web application, static web page and dynamic web page.

### **7.1.2. Key terms**

Web design is a process of designing and developing websites. Unlike web development, which is mainly about functionality, web design includes aesthetics and is concerned about the look-and-feel of the site as much as the functionality.

The creative aspect of web design covers areas like web graphic design, user experience design, interface design. Web designers work with tools like Sketch, Figma, and Photoshop. The technical aspect covers front-end and back-end development with tools and languages like HTML, CSS, etc.

- ❑ The **Internet** is a collection of computers around the world connected to each other via a high-speed series of networks. The computers that store the files are called **servers** because they can serve requests from many users at the same time. Users access these HTML files and documents via applications called **browsers**
- ❑ **A Web browser** is a program that displays Web pages and other documents on the Web. Unfortunately, different browsers may interpret the HTML of Web. There are a variety of browsers available but the most popular are:
  - Internet Explorer (from Microsoft)
  - Firefox (from Mozilla)
  - Safari (from Apple)
  - Chrome (from Google)
  - Microsoft Edge (From Microsoft)
- ❑ **Web page:** Each single resource on the web is called a web page. A web page is a document commonly written in HTML (Hypertext Markup Language), is also called hypertext document containing more specific information such as text, images, sound, video and so on; that is accessible through the internet or other networks using an internet browser.
- ❑ **A website** is a collection of several web pages with information on a subject that are connected together. Websites can be easily searched using **search engines like Google**. The World Wide Web is made of many websites and each is made of many webpages.
- ❑ **A web application** is a computer program that utilizes web browsers and web technology to perform tasks over the Internet is stored on a remote **server/web server**.

The main difference between a web application and a website is given below:

Parameter	Web Application	Website
Created for	A web application is designed for interaction with the end user.	A website mostly consists of static content. It is publicly accessible to all the visitors.
User interaction	In a web application, the user not only reads the page content but also manipulates data.	A website provides visual & text content which user can view and read, but not affect its functioning.

Authenticati- on	Web applications need authentication, as they offer a much broader scope of options than websites.	Authentication is not obligatory for informational websites. The user may ask to register to get a regular update or to access additional options. This features not available for the unregistered website visitors.
Task and complexity	Web application functions are quite higher and complex compared to a website.	The website displays the collected data and information on specific page.
Type of software	The web application development is part of the website. It is itself not complete website.	The website is a complete product, which you access with the help of your browser.
Deployment	All changes require the entire project to be re-compiled and deployed	Small changes never require a full re-compilation and deployment, you just need to update the HTML code.

- ❑ **Web server:** Is a computer that hosts a website on the Internet.
- ❑ **Search engine:** Is A web service that helps you find other web pages, such as Google, Bing, Yahoo, or DuckDuckGo.
- ❑ **World Wide Web:** The term World Wide Web (WWW), usually shortened to the “web” is a system of interlinked hypertext documents accessed through the Internet.

Really the Internet is the system that facilitates the transfer of data and the web is the data itself. The web is just one of the ways that data can be circulated over the Internet.

- ❑ **A dynamic web page website** is one whose displays different types of content every time a user views it. This display changes depending on a number of factors like viewer demographics, time of day, location, language settings, and so on.

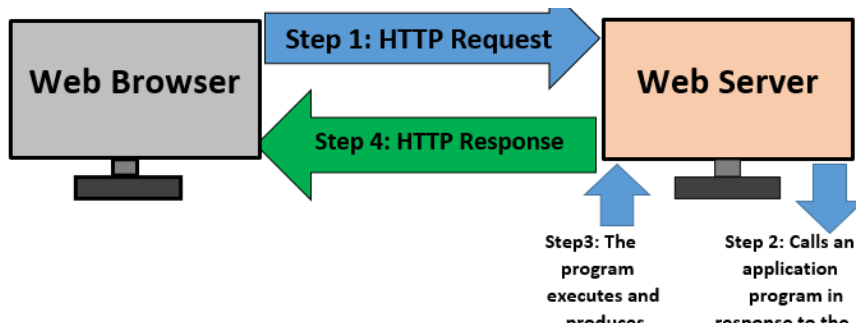


Figure 7. 1. Web Server interaction for Dynamic Web Page

- A static webpage** is one whose contents do not change, or at least do not change quickly. A static page is one that is usually written in plain HTML and what is in the code of the page is what is displayed to the user. These are webpages that contain information that does not need to be updated. They are always the same unless the content is changed physically on the server's hard disk. That is the reason these web pages are known as static web pages.

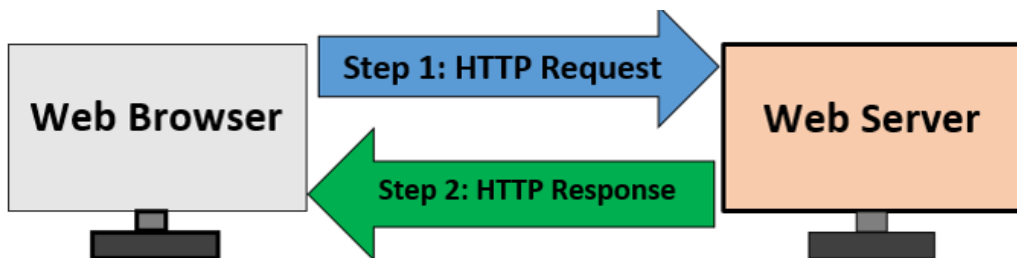


Figure 7. 2. Web Server interaction for Static Web Page





## Application activity 7.1

1. Discuss different characteristics of a website and a web application?
2. Define a web application and give two examples of web applications?
3. Among web application and web site, what is the advantageous? Explain your answer.
4. With a comparison table, differentiate static web page to dynamic web page
5. Discuss reason why it is easier to update a dynamic web site compared to a static website.
6. Is it very cheap to host static website in comparison with dynamic website? Explain.

### 1.1. Introduction to HTML

#### Activity 7.2



Using internet or other available resources, find the answers to the following questions:

1. Write in full the abbreviated terms bellows:
2. WWW, HTML
3. Explain what is www
4. Discuss the importance of HTML
5. Discuss and write an essay on how Hypertext Markup Language (HTML) had evolved from 1991 to the current trends seen today.

#### 1.1.1. Definition of HTML

HTML is the Standard Markup Language. It is the authoring language that describes how a Web page should be displayed by a Web browser. It is used for developing Web Pages. **Hypertext** means when a visitor clicks a link on a Web page, the visitor is led to another Web page or document.

«**Hypertext**» refers to links that connect web pages to one another, either within a single website or between websites. Links are a fundamental aspect of the Web.

HTML uses «**markup**» to annotate text, images, and other content for display in a Web browser. HTML markup includes special «**elements/tags**» such as «heading», «paragraph», «table», and so on. This unit discusses various HTML tags that are needed for developing web pages.

**Note: HTML is not a programming language, it is used to describe what should appear in a web document/page. HTML is not run/executed, it is parsed and transformed into Document Object Model (DOM) objects by the client web browser, which the browser can then render. Something like C++ is first put through a compiler then executed on the machine.**

### 1.1.1. Evolution of HTML

The HTML was invented by Tim-Berners Lee, the founder of World Wide Web. Lee's original HTML version was based on a more complicated document processing language known as Standard Generalized Markup Language (SGML). Soon, Lee released different versions of HTML causing incompatibilities between different developers using different versions. For this reason, the following was done:

- A consortium known as World Wide Web Consortium (**W3C**) was established to standardize HTML.
- The first standard version of HTML that was developed and maintained by W3C was **HTML 2.0** released in 1995. It specifies a set of tags that must be supported by all browsers.
- In 1996, release of **HTML 3.2** standard then later **HTML 4.0** in 1997.
- Most web browsers today support variation of HTML known as *Extensible Hypertext Markup Language* (**XHTML**) that support mobile web application too. Today, there is **HTML5** which many browsers and developers are using to develop web applications.

### 1.1.2. Some of the key advantages of learning HTML

- ❑ **Create Web site:** Someone can create a website or customize an existing web template if he/she knows HTML well.
- ❑ **Become a web designer:** If someone wants to start a career as a professional web designer, HTML and CSS designing is a must skill.
- ❑ **Understand web:** If someone wants to optimize the website, to boost

its speed and performance, it is good to know HTML to yield best results.

- ☐ **Learn other languages:** Once the basic of HTML is understood then other related technologies like JavaScript, php, or angular become easier to understand.



### Application activity 7.2

- 1) HTML is not a programming language but can be thought of as a presentation language. Explain.
- 2) What is the difference between Hypertext and Hyperlink?
- 3) What are the particularities of XHTML over HTML 4.01?
- 4) Discuss the advantages of HTML 5 comparing to the previous versions.

## 1.2.HTML Syntax and HTML Page Structure

### Activity 7.3



1. What is a HTML tag?
2. Give the syntax of HTML tag
3. What is the role of an attribute of a HTML tag?

Before adding content to the document, there's a need of basic structure to set up in a file. This structure isn't only required for document to be compliant but will also allow to provide useful information about the document.

*HTML Syntax*

Hypertext Markup Language (HTML) documents use the **.html or .htm extensions**. This extension allows a web browser or device such as a computer or a smartphone to understand that HTML content is on the page, and the content of the page is then rendered by the browser or device according to the rules of HTML.

**HTML tags** are element names surrounded by **angle brackets** or **Less Than and Greater Than** symbols (< >).

**Syntax:** <tag\_name>content goes here...</tag\_name>

**Example:** <title> *My First page*</title>

HTML tags normally come in pairs like <p> and </p>. The first tag in a pair is the start tag, the second tag is the end tag. The end tag is written like the start tag, but with a forward slash inserted before the tag name.

**Note:** The start tag is also called an opening tag and the end tag a closing tag. For example, to instruct a browser to present text as a paragraph, use the <p> opening and </p> closing tags as follows: <p> This is a new paragraph separated from others by a blank line</p>

### 1.1.1.HTML Page Structure

An element called HTML surrounds the whole document. This element contains two sub-elements which are Head and Body. These elements are required to form any HTML document

The Head contains the information about the HTML document like Title of the page, version of HTML, Meta Data, etc while the Body contains everything to be displayed on the Web Page.

The basic structure of a HTML for every web page is shown below:

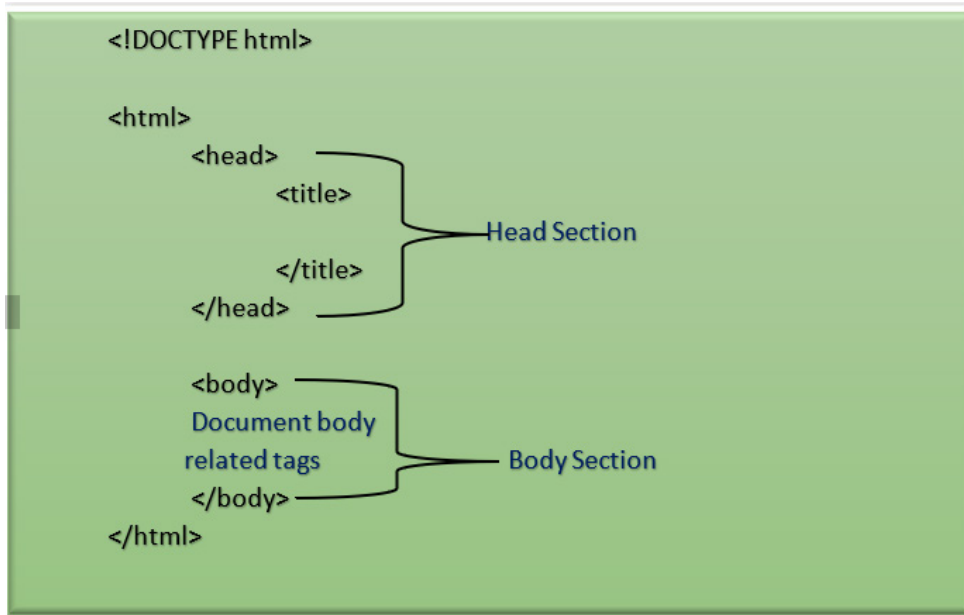


Figure 7. 3.Basic structure of HTML

## Explanation of each of the tag used in the above piece of HTML code:

**<!DOCTYPE html>:** This tag is used to tell the HTML version. This currently tells that the version is HTML 5.

**<html>:** This is called HTML root element and used to wrap all the code.

**<head>:** Head tag contains metadata, title, page CSS etc. All the HTML elements that can be used inside the <head> elements are: <style>, <title>, <base>, <no script>, <script>, <meta> that contain meta information about the document.

### 1.1.1.Elements and Attributes Tags

Tags are comprised of elements and attributes. An element is an object on a page such as a heading, paragraph, or image while attributes are qualities that describe that element such as width and height.

#### Example of element tags:

Start Tag	Content	End Tag
<p>	This is paragraph content.	</p>
<h1 >	This is heading content.	</h1 >
 	This inserts a single line break	</br>

An attribute is used to define the characteristics of an HTML element and is placed inside the element's opening tag. All attributes are made up of two parts a name and a value. The name is the property to set while the value is what you want the value of the property to be set and always put within quotations.

The example below shows three possible values of align attribute: left, center and right.

`<p align = «left»>This is left aligned</p>`

`<p align = «center»>This is center aligned</p>`

`<p align = «right»>This is right aligned</p>`

Note: A few tags are called non-container tags, because they don't contain any content – they stand alone. Examples are images and line breaks. XHTML is stricter than HTML, and requires that all open tags must be closed, even if they're not container tags. Therefore, non-container tags end in />. For example, the tag for a line break is <br/>. HTML does not have this same requirement, but it's a good habit to get into in case you ever need to code in XHTML. Tags in HTML are not case sensitive, but in XHTML all tags must be in lower case. Even when coding in HTML, you should get in the habit of writing tags in lower case.



### Application activity 7.3

1. Discuss the syntax of an HTML tag
2. Define an attribute
3. You are given the HTML statement below:

```
<font color=»green»> Hello Rwanda </font>
```

What is the function of:

- a) Color
- b) Green

## 1.1.Tags that identify and name documents

## Activity 7.4



1. Using Notepad text editor, write the following HTML code and save the file as mypage.html then run the file in a browser.

```
<!DOCTYPE html>  
<html>  
<head>  
<title>Identifying elements</title>  
</head>  
<body>  
<strong>Rwanda is known as a country of thousand hills! </strong>  
<br>  
<mark>The development of Rwanda is based on its people</  
mark><br>  
<del>strong and mark are HTML tags that organize web page contents</  
del><br>  
</body>  
</html>
```

Study carefully the output of above HTML code and answer the following questions:

1. What is the function of?  
    <strong> tag?  
    <mark> tag?  
    <del>tag?
2. Give any other 2 HTML tags that identify and name a document.

TML language specification defines the markup that can be used to create a webpage, the **webpage author** decides which elements they will use to markup content.

## Basic HTML Headings

Heading tags are used in the body section to define section headings that stand out from the rest of the text. HTML provided six levels of section headings i.e. (Size of H6<H5<H4<H3<H2<H1)

```
<!DOCTYPE html>
<html>.....
<body> → → →
<h1>Heading-1</h1>
<h2>Heading-2</h2>
<h3>Heading-3</h3>
<h4>Heading-4</h4>
<h5>Heading-5</h5>
<h6>Heading-6</h6>
</body>
</html>
```

☒

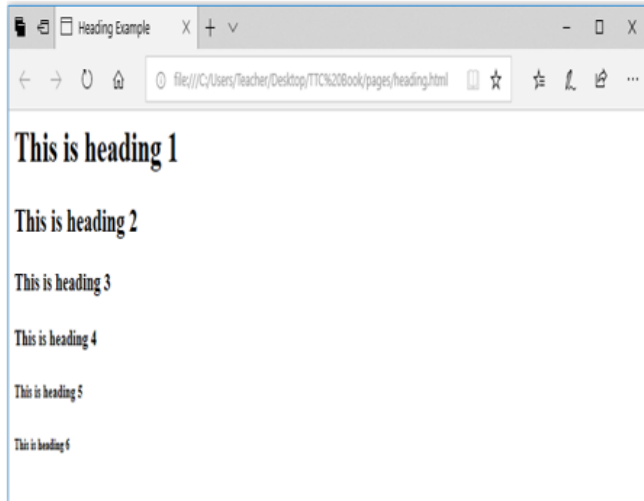


Figure 7. 4.Headings Level

The figure above shows how the headings appear when displayed on a browser such as chrome or Mozilla Firefox.

### 1.1.1.Basic HTML Paragraphs and style

A paragraph always starts on a new line, and browsers automatically add some white space (a margin) before and after a paragraph.

```
<p>This is a paragraph. </p>
```

```
<p>This is another paragraph. </p>
```

The HTML style attribute is used to add styles to an element, such as color, font, size, and more.

```
<!DOCTYPE html>
```

```
<html>
```

```
<body>
```

```
<p>I am normal</p>
```

```
<p style="color:red;">I am red</p>
```



```

<p style="color:blue;">I am blue</p>
<p style="font-size:50px;">I am big</p>
</body>
</html>

```

The figure below shows how the Paragraph and style appear when displayed on a browser such as chrome or Mozilla Firefox

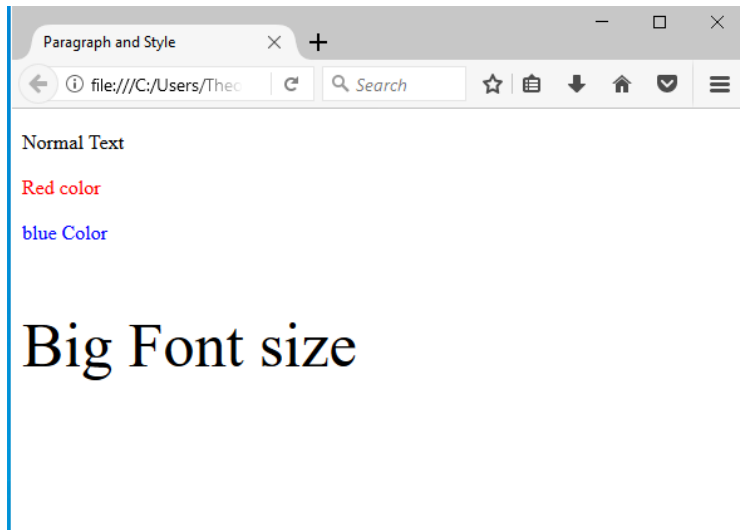


Figure 7. 5.Paragraph and style

### 1.1.1.The appearance: Formatting Elements

A document heading may be created by making text larger, bold and with a different color. Presentational markup for such a heading may look like this:

```

<p>
< font size="36" color=" red" > <b>ICT is a key of development </b>
</font> </p>

```

Formatting elements were designed to display special **types of text**:

The table below shows html text formatting elements:

HTM Tag	Description
<b>	Defines bold text
<em>	Defines emphasized text
<i>	Defines italic text
<small>	Defines smaller text

<strong>	Defines important text
<sub>	Defines subscripted text
<sup>	Defines superscripted text
<mark>	Defines marked/highlighted text
<ins>	Defines inserted text
<del>	Defines deleted text

## UP TO HERE

Example: The HTML document below shows how to use formatting HTML elements

```
<!DOCTYPE html>
```

```
<html>
```

```
<head>
```

```
<title>Formatting elements</title>
```

```
</head>
```

```
<body>
```

```
<mark><b>Rwanda has 4 provinces and Kigali City</b></mark> <br>
```

```
<strong>Kigali City has 3 districts</strong><sup> which ones? </sup><br>
```

```
<del>Kigali Convention Center is in Nyarugenge district</del> <br>
```

```
<ins>Thank you! </ins>
```

```
</body>
```

```
</html>
```

The web page below is displayed by the above HTML document:

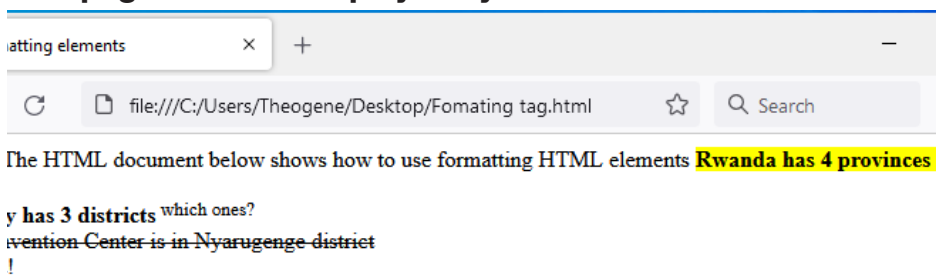


Figure 7. 6.HTML document

### 1.1.1.HTML images

One of the most compelling features of latest HTML standard is the ability to embed images that make a website more attractive. The three types of images supported by HTML4 are **GIF** (Graphics Interchange Format), **JPEG** (Joint Photographic Experts Group) and **PNG** (Portable Network Graphics). To insert an image onto a web page, use the **<img>** tag; **img** is an abbreviation of the word image. The **<img>** is an empty tag does not require a corresponding closing tag. The general syntax for inserting a graphical object or image is:  
****

The **src** in the **img** tag is an important attribute that specifies the location (source) or URL of the image to insert onto the page.

For example, the following HTML code displays an image called Volcano:

```
<!DOCTYPE html>
<html>
<head>
<title> Visit Rwanda </title>
</head>
<body>
<p><Strong><font color=»red» size=48>
Visit Volcanoes National Park</font> </strong> </p>
<center><img src=»volcano.png»alt=»Gorilla in Rwanda» />
</center>
</body>
</html>
```

The HTML document above produces the following output:

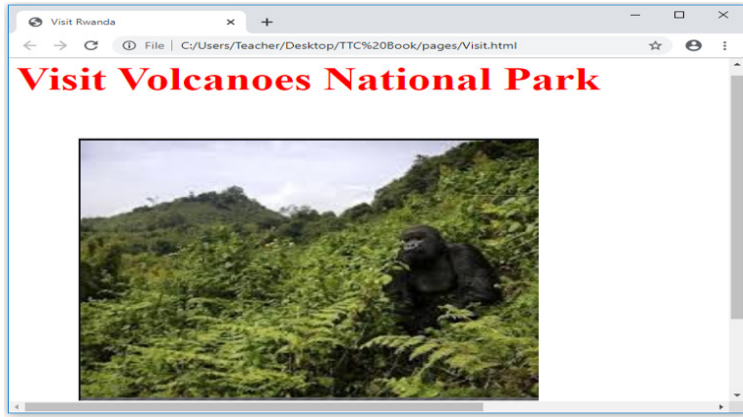


Figure 7. 7.HTML Image

**NB:** use of the **alt** attribute is a good practice to specify alternate text for an image, if the browser cannot display or locate the image.

### 1.1.1.Setting Image size

It is possible to specify the size using width and height attributes. The two attributes set width and height of the image in terms of pixels or percentage of its actual size. For example, to set the size of the volcano.png to occupy quarter of the screen, use:

```

```

### 1.1.1.Image Alignment

The <img> tag uses the align attribute to align an image on top, bottom, left or right of the browser window. For example, to align the volcano.png on top of the page, use align attribute as follows:

```

```

**Notice:** with HTML it is possible to set **page background color**; bgcolor attribute is used within body element.

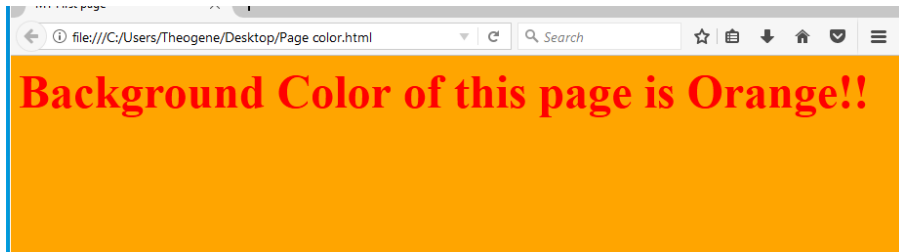
For example, the following html code explains how bgcolor attribute is used while setting yellow color as the page background.

```
<! DOCTYPE html>
```

```
<html>
```

```
<head>
<title>MY First page</title>
</head>
<body bgcolor=»Orange»>
<h1><font color=»red» size=»72»>Background Color of this page is
Orange!!</h1 >
</body>
</html>
```

The above html document displays the following web page in a browser:



#### Application activity 7.4

1. Using heading, paragraph, font and image elements create a page that briefly describes a topic that you would like to cover in your small website. The website should contain information such as:
  - a) Institution Descriptions,
  - b) Mission
  - c) Vision
  - d) Institution Logo.
2. Discuss the function of the following attributes in <font> tag:
  - a) Color attribute
  - b) Size attribute
3. Explain the role of **src**, **alt**, and **align** attributes within <img>tag

## 1.1 Organize web page contents using HTML tag and hyperlinks

### Activity 7.5



1. Type and execute the HTML code below, observe the output and explain the way page content is organized.

```
<!DOCTYPE html>
```

```
<html>
```

```
<head>
```

```
<title>list</title>
```

```
</head>
```

```
<body bgcolor=»yellow»>
```

```
<p><Strong> The most common colour names are </strong></p>
```

```
<ol >
```

```
<li>Red. </li>
```

```
<li>Orange. </li>
```

```
<li>Yellow. </li>
```

```
<li>Green. </li>
```

```
<li>Cyan. </li>
```

```
<li>Blue. </li>
```

```
<li>Magenta. </li>
```

```
<li>Purple. </li>
```

```
</ol>
```

```
</body>
```

```
</html>
```

Observe the following list of items and give its type

## Activity 7.5



<b>RDB</b>	RDB stands for Rwanda Development Board
<b>RURA</b>	RURA stands for Rwanda Utilities Regulatory Authority
<b>RGB</b>	RGB stands for Rwanda Governance Board
<b>RSB</b>	RSB stands for Rwanda Standards Board

1. How do you call a list which is written inside another list?
2. Using HTML code, write the above list

This section discuss, some HTML elements that describe the structure and organize web contents. The information can be displayed in numbered or bulleted list. HTML supports three types of lists namely ordered list, unordered list, and definition list.

- ☐ **Ordered <ol>** list is a container for enumerated items ordered using numbers such as 1, 2, 3.
- ☐ **Unordered list <ul>** is a collection of related items that have no special order or sequence.
- ☐ **Definition list <dl>** is used for definitions such as glossaries that pair each label with some kind of description.

### 1.1.1.Creating ordered list

To create an ordered list, use the <ol>...</ol> tags within which to include one or more <li>...</li> (list item) tags.

Example:

```
<!DOCTYPE html>
<html>
<head>
<title>Numbered List</title>
</head>
<body bgcolor=cyan>
```

```
<p><Strong><font color="blue" size=6 face="Cooper">
```

```
Easter African Community (EAC) has 6 Partner States:</font></strong></p>
```

```
<ol>
```

```
<li>Rwanda</li>
```

```
<li>Uganda</li>
```

```
<li>Burundi </li>
```

```
<li>Kenya</li>
```

```
<li>Tanzania</li>
```

```
<li>South Sudan</li>
```

```
</ol>
```

```
</body>
```

```
</html>
```

The figure below shows the ordered list of 6 <li> Countries after displaying the page on a browser:

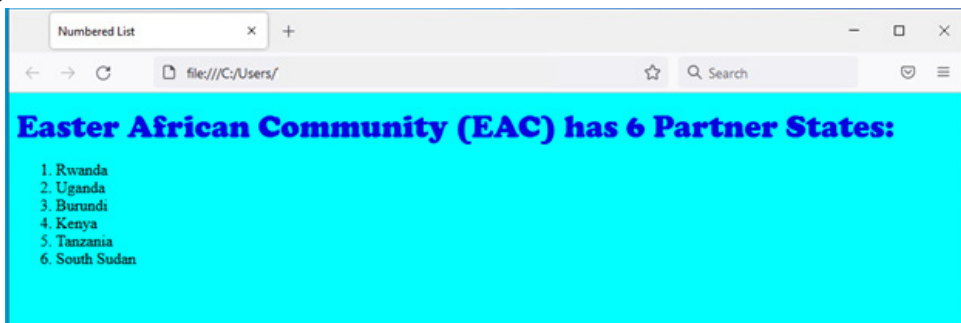


Figure 7. 9.Ordered List

It is possible to customize the numbering style of an ordered list using the type attributes as follows:

```
<ol type = "counter-type">....</ol>
```

```
<ol type = "a"> ...</ol>
```

```
<ol type = "i"> ...</ol>
```

**Examples:** using above html document change only “<ol> “replaced by <ol type =”I”>

The page on a browser automatic changed as below:



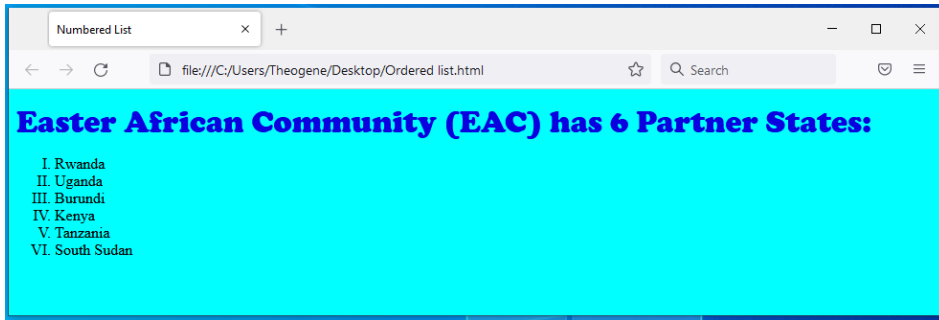


Figure 7. 10. Ordered List with type attribute

### 1.1.2 Creating unordered list

Unordered list is similar to ordered list only that the items are listed using bullets. To create unordered list, use `<ul>...</ul>` instead of `<ol>..</ol>` element

#### Example:

```

<!DOCTYPE html>
<html>
<head>
<title>bulleted List</title>
</head>
<body bgcolor=pink>
<p><Strong><font color=»red» size=6 face=»Cooper»>
Easter African Community (EAC) has 6 Partner States:</font></strong></
p>
<ul>
<li>Rwanda</li>
<li>Uganda</li>
<li>Burundi </li>
<li>Kenya</li>
<li>Tanzania</li>
<li>South Sudan</li>
</ul>
  
```

</body>

</html>

The figure below shows the unordered list of 6 Countries after displaying the page on a browser:

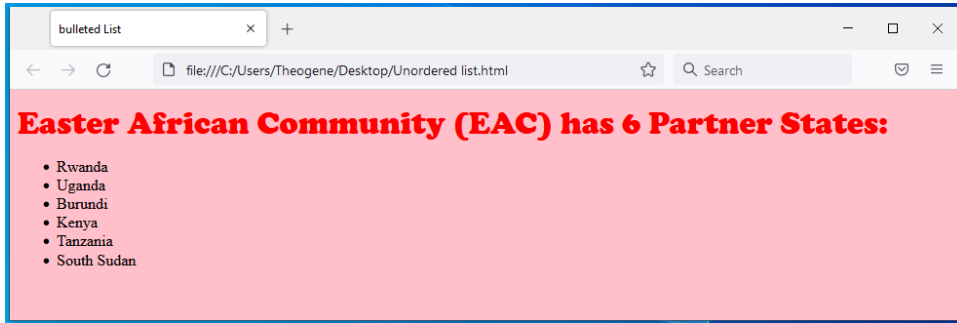


Figure 7. 11.Unordered List

**Unordered list:** It is possible to customize unordered lists using type attribute and values that denote bullet types such as disc, square, or circle. For example, to change the bullets displayed in above figure from round to square, use the following syntax:

**<ul type = "bullet-type">....</ul>**

For example, to display unordered list shown in figure above as a square, bullets, use the style attribute for example like `<ul type = "square"> ..</ul>` in above html document; Then Page on browser will be change as follow:

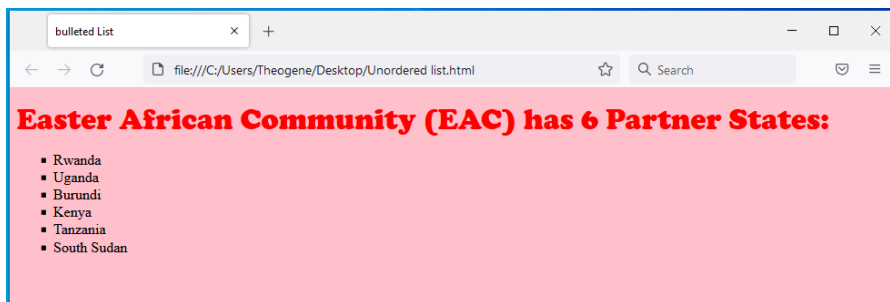


Figure 7. 12.Unordered List with attribute type

### 1.1.1.Creating definition list

A definition list is used to present a glossary of terms, or other definition lists like Dictionary and encyclopedia. To create a definition list, use `<dl> ...</dl>` element in which you place `<dt> ... </dt>` to mark up the term and `<dd> ... </dd>` to mark up the definition part.

Therefore, a definition list consists of the following parts:

- `<dl>` - Defines the start of the list
- `<dt>` - A term
- `<dd>` - Term definition
- `</dl>` - Defines the end of the list

For example, the following HTML document shows a definition list of four terms:

```
<!DOCTYPE
<!DOCTYPE html>
<html>
<head>
<title>Definition list </title>
</head>
<body>
<dl>
<dt><b>ICT </b></dt>
<dd>ICT stands for Information and Communication Technology</dd>
<dt><b>HTML</b></dt>
<dd> HTML stands for Hyper Text Markup Language</dd>
<dt><b>JPEG</b></dt>
<dd>JPEG stands for Joint Photographic Experts Group</dd>
<dt><b>CSS</b></dt>
<dd>CSS stands for Cascading Style Sheet</dd>
</dl>
</body>
</html>
```

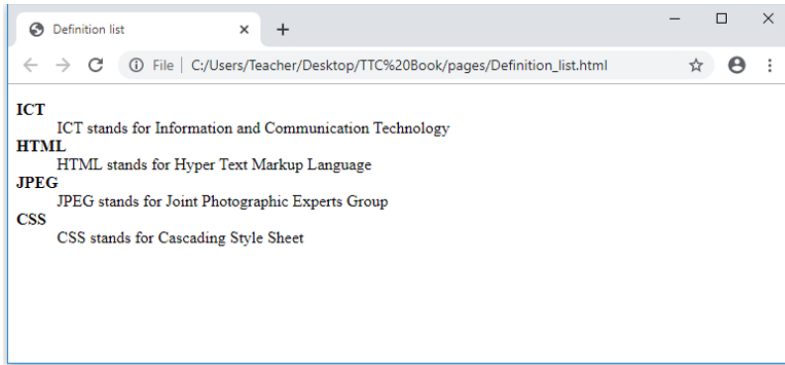


Figure 7. 13. Definition List

### 1.1.1. Creating nested lists

To create a nested list, put the entire list structure inside another list

Example:

```
<!DOCTYPE html>
<html>
<head>
  <title>sample Nested List </title>
</head>
<body>
  <p><Strong><font color=»blue»size=48>
HTML-BASED WEB</font></strong></p>
  <ol>
    <li>World wide web</li>
    <li>Organization</li>
    <li>Introduction to HTML</li>
  </ol>
  <ul>
    <li>Definition of HTML</li>
    <li> HTML Syntax</li>
    <li>Doc structure</li>
  </ul>
</body>
</html>
```

```
</li>Headings</li>
</li>Paragraphs</li>
</li>HTML Comments</li>
</ul>
</li>
</li>Hyperlinks</li>
</li>Advanced HTML</li>
</ol>
</body>
</html>
```

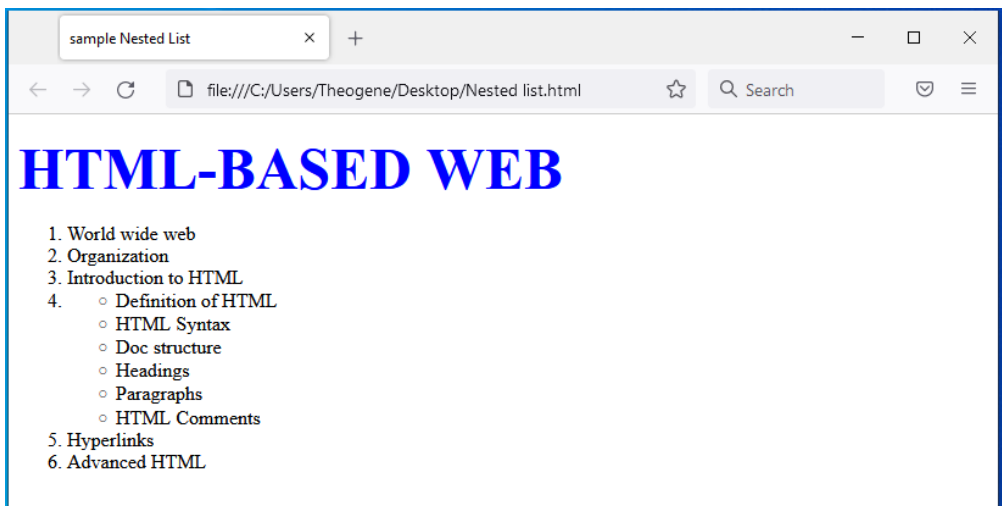


Figure 7. 14.Nested List



## Application activity 7.5

Study the following HTML document and answer related questions:

```
<!DOCTYPE html>
<html>
<head>
<title>list</title>
</head>
<body bgcolor="yellow">
<p><Strong> Fruits Menu:</strong></p>
<ul >
<li>Orange</li>
<li>Banana</li>
<li>Guava</li>
<li>Mango</li>
</ul>
</body>
</html>
```

1. Write and execute the above html code then specify the type of a list
2. Write the same html code and change it into ordered list using capital letter types.
3. Give a clear difference between:
  - i. Definition and Nested list
  - ii. `<dt>...</dt>` and `<dd>...</dd>` tags
4. Study the following web page and write its HTML code which displays it into browser

## 1.1.HTML Frame and table Tags

### Activity 7.6



1. By searching from internet, differentiate Frame and table
2. Write HTML code that display the below table

North Province	East province	West province	South Province
Musanze	Bugesera	Rubavu	Nyarza
Gicumbi	Kirehe	Karongi	Ruhango

3.

HTML frames are used to divide the the browser window into multiple sections where each section can load a separate HTML document. A collection of frames in the browser window is known as a frameset. The window is divided into frames in a similar way the tables are organized: into rows and columns.

### 1.1.2.Creating Frames

To use frames on a page we use tag instead of tag. The tag defines how to divide the window into frames.

- The **rows** attribute of tag defines horizontal frames.
- the **cols** attribute defines vertical frames. Each frame is indicated by tag and it defines which HTML document shall open into the frame.

```
<!DOCTYPE html>
<html>
<head>
<title>HTML Frames</title>
</head>
<frameset rows=»25%,50%,25%»>
<frame name=»top» src=»Nested list.html» />
<frame name=»main» src=»Page color.html» />
<frame name=»bottom» src=»Ordered list.html» />
</frameset>
```

```
<body>
```

Your browser does not support frames.

```
</body>
```

```
</noframes>
```

```
</frameset></html>
```

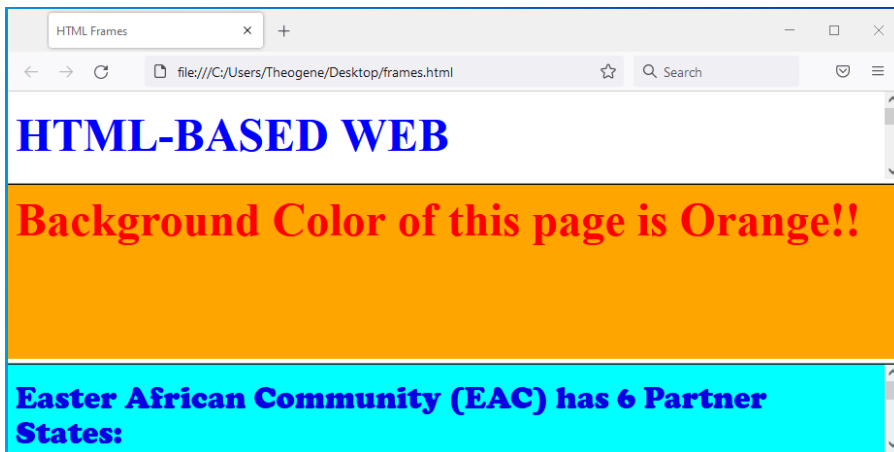


Figure 7. 15.Horizontal frames

### 1.1.1.Creating Frames

Let's put above example as follows, here rows attribute was replaced by columns and changed their width. This will create all the three frames vertically:

```
<!DOCTYPE html>
```

```
<html>
```

```
<head>
```

```
<title>HTML Frames</title>
```

```
</head>
```

```
<frameset cols=»25%,50%,25%»>
```

```
<frame name=»left» src=»Nested list.html» />
```

```
<frame name=»center» src=»Page color.html» />
```

```
<frame name=»right» src=»Ordered list.html» />
```

```
<noframes>
```

```
<body>
```



Your browser does not support frames.

```
</body>  
</noframes>  
</frameset> </html>
```

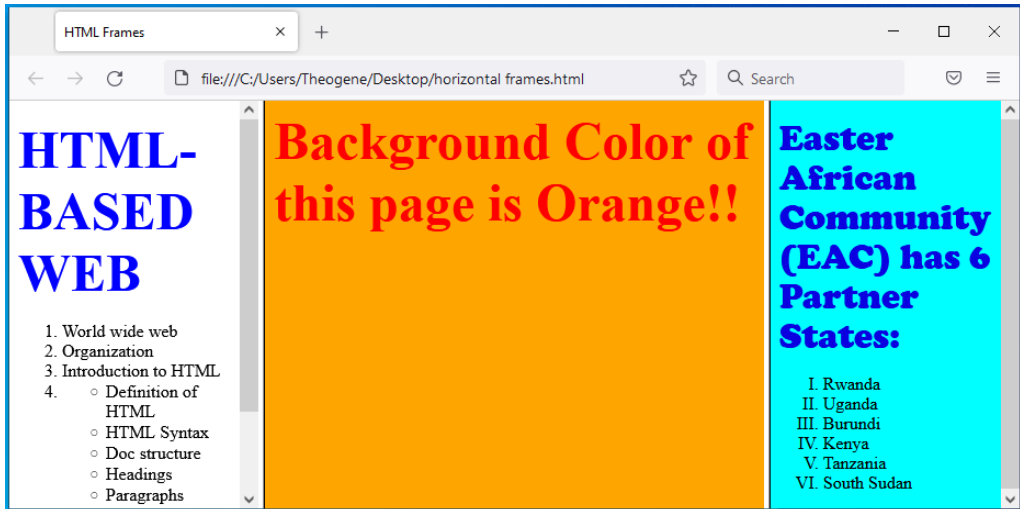


Figure 7. 16.Vertical frames

### 1.1.1.HTML Table tags

Tables are used to organize data such as numbers, text, links and images into rows and columns. An intersection of a row and a column forms data cell in which table data is held. The HTML tables are created using the **<table>** tag in which the **<tr>** tag is used to create table rows and **<td>** tag is used to create data cells. The elements under **<td>** are regular and left aligned by default.

**Before creating a table, consider the following table-features:**

- ❑ **Caption:** indicates the type of data presented in the table **<caption>...</caption>**
- ❑ **headings:** the row that indicate the data displayed in each column **<th> ...</th>**
- ❑ **Cells** intersection of rows and columns in which we insert data .

```
<!DOCTYPE html>
```

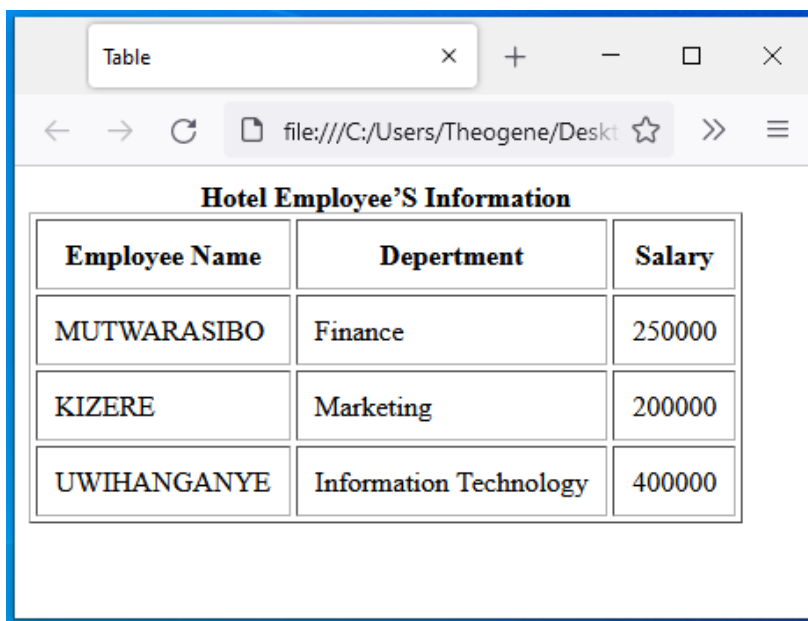
```
<html>
```

```

<head>
<title>Table </title>
</head>
<body>
<table border="2" cellpadding="10" cellspacing="3">
<Caption><b>Hotel Employee'S Information</b></caption>
<tr>
<th>Employee Name</th>
<th>Depertment</th>
<th>Salary</th>
</tr>
<tr>
<td>MUTWARASIBO</td>
<td>Finance </td>
<td>250000</td>
</tr>
<tr>
<td>KIZERE</td>
<td>Marketing</td>
<td>200000</td>
</tr>
<tr>
<td>UWIHANGANYE</td>
<td>Information Technology </td>
<td>400000</td>
</tr>
</table>
</body> </html>

```

The HTML document above produces the following table:



The screenshot shows a web browser window with a single tab titled 'Table'. The address bar shows the file path: file:///C:/Users/Theogene/Desktop. The main content area displays a table with the following data:

Employee Name	Department	Salary
MUTWARASIBO	Finance	250000
KIZERE	Marketing	200000
UWIHANGANYE	Information Technology	400000

Figure 7. 17. Sample HTML Table

### a) Define or format a HTML table

The following are basic attributes used to define or format a HTML table:

- ❑ **Border Attribute:** Numeric values that specify thickness of the border that surrounds all the table cells. If 0 is used, the border is invisible while.  
*Example* `<table border="2" >`

- ❑ **Height and Width attributes**

To set the size of the table, use width and height attributes. For example, the statement below sets the table size to width of 400 pixels and height of 150 pixels.

```
<table border="2" width="400" height="150">
```

- ❑ **Cellpadding Attribute:** Specifies the space, in pixels, between the cell wall and the cell content.
- ❑ **cellspacing attribute:** which specifies the space between cells.

**Syntax:** `<table cellpadding="pixels">`

### a) Table Caption

- ☐ **Colspan attribute:** Specifies the number of columns a cell should span. It allows the single table cell to span the width of more than one cell or column. It provides the same functionality as “merge cell” in the spreadsheet program like Excel. It can be used with <td> and <th> element while creating a HTML table.

**Syntax:** `<td colspan = "value"> table content...</td>`

**<th>:** The colspan attribute when used with <th> tag determines the number of header cells it should span.

**Syntax:** `<th colspan = "value"> table content...</th>`

The **value** specifies the number of columns that the cell fills. The value must be an integer

- ☐ **Rowspan attribute: Specifies** the number of rows a cell should span. That is if a row spans two rows, it means it will take up the space of two rows in that table. It allows the single table cell to span the height of more than one cell or row. It provides the same functionality as “merge cell” in the spreadsheet program like Excel. It can be used with <td> and <th> element in a HTML table.

- ☐ **<td>:** The rowspan attribute when used with <td> tag determines the number of standard cells it should span. **Syntax:**

`<td rowspan = «value»> table content...</td>`

The **value** specifies the number of rows that the cell fills. The value must be an integer.

- ☐ **<th>:** The rowspan attribute when used with <th> tag determines the number of header cells it should span. **Syntax:**

`<th rowspan = «value»>table content...</th>`

- ☐ The **value** specifies the number of rows that the cell fills. The value must be a integer.

**Example:** The following HTML code explains how to use HTML table attribute discussed above:

```
<!DOCTYPE html>
```

```
<html>
```

```
<head>
```

```

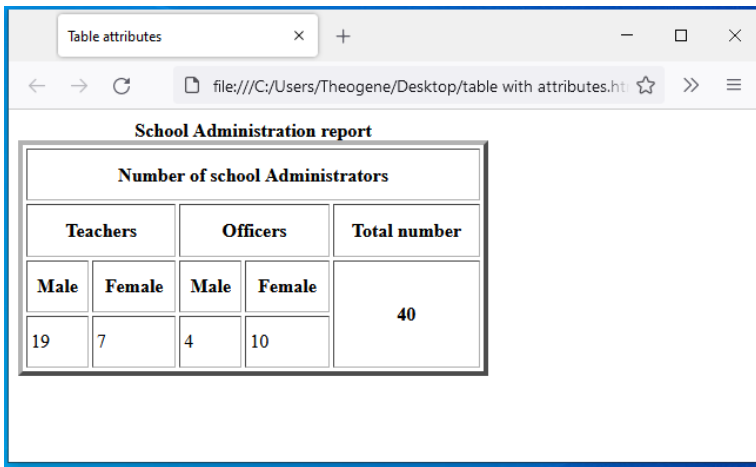
<title>Table attributes </title>
</head>
<body>
<table border=»4» cellpadding=»3» cellspacing=»3»
width=»400»height=»200»>
  <Caption><b>School Administration report</b></caption>
<tr>
<th colspan=6>Number of school Administrators</th>
</tr>
<tr>
<th colspan=2>Teacher</th>
<th colspan=2>Officers</th>
<th colspan=2>Total number</th>
</tr>
<tr>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
<th rowspan=»2»>40</th>
</tr>
<tr>
<td>19</td>
<td>7</td>
<td>4</td>
<td>10</td>
</tr>
</table>

```

```
</body>
```

```
</html>
```

The above HTML code produces the output below:



The screenshot shows a web browser window with the title 'Table attributes'. The address bar shows the file path: file:///C:/Users/Theogene/Desktop/table with attributes.ht. The main content of the browser is a table with the following structure:

School Administration report				
Number of school Administrators				
Teachers		Officers		Total number
Male	Female	Male	Female	40
19	7	4	10	

Figure 7. 18.HTML Table Attributes



### Application activity 7.6

1. Discuss the use of the following tags and attributes:
  - a. <Frameset> tag
  - b. <Caption> tag
  - c. Colspan attribute
  - d. <Th> tag
1. Create an html document which create a web page with three frames named: «Top\_Frames «,»Main\_Frames «, and»Bottom\_Frame».

## 1.1.HTML Forms

### Activity 7.7



A website is developed with different pages; the page below is created using HTML language. Observe it and answer related questions.

Please provide your registration details and click SEND button

first name:

second name:

nationality:

phone number:

Email:

password:

1. What do you understand a HTML form?
2. What is the use of HTML form?
3. Use HTML code to produce the above page

A person may need to gather information such as student's details and store such information in the server. The most common method for gathering such information is by using a form.

### 1.1.1.Form Attributes

No	Attribute & Description
1	<b>Action:</b> Backend script ready to process the passed data. <b>For example:</b> <code>&lt;form action="register.php"&gt; &lt;/form&gt;</code> A file named register.php that receives registration details after the user clicks the submit button
2	<b>Method:</b> Method to be used to upload data. The most frequently used are GET and POST methods. <b>Get Method:</b> If a "GET" method is used, the data supplied in the form is appended at the end of the URL. <b>Post Method:</b> Use POST if the form is updating data, or includes sensitive information (password).
3	<b>Target:</b> Specify the target window or frame where the result of the script will be displayed. It takes values like <code>_blank</code> , <code>_self</code> , <code>_parent</code> etc.

## Html Form elements

The most common controls include: text, textarea, select, radio buttons, checkboxes, file select, command button and reset buttons.

Let see the use of every form element and basic form attributes

### i) The <input> Element

An <input> element can be displayed in many ways, depending on the type attributes. Here are some examples:

Type	Description
<input type=»text»>	Displays a single-line text input field
<input type=»radio»>	Displays a radio button (for selecting one of many choices)
<input type=»checkbox»>	Displays a checkbox (for selecting zero or more of many choices)
<input type=»submit»>	Displays a submit button (for submitting the form)
<input type=»button»>	Displays a clickable button

#### ☐ Text Input Controls

There are three types of text input used on forms

- ☐ **Single-line text input controls** This control is used for items that require only one line of user input, such as search boxes or names. They are created using HTML **<input>** tag

For example, the following statement defines text input for capturing First name. First name: <input type=»text” name=»first” size = »20” />

The HTML code above will display the following:

First name:

**Password input controls** This is also a single-line text input but it masks the character as soon as a user enters it. They are also created using HTML <input> tag but type attribute is set to **password**. Example



**<input type=»password»>** defines a **password field**:

Example:

```
<form>
```

User name:<br>

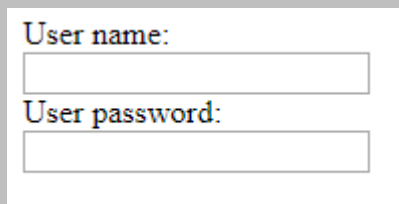
```
<input type=»text» name=»u-  
sersname»> <br>
```

User password:<br>

```
<input type=»password»  
name=»psw»>
```

```
</form>
```

The HTML code above will display the following:



User name:

User password:

**Multi-line text input controls** This is used when the user is required to give details that may be longer than a single sentence. Multi-line input controls are created using HTML **<textarea>** tag. The attributes used with textarea tag are: name, rows, and cols.

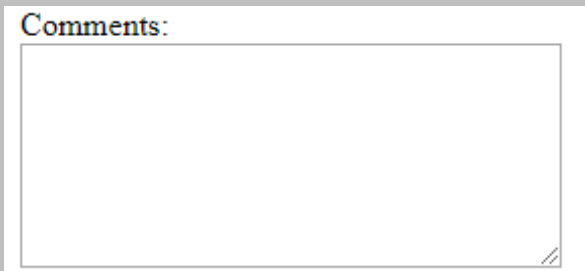
**For example, the following statement defines textarea named comment that has 7 rows and 25 columns:**

```
<form >
```

```
Comments: <br > <textarea rows=»7»cols=»25»-  
name=»comment»></textarea>
```

```
</form>
```

This is how the HTML code above will be displayed in a browser:

A screenshot of a web browser window. The title bar is not visible. The main content area shows the word "Comments:" in a blue, serif font. Below it is a large, empty rectangular text area with a thin grey border. In the bottom right corner of the text area, there is a small icon of a pencil and a diagonal slash, indicating that the text area is editable.

## Checkbox

Checkboxes are used when more than one option is required to be selected. They are also created using HTML `<input>` tag but type attribute is set to **checkbox** value as shown by the following statements:

```
<!DOCTYPE html>
```

```
<HTML>
```

```
<HEAD><TITLE>Checkbox</TITLE>
```

```
</HEAD>
```

```
<BODY>
```

```
<P><Strong><font color=»green» size=36>Choose your favorite games</  
font></strong></p>
```

```
<form>
```

```
<p><input type=»checkbox» name=»game» checked=»checked»> Football  
</p>
```

```
<p><input type=»checkbox» name=»game» > Basketball <p>
```

```
<p><input type=»checkbox» name=»game» > Volley Ball<p>
```

```
<p><input type=»checkbox» name=»game» > Net Ball<p>
```

```
</form>
```

```
</BODY>
```

```
</HTML>
```

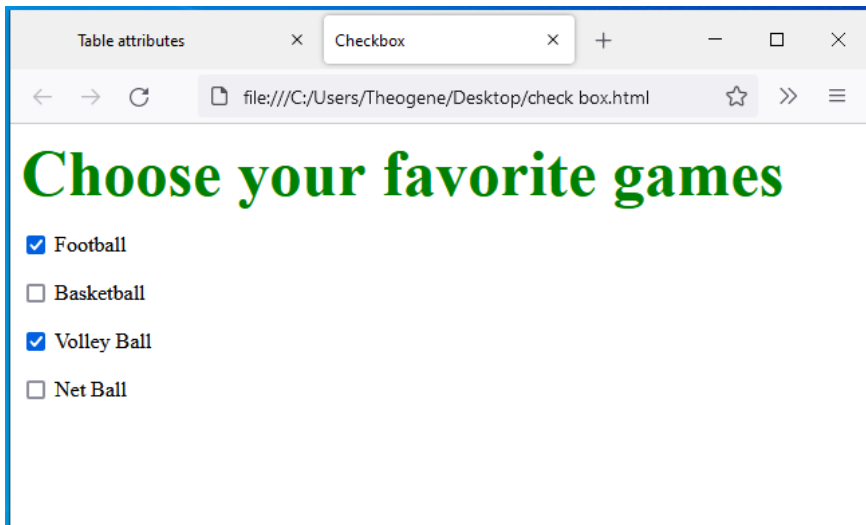


Figure 7. 19.HTML checkbox input type

## Radio button

Radio buttons let a user select ONLY ONE of a limited number of choices.

**<input type=»radio»>** defines a **radio button**. **Example:**

```
<!DOCTYPE html>
```

```
<HTML>
```

```
<HEAD><TITLE>radio buttons</TITLE>
```

```
</HEAD>
```

```
<BODY>
```

```
<P><Strong><font color=»purple» size=36>Select your subject</font></strong></p>
```

```
<form>
```

```
<input type=»radio»name=»sex» value=»physics»checked=»checked» > Math </br>
```

```
<input type=»radio»name=»sex» value=»Math»>>Physics </br>
```

```
<input type=»radio»name=»sex» value=»Accounting»>>Accounting </br>
```

```
</form>
```

```
</BODY>
```

</HTML>

The HTML code above will be displayed in a browser as follows:



Figure 7. 20.HTML Radio input type

## ❑ Select Box Control/ (Drop-Down List)

The **select** control also known as **dropdown box** provides the user with various options in form of drop-down list, from which a user can select one or more options. For example, the following select defines a dropdown for selecting only one option:

```
<!DOCTYPE html>
```

```
<HTML>
```

```
<HEAD><TITLE>Dropdown list</TITLE>
```

```
</HEAD>
```

```
<BODY>
```

```
<P><Strong><font color=»Orange» size=36>
```

```
Select your residence province:</font> </strong> </p>
```

```
<form>
```

```
<select name=»dropdown»>
```

```
<option value=»Kigali» selected>Kigali City</option>
```

```
<option value=»South»>South Province</option>
```

```
<option value=»North»>North Province</option>
```

```
<option value=»Easter»>East Province</option>  
<option value=»West»>West Province</option>  
</select>  
</form>  
</BODY>  
</HTML>
```

The HTML document above produces the following webpage:

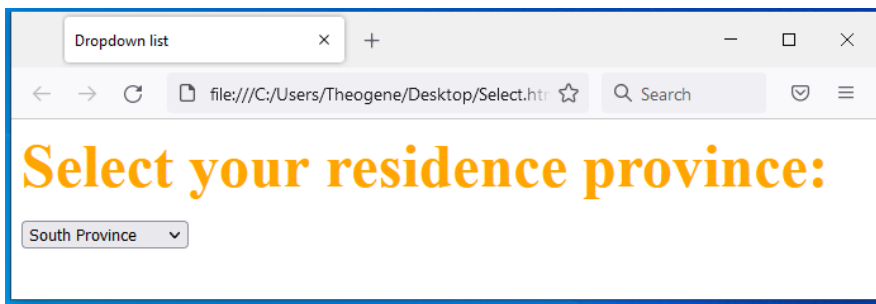


Figure 7. 21. HTML Select element

When you click on drop down arrow of a box, it will be as follow

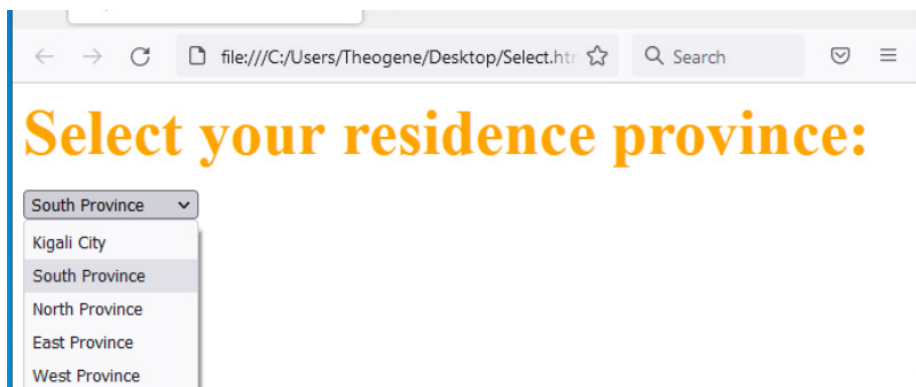
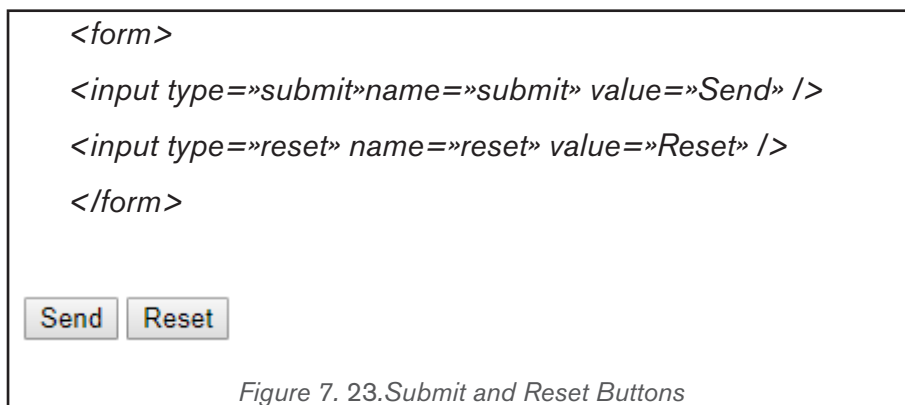


Figure 7. 22.Drop down list

## Submit and Reset Button

**Submit** input type used to create a button that automatically submits form data to web server. On the other hand, **reset** is used to refresh (reset) form controls to their default values. The following statements creates submit and reset buttons with values set to **Send** and **Reset** respectively:

This is how the HTML code above will be displayed in a browser:



*Figure 7. 23.Submit and Reset Buttons*

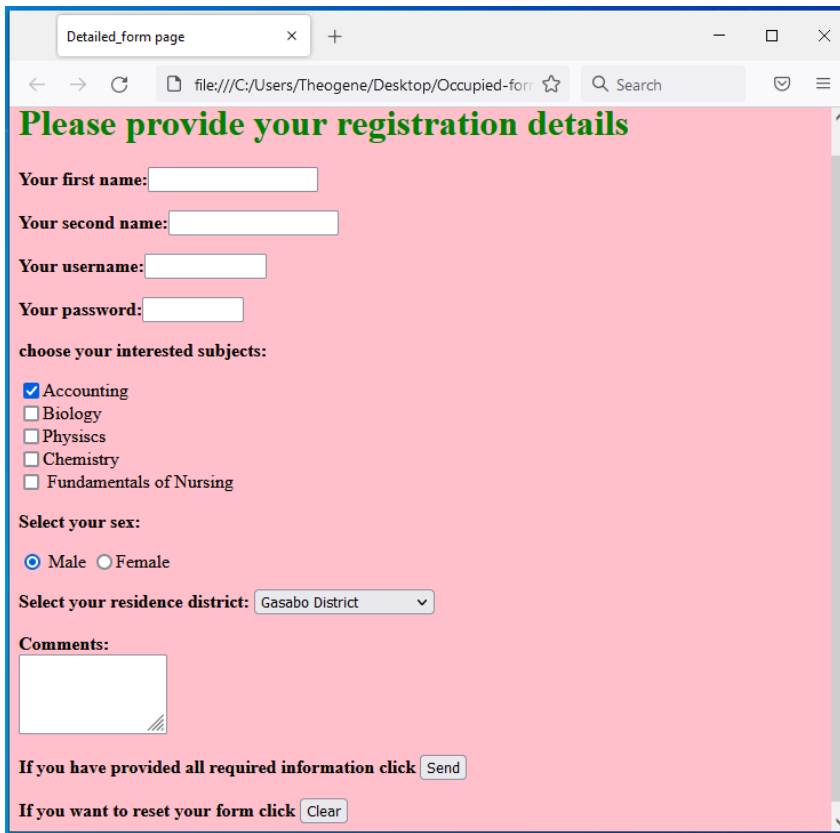
The following is a HTML document that implements input text box, input password box, checkbox, radio buttons, select, text area and action buttons (Submit and Reset)

```

<!DOCTYPE html>
<HTML>
<HEAD><TITLE>Detailed_form page</TITLE>
</HEAD>
<BODY bgcolor=pink>
<h2><Font color=»green» size=6>Please provide your registration details
</font></h2>
<form action=»register.php»method=»post»>
<p><b>Your first name:</b><input type=»text» name=»first»size=20></p>
<p><b>Your second name:</b><input type=»text» name=»second»size=20></
p>
<p><b>Your username:</b><input type=»text» name=»mail»size=13></p>
<p><b>Your password:</b><input type=»password» name=»pass»size=10
></p>
<p></u><b>choose your interested subjects:</b></u></p>
<input type=»checkbox» name=»check»checked=»checked»>Accounting
<br>
<input type=»checkbox» name=»check»>Biology<br>
<input type=»checkbox» name=»check»>Physics<br>
<input type=»checkbox» name=»check»>Chemistry<br>
<input type=»checkbox» name=»check»checked=»checked»> Fundamentals of
Nursing
<p></u><b>Select your sex:</b></u></p>
<input type=»radio»name=»sex» value=»male»checked=»checked» > Male
<input type=»radio»name=»sex» value=»female»>Female
<p></u><b>Select your residence district:</b></u>
<select name=»dropdown»>
<option value=»Gasabo» selected>Gasabo District</option>
<option value=»Nyarugenge»>Nyarugenge District</option>
<option value=»Kicukiro»>Kicukiro District</option>
</select></p>
<p><b>Comments:</b><br>
<textarea rows=»3»cols=»15»name=»comment»></textarea>
</p>
<p><b>If you have provided all required information click
<input type=»submit»name=»submit» value=»Send» /></p>
<p><b>If you want to reset your form click
<input type=»reset»name=»reset» value=»Clear» /></p>
</form>
</body>
</html>

```

The above HTML document produces the following web page:



The screenshot shows a web browser window with the title 'Detailed\_form page'. The address bar shows the file path: file:///C:/Users/Theogene/Desktop/Occupied-form. The main content area has a pink background and contains the following form elements:

- Please provide your registration details** (Section Header)
- Your first name:
- Your second name:
- Your username:
- Your password:
- choose your interested subjects:
  - Accounting
  - Biology
  - Physics
  - Chemistry
  - Fundamentals of Nursing
- Select your sex:
  - Male
  - Female
- Select your residence district:
- Comments:
- If you have provided all required information click
- If you want to reset your form click

Figure 7. 24.Detailed HTML Form

**Notice:** It is possible to organize the HTML form elements using a table so that they can be well arranged.



For example, HTML document below explains how you can insert an html form in a table:

```
<!DOCTYPE html>
<html>
<head>
<title> Registration</title>
</head>
<body>
<center>
<h1> <font color="blue">Please provide the following details</font></h1>
<table><form Action= "register.php" Method= "get" >
<tr><td>First Name:</td> <td><input type= "text" name=
"FName" size="15"></td></tr>
<tr><td>Last Name:</td> <td><input type= "text" name=
"lname"size="15"></td></tr>
<tr><td>Nationality:</td> <td> <input type="text" name=
"country" size="25"></td></tr>
<tr><td>Phone:</td> <td> <input type= "text" name= "phone"
size="15"></td></tr>
<tr><td><input type="checkbox" name="subjects" checked="checked"></td> <td> Computer Science</td></tr>
<tr><td><input type="checkbox" name="subjects" ></td> <td>
Physics</td></tr>
<tr><td><input type="checkbox" name="subjects" ></td> <td>
Economics</td></tr>
<tr><td><select name="dropdown"> <option value="maths" se-
lected>Mathematics</option>
<option value="computer">Computer Science</option> </se-
lect> </td></tr>
<tr><td>Comments:</td> <td> <textarea rows="3"cols="10">
name="comment"> </textarea></td></tr>
<tr><td><input type="submit" name="submit" value="Send"></td></tr></form></table>
</center>
</body>
</html>
```

The HTML code above displays the following page in a browser:

Registration

file:///C:/Users/Theogene/Desktop/Occupied-forr

### Please provide the following details

First Name:

Last Name:

Nationality:

Phone:

Computer Science

Physics

Economics

Mathematics

Comments:

Send

Figure 7. 25.HTML Form in Table



### Application activity 7.7

1. Explain the following HTML tag and attributes:
  - a. Action attribute
  - b. Method attribute
  - c. Text area tag
2. Write the syntax of select HTML tag
3. Write the HTML code that displays the form below:

Username:

Password:

Phone:

Country Music

Jazz Music

Techno Music

Rock Music

Male

Female

MCE

Comments:

Send

## 1.1.Creation of links

### Activity 7.8



1. A website is a collection of several web pages with information on a subject that are connected (linked) together. What do you understand by a link?
2. What is difference between internal and external link?

A hyperlink is a text, phrase or image that is clicked on in order to go to another web page or a section within the current page or to another website. In most browsers, hyperlinks are often in blue and underlined.

#### a) HTML Links – Syntax

To create a hyperlink, use the anchor element: **<a>...</a>**. The **<a>** tag is called an anchor tag because it is used to create anchors for hyperlinks.

**<a href="url">link text</a>**

#### Example:

```
<a href="http://www.irembo.gov.rw">Irembo Official Website</a>
```

The href (Hypertext Reference) attribute specifies the destination address (<http://www.irembo.gov.rw>). The **link text** is the visible part (**Irembo Official Website**). Clicking on the link text, will send the page visitor to the specified address.

#### a) Local Links

The example above used an absolute URL (A full web address).

A local (**internal**) link (link to the same web site) is specified with a relative URL (without <http://www...>).

The following code shows how to add text-based hyperlink into a HTML page:

```

<!DOCTYPE html>
<html>
<head>
<title>Hyperlink page</title>
</head>
<body bgcolor=black>
<p><font color=»orange» size="20"> For getting more information
Click following link:
</font></p>
<a href=»http://www.igihe.com»>Visit Tutorial Site</a>
</body>
</html>

```

The figure below shows how the link is displayed on the browser

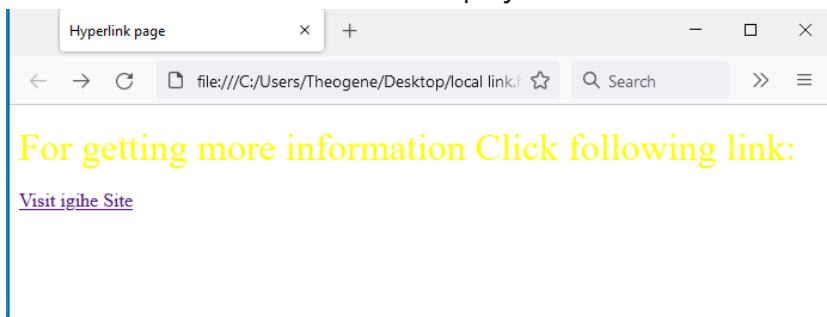


Figure 7. 26.External link

In most browsers, a hyperlink is an underlined text and blue in color. In our case, once the visitor clicks on the link, he or she is taken to the web page of the tutorial site as long as it is a valid URL.

### Example 2:

### Example 2:

```
<!DOCTYPE html>
<html>
<head>
<title>Hyperlink page</title>
</head>
<body>
<p><font color=»black» size=»3» face=»Goudy Stout»> Click following link
for more information:
</font></p>
<a href=»Occupied-form.html»>click here</a>
</body>
</html>
```

### Output of above html code:

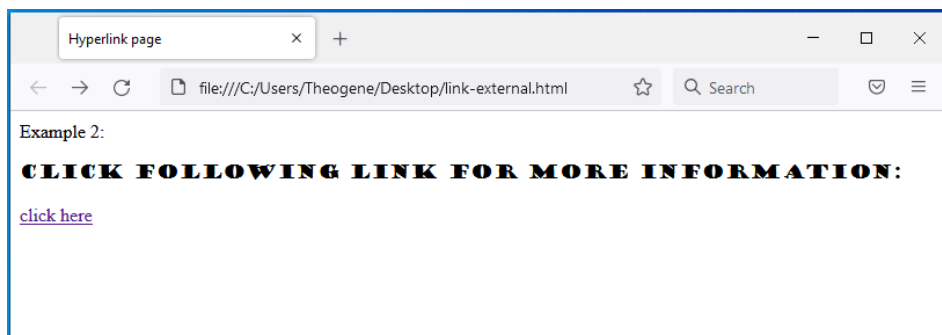


Figure 7. 27. Internal link

The [click here](#) hyperlink fall on the following frame.html page:

Detailed\_form page

file:///C:/Users/Theogene/Desktop/Occupied-for

### Please provide your registration details

Your first name:

Your second name:

Your username:

Your password:

choose your interested subjects:

Accounting

Biology

Physics

Chemistry

Fundamentals of Nursing

Select your sex:

Male  Female

Select your residence district: Gasabo District

Comments:

If you have provided all required information click

If you want to reset your form click

Figure 7. 28.Targeted page



### Application activity 7.8

1. Define the following terms:
  - a. Hyperlink
  - b. Hypertext
  - c. Href attribute
2. What do you understand by a local link?
3. Explain this statement: `<a href=»photo.html»> image link</a>`
4. Create two static web pages and hyperlink called **“next”** which links them

## 1.1.Back-end vs Front end

### Activity 7.9



With research on internet, discuss the difference between Front end and Back end in the web site design and development process.

Database systems are comprised of a Front End and Back End. The Back End has the tables that stores data, including the relationships between the tables, data queries and other behind the scenes technology that accepts information from and displays information to the user via the Front End.

For example, when someone is requesting for a birth certificate through Irembo there is a number of information provided through different forms and that information is kept in the Irembo database tables.

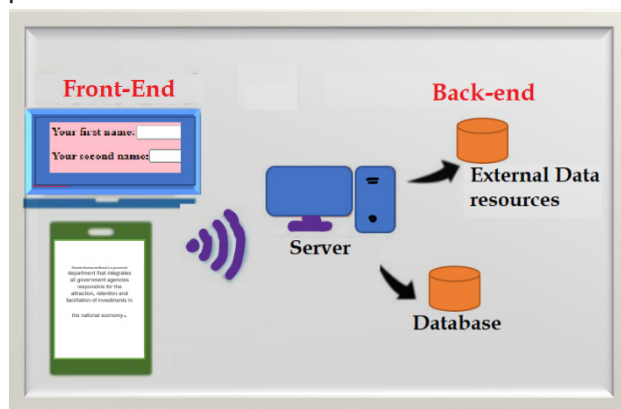


Figure 7. 29.Front end-Back end

The front end is the part of the website, users can see and interact with. Back end, on the contrary, is the part of the website users cannot see and interact with.

*Front end* development is programming which focuses on the coding and creation of the visual elements of a website or app that a user will interact with (the client side). In contrast to *front end* development, *back-end* development focuses on the side of the website users can't see.

The back end can also be referred to as the “server side” of a website. As an example, let’s say that someone is running a social media website. he/ she needs an accessible place to store all of users’ information. This storage center is called a database and a few widely used examples include Oracle, SQL Server, and MySQL.

Databases are run from a server, which is essentially a remote computer. A back-end developer will help manage this database and the site contents stored on it. This ensures that front end elements on social media website can continue to function properly as users browse uploaded content and other user profiles.

**Note:**

- The front end can be created using Visual Basic, HTML, programming languages

The user at the front end of a system does not need to know how data is stored and how it is modified or retrieved.

- The Back ends can be built using different Relational Database Management Systems such as Microsoft Access, SQL Server, Oracle etc.
- Front end developers build elements like:

Buttons

Layouts

Navigation

Images

Graphics

Animations

Content organization

- **Back-end web developers work on tasks like:**

- Building code**
- Troubleshooting and debugging web applications**
- Database management**
- Framework utilization**





### Application activity 7.9

1. What is difference between Front end and back-end development
2. Discuss different types of software used in:
  - o Front end development
  - o Back-end development
3. Describe tasks done in Front end and Back-end development



### End of unit assessment 7

1. Define the terms below:
  - a. Web site
  - b. Web application
  - c. Web server
2. Differentiate between internet and web.
3. A program, such as Mozilla Firefox that lets a user display HTML-developed web pages is referred to as .....
4. Discuss three key factors that a web developer should consider before developing a website
5. Explain four types of image formats that can be inserted into a web page
6. Write sample HTML statements to demonstrate how to insert the following:
  - a. An image of a car
  - b. Page with four horizontal frames
  - c. Table of 5 rows and 8 columns
7. Explain statement: `<form action =»login.php» method=»post»>`

8. Differentiate between GET and POST methods used to send form content to a web server.
9. Explain at least four types of controls that are used to create a form object.
10. Differentiate between Hypertext and hyperlink.
11. Giving examples, explain three restrictions that were imposed by XHTML that have been relaxed in HTML5.



### Introductory activity

Kamali's grandfather worked in a bank in 1980. He narrates that at that time when a customer came to the bank, a bank staff had to get his/her booklet, locate his/her information sheet which was kept in a box with other clients' information sheets and bring it to the teller. When a transaction was done the information about that transaction was kept both in the booklet and the customer information sheet. The teller had to count the money by hand and give it to the customer. The bank's staff had then to take back the customer information sheet and put it again in its appropriate place.

Visit the nearest bank of your home or school, and request to branch manager some information about:

- a. How the bank process was done in the years 1980
- b. What are the dangers presented in that banking process stated in question 1?
- c. What are the common ICT tools used at banks in these days?
- d. How the current banking system corrected the problems that were in the old banking system

## 8.1 Counting machines

### Activity 8.1



Kamanzi is a company owner whose activities are carried out in East Africa and China. At the end of the day the company's headquarter have to count the received money and deposit it to the company's accounts.

- 1) If at the end of the day this company has hundreds of millions to count, what are the tools that they will use to ease this task?
- 2) State the process of using the tool given in questions 1)
- 3) Give at least the parts of the tool you have given.

A counting machine or more precisely a currency counting machine is a machine that counts money. They are in different types namely bank note only counters, banknote and coin counters, coin sorters, coin counters. All these machines have many advantages including among others saving time and resources, fighting counterfeited notes, increased accuracy in accounting and facilitating the keeping book of accounts.

### 8.1.1. Banknotes only counters

These are devices which can count bank notes only. Most of the counters need to be fed with sorted notes for counting to be properly done meaning that they can count only same value bills at the same time. However more advanced counters can identify different bill and provide a total currency value of mixed banknotes, including those that are upside down.

NB: There are devices which can count both coins and banknotes. These are called Banknotes and coins counters.

#### A. Parts of a banknote counter

Apart from the external frame, a banknote counter has different part which are seen from outside of which are not visible as they are encased inside.

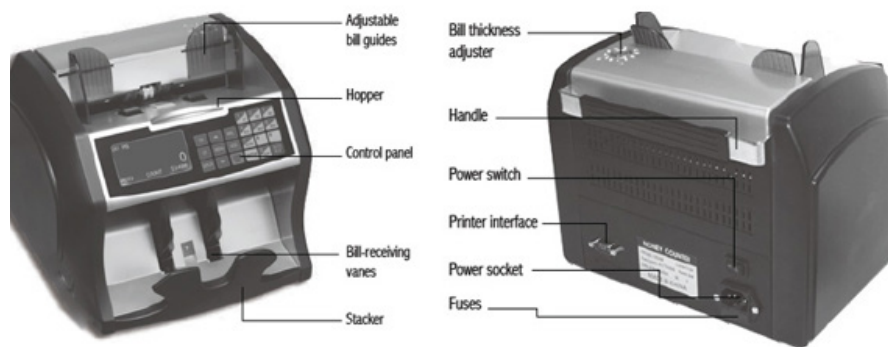


Figure 8. 1.Parts of a banknotes counter

## B. Using a counter

A billing machine is used in the following process :

- The billing machine has first to be plugged to the power source using its powercable then switched on. If the billing machine has a battery, it can be operated without being plugged to the power source.
- Select the function that the counter will perform
- Place the bank notes in the appropriate tray
- Press the start button for the counting operation to start

### i). Some of a counter's functions

A counter has functions which facilitate how it is utilized by a user. Some of the basic functions are:

**Currency Code:** After the machine is turned on, the currency kind is displayed on the screen. To change the current currency press “CURRENCY” key to choose a new currency.

**Counting Mode:** There are different counting mode which are selected by pressing the MODE button. One example of counting is batch in which the user specifies the number of notes to count say 100 notes.

### ii). Counter basic maintenance

A counter may have slight problems that don't need deep competences in order to sort them out. Those problems can be prevented in this way:

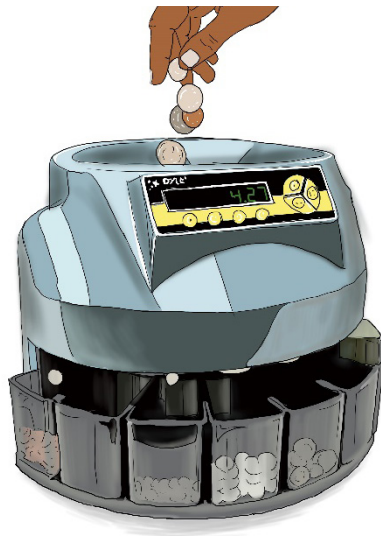
- Clean regularly the counter for optimal performance. This cleaning includes that of the hopper and stacker which has to be done using a brush

- Clean the banknote pathway using a soft brush or a dry soft lint free cloth
- Occurrence of error during banknotes counting can be solved by doing one of these depending on the kind of error: Removing the banknote, cleaning the counter's sensors.

### **8.1.2.Coin sorters and coin counters**

Coin sorters are devices used to arrange coins into separate groups according to their denominations. These devices are commonly specific for coins of specific countries as the size of coins may vary depending on countries. Some sorters have screens which show the number of the coins that passed through it.

As its name suggest, a coin counter on the other hand is used to count the value of coins. However some of these devices both sort and count coins at the same time or count only presorted coins that are all the same size. Most counters use bowl with flat spinning disks at the bottom of the bowl to distribute the coins around the bowl perimeter. At the bottom of that bowl there is an opening which allows the passing of one coin at a time. These coins then pass through a light beam counter or are pushed through a spring loaded cam that accepts only one coin at a time.



*Figure 8. 2.A coin counter with bowl filled with coins*



### Application activity 8.1

- 1) What is a banknotes counter?
- 2) What are the different parts of a banknotes counter?
- 3) By doing a research identify the internal parts of a banknote only counter
- 4) By doing a research on the internet find at least 5 different banknotes counters and their specifications. The specifications should at least include the counting speed, hopper capacity, stacker capacity, weight.

## 8.2.3 Billing machines



### Activity 8.2

Isimbi, a student in was doing a research about billing machines used in Rwanda. She visited one supermarket to ask questions to the owner, clients and the supermarket staff. Suggest the answers she will get about the following questions:

- 1) Which machines are used to make bills in a supermarket?
- 2) How does the supermarket staff proceed in order to make a bill for a customer?
- 3) Which type of information is found on a bill?
- 4) What are the advantages of the billing system in a supermarket in regard to:
  - a) Stock management?
  - b) Paying taxes?

These are machines that are used in entering in a system of customer information and purchased goods so as to come up with invoices or bills.

For these machines to print bills they use a thermal printing process by which images are produced by selectively heating coated thermochromic paper when it passes over the thermal print head. The coating becomes black in the areas where it is heated, producing an image. Two-color direct thermal printers can print both black and an additional color (often red) by applying heat at two different temperatures.

Bill printers print by direct contact between the thermal head which generates heat and thermal paper which is thermally coated to be sensitive to heat. The paper rolls available are sensitive to the heat and thus when the heat is produced it can easily initiate the process of printing. It can print more than just a single color by setting the printer to different temperatures.

The world is becoming more digital and this require that stores acquire billing machines as every business is required to issue receipts generated using billing machines. Billing machines reduce the chances of error, once the required information is entered into the system, it automatically updates each new bill without any additional effort.

### **8.2.1.Main parts of a billing machine**

Billing machine systems, like most electronic devices, consist of different parts which play different roles grouped into three categories namely **inputting data, processing and printing bills**. The first part is the keyboard which is used to feed information like goods names in the billing machine. The second part can be considered to be the processor and all parts working with it like memory and motherboard. The third part is the printer which plays the role of helping get hard copy bills. Also in the same third category is a screen which displays information that a billing machine user can understand. Note that some billing machines may have additional parts which help in payments like a weighing scale.

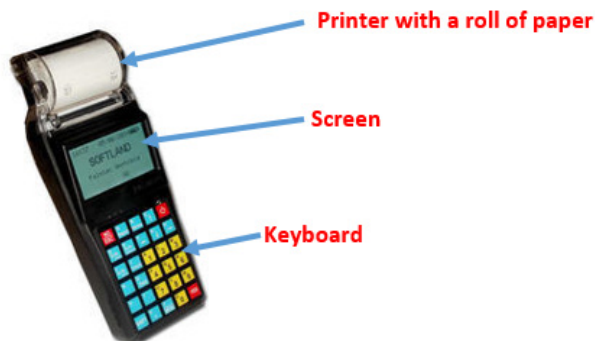


Figure 8. 3.Main parts of a billing machine



## 8.2..2.Operating a billing machine

Producing a bill by a billing machine requires the presence the information to appear on the bill. That information can be fed to the billing machine's printer from different sources namely the database on which the billing machine is connected through internet or a local network, the billing machine's permanent memory or temporary memory. The temporay memory of this machine keeps information which is immediately fed to it by using its keyboard or any other input device

Before using a billing machine make sure the following is met :

- It is properly connected to a power source or that its battery has enough power,
- It is properly connected to a local network or internet by the use of a cable or wireless network. This is necessary when the machine gets or submits data to a database stored at another location
- All the peripherals to a billing machine are properly connected
- Make sure that as a user, you have the right access credential if the machine is password protected

When a billing machine is ready follow the following steps to use it:

- Log in to the machine. Some may need a username and password while some need a swiping card accompanied by a password.
- Enter the billing information by using the keyboard. This information is about the client details, purchased goods details and amount to be paid. Most of the time the price of each item purchase is got from the machine's database and the total price to pay is automatically calculated.
- Print the bill by pressing the key for printing

Note that:

- ❑ Some billing machines may not require login depending on how their setting were configured. There exist typically three types of user on a billing machine namely Clerk who can only generate invoice, the Administrator who can generate Invoice and Reports, add or modify items and their price, change print settings and the Supervisor who has access to all that the administrator can do and more to that have access to System settings, Erase Memory/Bills, Create different users and assign password.
- ❑ Billing machines allow users to get different reports. Depending on the available functionalities, these machines can provide daily, weekly or yearly reports.

### **8.2.3. Billing machines in Rwanda**

Rwanda through the Rwanda Revenue Authority (RRA) adopted the use of billing machines from 2013. These machines which are known as Electronic Billing Machines (EBM) are devices which receive information from the user like bought items and generate a bill which is then printed. These devices come with software installed by the manufacturer or the vendor and the user can not easily remove or add a new software.



*Figure 8. 4. An example of an EBM in Rwanda*

In 2017 Rwanda Revenue Authority adopted a new version of EBM which is known as EBM version 2 (EBM ver2.0) which is a software installed on a computer allowing then to have access to the central database. With this software installed, after logging in the user has access to different functionalities including among others item management, customer management, sales management, purchase management. This EBM also allows the printing of an invoice to be given to the customer.

### **8.2.4. Types of billing machines**

There are machines which are dedicated to be billing machines. With these machines the software which make them operate is installed by the manufacturer or the vendor and these devices cannot play another role other than the one they were made for. On another hand, billing machine functionalities are implemented in a software which can then be installed on electronic devices like computers, ipad, smart phones and therefore acting as billing machines.

The different types of dedicated billing machines are outlined below :

## A. Portable machines

Billing machines that can be moved from place to place are referred to as portable machines. The handheld machines or the bus ticketing machines are examples of such machines.



*Figure 8. 5.A handheld machine used in bus ticketing*

Among portable machines are card swipe machines which are devices that read the magnetic stripe on a card and takes the information from it. The most common card swipe machine is a credit card reader that is used with a cash register. These machines come with a keypad for the customer to enter the PIN of the card, a display bar and a swipe slot for swiping the card.



*Figure 8. 6.A card swipe machine*

## B. Automatic machines

These are machines come with software and algorithms inbuilt in it to add up the taxes and deduct the rebates automatically. No additional manual instructions are required for such type of machines.



Figure 8. 7. An example of an automatic billing machine

### C. POS machines

The POS or the Point of Sale is a billing technology used in supermarkets to keep track on the sales of goods. This system uses bar-code technology to perform tasks like review sales or prepare the next fresh lot of products that need to be replaced with the sold-out ones.

Normally a POS system is referred to as a cash register at a store. While this is still true today's modern POS systems accepts payments even when customers are away from the POs system. What is needed in this case is a POS app and an internet-enabled device, like a tablet or phone.

#### Hardware parts of a POS system

POS system uses POS software. However in the case of an online store the POS system does not need to have the hardware. In this case of an online store all of the sales happen on a website, so the business owner does not need POS hardware to help accept payments.

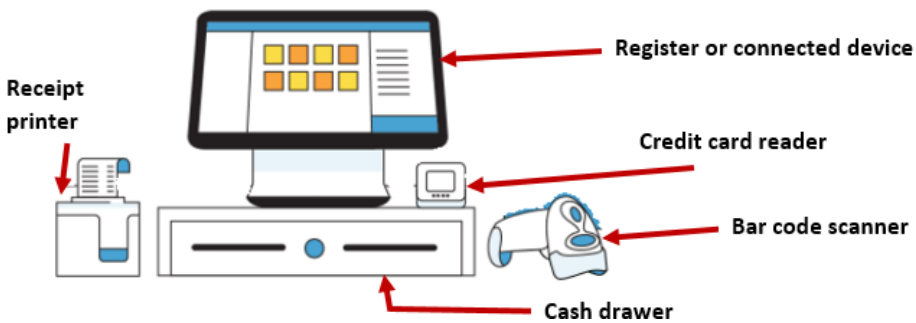


Figure 8. 8. Diagram illustrating the parts of a POS system

**Register:** this helps calculate and process a client's transaction.

**Connected device, like an iPad or other tablet:** These are devices equipped with a monitor allowing the user to view a list of items and interact with the system

**Credit card reader:** A card reader lets a customer pay by credit card

while in the store.

**Cash drawer:** This is a place where cash can be kept in case the store accepts payments in cash. POS software that's connected to a cash drawer can minimize fraud by tracking exactly when the drawer is opened.

**Receipt printer:** A paper receipt shows customers exactly when and what they purchased and how much they paid.

**Bar code scanner:** A bar code scanner reads an item's product details so you can ring it up. It can also be a quick way to double-check the price, stock level, and other details.



### Application activity 8.2

- 1) What is the technology used by billing machines in printing the bills?
- 2) What are the 3 main parts of a billing machine?
- 3) What is EBM version 2

## 8.3 Note detector

### Activity 8.3



- 1) Suppose you are a teller at a new bank which features will you check in a note in order to discover counterfeited notes
- 2) Which device will your bank buy in order to detect fake notes easily?
- 3) What are the advantages that using the device stated in question 2 has?

A note detector is a device which is designed to sort identify a fake note which does not have all the attributes of a nation's notes. Fake notes can be identified by using hands and eye, a counterfeit detector pen, or a machine known as a note detector.

## i) The Counterfeit Detector Pen

Counterfeiters don't use expensive special inks to try to closely duplicate paper currency. They instead try to create a bill that looks like the authentic one by using their available means which include wood-based paper. However, their bills would not raise any initial suspicion when used in an everyday purchase.

One of the simplest tools used for counterfeit detection is a Counterfeit Detector Pen. This pen contains an iodine solution that reacts with the starch in wood-based paper to create a black, marker-like stain. When the solution found in this pen is applied to the fiber-based paper used in authentic bills there is no change in color and no stain appears. This tool is useful for identifying amateur counterfeit currency. However, when dealing with more sophisticated counterfeit bills, utilizing a more complex detector is necessary.

## ii) Fake notes detection by a counter

Some banknote counters can also detect counterfeit notes by using one of the following methods:

- **Magnetic counterfeit bill detection:** This is a method by which the specialized magnetic ink which is found in bills is read by currency counters with magnetic detection capabilities to identify counterfeited bills from genuine ones.

Magnetic inks are ones with pigments containing magnetic material typically iron oxide similar to what is used in the coatings of audio and video tape. These inks are employed by most countries in the printing of paper currencies.

There are different methods and devices used in detecting the magnetic properties in currency such as hand-held units and single-bill readers that require the user to rub or slide the bill across a sensor. This device then emits an audible signal to indicate the presence of the magnetic properties in the bill. These devices are easy to use and are effective but they are impractical for banks and big businesses with big amounts of cash to verify. There are also more effective and quick modern money counters equipped with magnetic counterfeit technology which can scan hundred or even thousands of bills per minute.

- **UV counterfeit detection:** This is a method in which detection devices use ultra-violet light to detect fake notes. With this method the counterfeit detector works by detecting the UV fluorescent phosphors used on authentic bills. This phosphor produces a reaction when placed under the UV light but remains hidden when viewed under normal lighting conditions. The UV ink changes its appearance and can then be easily seen by the human eye under UV light.

Apart from banknotes detectors which have fake notes detection functionalities, there are note detectors which have the sole functionality of detecting fake money by using the ultraviolet light or the magnetic detection method. To use these devices the user places suspicious notes in the appropriate place and the device detects its authenticity.



Figure 8. 9.A Note Detector Machine (STS Fake Note Detector)



### Application activity 8.3

- 1) Explain the methods used by a note detector to identify fake notes
- 2) By doing a research on the internet, identify the parts of a note detector.

## 8.4 Automatic Teller Machine

### Activity 8.4



You have at least once visited banks in Rwanda.

- 1) Explain how the process of withdrawing and depositing money at a bank is done
- 2) Give the name of a machine that can do the task of a human teller?
- 3) Explain how withdrawing and depositing money using the machine stated in 2) is done.

An ATM known in full letters as an Automated Teller Machine, is a specialized computer device that is used by bank customers to perform transactions on their bank accounts. With these devices customers can check account balances, withdraw or deposit money, transfer funds from one account to another, print a statement of account activities.

ATMs can be found in financial institutions like banks. However there are also ATMs that can be displaced and found at other places like airports, shopping malls where there may be many people needing cash. ATMs started being used as a response to labor cost and request to get cash even after working hours.

### **8.4.1.Parts of an ATM**

Like other computers and most electronic devices, an Automatic Teller Machine has two parts namely hardware and software.

#### **A. Hardware**

The hardware parts of an ATM work together in order to make a transaction possible. An ATM has parts that are visible by the client that can be considered as an interface and other parts which are visible by the bank administrators. Although each ATM offers various features other than basic services, all the devices contain the same components. The parts of ATM are detailed below :

##### **☐ Card Reader**

A card reader is a device that can decode the information contained in a credit or debit card's magnetic strip or microchip. In finance, this term refers to the technologies used to detect the account number, cardholder information, and authorization code contained on a credit card. When a customer inserts a card in the machine, a card reader reads the account details of the clients then verify the provided information and process the transaction.

##### **☐ Keypad**

A keypad for electronic devices is an input unit which enters data in that device. Keypads have keys which are mostly numeric and letter keys. When the bank card holder has put it in the ATP slot, he/she is prompted to enter a password, choose among different options, etc and this is done using the keys found on the keypad

##### **☐ Cash Dispenser**

A cash dispenser is the part that contains cash. Cash dispensers are connected with a safe that contains cash. Through cash dispensers, customers receive banknotes in return to the transaction they made.



## **Printer**


An ATM printer has the role of printing a receipt of the performed transaction. The printed receipts include all the details of the transaction for cash withdrawal. It further shows the total balance that a cardholder has in their bank account.

### Screen

The display screen in ATM shows the cardholder all the details. It prompts the customer through each step of the transaction process. Nowadays advanced ATM screens may be touchscreens whereby instead of using the physical key there is a virtual keypad laying under the screen.

## **Speaker**

The speaker provides feedback in form of audio when a particular key is pressed.

-  **Vaults:** This is a house to which store the parts of the machinery requiring restricted access

Note also that, like other computers, ATMs have most hardware parts found inside a computer like processors and motherboards to support the whole circuitry. Moreover they have sensors and indicators and cameras. One of the functions of a sensor is to measure if the thickness of the bill is normal in order to avoid that two bills may pass at the sametime which would result in a customer receiving more money than requested.

## A. **Software**

Like any other electronic device that performs complex tasks, an ATM has an operating system. Today, the vast majority of ATMs worldwide use Microsoft Windows among which a big number runs on Windows XP (95% in 2014). There are also a small number of ATMs which are still running older versions of Windows such as Windows NT, Windows CE or Windows 2000. Some others use newer operating systems such as Windows 8.1, Windows 10 and Windows 11.

Windows is not the only operating system for ATMs because in these days Linux is also finding some ground like in Brazil where the Banrisul bank's ATMs run on Linux.

### **8.4.2. Withdrawing and depositing from an ATM**

The process of withdrawing cash from an ATM machine has to go through a number of steps starting by insertion of the bank card and a withdrawal of that same card. Those steps are outlined below:

**Step 1:** Insert an ATM Card in the card slot

**Step 2:** Select the language from the language options appearing on the display screen

**Step 3:** Enter ATM Pin using the keypad. For most ATMs PIN are in 4 digits. Do not ever share your ATM Pin with anyone even with bank staff. Ensure that nobody is watching you, while you enter the Pin. Make sure you enter a right pin as entering a wrong one may lead to the blockage of the ATM card.

**Step 4:** Select the type of transaction which can be withdrawal, deposit or transfer.

**Step 5:** Select your type of account: As an individual banker, you should be choosing a savings account, as current accounts are a special type of accounts used by businesses. Some ATMs offer you a choice to add a line of credit to your account. This can help a banker when they need excessive money in an emergency.

**Step 6:** Enter the withdrawal amount. The withdrawal amount should not be more than the balance in your account.

**Step 7:** Collect the cash from the ATM cash slot

**Step 8:** Take the receipt which is produced by the ATM printer. Making the printer produce a receipt is done by prompting the ATM to print it. If you choose not to have a receipt, it will not be produced.



Figure 8. 10. Accessing bank account using ATM

### A. **ATM malfunction errors**

The hardware components specifically the ones which move may wear out or get old therefore resulting in a faulty equipment

- **Faulty dispenser**

When the dispenser has problems, customers insert their ATM cards in the slot, enter their password or PIN, select the cash withdraw option and fill the cash amount but when it arrives at the steps of counting and dispensing the cash everything halts yet the customer's account has already been to the full amount. Another scenario is that ATM may fail to provide the full requested amount. When such errors happen, the customer will have to apply for payment and the bank manager will verify that application.

- **Worn out card reader**

Bank cards have a dark magnetic stripe on the back which contains specific details about the card and its owner. When the bank card is inserted in an ATM, the reader verifies the information on the card before it authorizes the transaction. As a card is used again and again, the ATM card reader wears it out therefore making the reading of information on the card impossible. If this happens, obviously the transaction the customer wanted to carry out will not be done.

- **Broken Keypad**

The keypad which is used as an interface between a customer and the ATM may be broken or one key may stick or may be unresponsive. If among the keys that the customer needs have such problems, a transaction will not be possible.

## ▪ **Receipt Malfunctions**

The ATM printer may not give a receipt due to different reasons such as when the machine has run out of paper, the printer has run out of paper, there is a paper jam or any other problem with the ATM printing system. Since the receipt contains vital information about the ATM transaction, it's imperative that any issues with printing receipts is handled quickly.

## ▪ **Software glitches**

ATM have different software whose technology never ceased to advance. Many ATMs now have touch screen and other technology that relies on computer software to function. Like other machines that run on computer software, ATMs can have software glitches. When such problem happens, a transaction in not possible.



### **Application activity 8.4**

- 1) By doing a research on the internet, identify the internal parts of an Automatic Teller Machine
- 2) Can an ATM be hacked? If yes explain the likely consequences of this hacking.

## **Skills Lab 7**



Use different ICT tools in Accounting you have learnt to perform the following activities:

- a) Counting money
- b) Detecting fake money
- c) Withdrawing using ATM cards



## End of unit assessment 8

- 1) What are the benefits of using ICT tools in Accounting
- 2) Describe the ICT tools you have seen in this unit
- 3) Using the internet do a research on the software tools used in Accounting

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