ICT FOR GENERAL EDUCATION

Senior 5

STUDENT BOOK

Experimental version

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FOREWORD

Dear Student

Rwanda Basic Education Board is honored to present Senior Six ICT Student book for General Education combinations excluding MCE and MPC. This book serves as a guide to competence-based teaching and learning to ensure consistency and coherence in the learning of the ICT subject. The Rwandan educational philosophy is to ensure that learners achieve full potential at every level of education which will prepare them to be well integrated in society and exploit employment opportunities.

In line with efforts to improve the quality of education, 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 acquired. Those factors include the relevance of the specific content, the quality of the teacher's pedagogical approaches, the assessment strategies and the instructional materials available. We paid special attention to the activities that facilitate the learning process in which learners can develop ideas and make new discoveries during concrete activities carried out individually or with peers. With the help of the teacher, you will gain appropriate skills and be able to apply what you have learnt in real life situations. Hence, you will be able to develop certain values and attitudes allowing you to make a difference not only to your own life but also to the nation.

This is in contrast to traditional learning theories which view learning mainly as a process of acquiring knowledge from the more knowledgeable who is mostly the teacher. In competence-based curriculum, learning is considered as a process of active building and developing of knowledge and understanding, skills and values and attitude 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.

In addition, such active learning engages you in doing and thinking about what you are doing and you are encouraged to bring your own real experiences and knowledge into the learning processes. In this view, your role is to:

- Develop knowledge and skills by working on given activities which lead to the content;
- Communicate and share relevant information with other learners through presentation, discussion, group work and other active learning techniques such as role play, case studies, investigation and research in the library on internet or outside;
- Participate to and take responsibility for your own learning;
- Carry out research/investigation by consulting printed/online documents and resourceful people, and present your findings;
- Ensure the effective contribution of each group member in assigned tasks through clear explanations and arguments, critical thinking, responsibility and confidence in public speaking;
- Draw conclusions based on the findings from the learning activities.

I wish to sincerely extend my appreciation to the people who contributed towards the development of this book, particularly REB staff who organized the whole process from its inception. Special appreciation goes to the teachers who supported the exercise. Any comment or contribution would be welcome to the improvement of this textbook for the next versions.

Dr. MBARUSHIMANA Nelson

Director General of REB

ACKNOWLEDGEMENT

I wish to express my appreciation to all the people who played a major role in the development of this ICT student book for General Education combinations (excluding MCE and MPC). It would not have been successful without active participation of different education stakeholders.

I owe gratitude to different universities and schools in Rwanda that allowed their staff to work with REB in the production of this textbook. I wish to extend my sincere gratitude to lecturers from the University of Rwanda, teachers and all other individuals whose efforts in one way or another contributed to the success of writing of this textbook.

Finally, my word of gratitude goes to the Rwanda Basic Education Board staff particularly those from the Curriculum, Teaching and Learning Resources Department (CTLR) who were involved in the whole process of writing the adapted textbooks.

Joan MURUNGI,

Head of CTLR Department

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Unit 1: ADVANCED SPREADSHEET II

1.0. INTRODUCTORY ACTIVITY

Using Ms Excel summarize the number of expectant mothers and children under 2 years in the cells of Huye District who must receive mosquito nets

SN	Sector	Expectant Mothers	ChildrenUnderAgeTwo
1	Ngoma	25	14
2	Mbazi	21	10
3	Mukuru	19	12
4	Kinazi	15	13
5	Simbi	20	11

a. Which sector that has more expectant mothers to receive mosquito nets?
b. Which sector that has more children under age Two?
c. Calculate the average number of children to receive mosquito nets in Ngoma?
d. Which cell has less children under age Two?

1.1. Advanced Spreadsheet functions

1.1.1. Logical functions

ACTIVITY 1.1

Ministry of Health is rewarding best performing students with marks between 80 and 100 in Biology and Chemistry. The reward is a laptop for those who succeeded in both subjects and a dictionary for those who succeeded in one subject. Using MS Excel answer below questions:

	Marks in Biology	Marks in Chemistry	Rewarded with a laptop	Rewarded with a dictionary	Not re-warded
Kabera	70	92			
Umutoni	84	88			
Mugabo	60	75			
Isimbi	90	93			
Uwase	55	70			
Uwacu	70	81			
Gihozo	98	95			
Rugwiro	78	80			
Kamikazi	62	68			
Gakuru	80	82			
Total laptops/ dictionaries given					

a. Write an Excel function to find students who are to be rewarded with laptops, dictionaries and those not rewarded
b. Determine the number of students that have not been rewarded?
c. How many laptops and dictionaries will be given?
d. In which subject does Kabera have more marks?
e. In which subject does Umutoni have minimum marks
f. Use Excel logical functions to fill the table above

A condition is an expression that either evaluates to true or false. The expression could be a function that determines if the value entered in a cell is of numeric or text data type, if a value is greater than, equal to or less than a specified value, etc

Logical Function is a feature in Excel that allows excel users to introduce automated decision-making when executing formulas and functions.
The role of functions in this is to check if a condition is true or false. It combines multiple conditions together and comes up with a result depending on the result of the evaluation of the condition.

a. IF Function

The If function checks whether data in a cell meets a certain condition and returns one value which can be True or False

- **Syntax: = IF(Logical_test, Value_If_True, Value_If_False)**

The If function takes as arguments the logical test, checks if it evaluates to true and if so returns as a result the content of the second argument and if false the content of third argument is returned

- **Example 1:**

Figure 1. 1. The use of If function to compare names

In the above example the If function with its arguments is entered in the cell where the result is to appear.

To apply that function in other cells proceed like this:

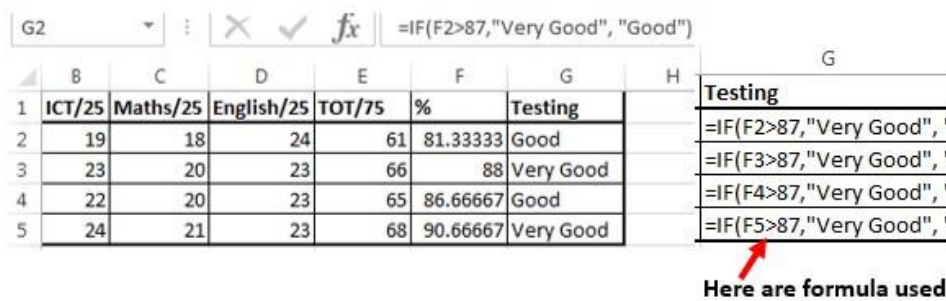
1. Place the cursor in the bottom corner of the cell

2. Hold down the left key, scroll down to other cells and release the left button

The **If** function in the above examples checks if the two names are alike and if yes, the function writes MATCH in the cell, if not the function writes DON'T MATCH

- **Example 2:**

Considering the marks obtained by Irasubiza, Karenzi, Byukusenge and Shyaka in ICT, Maths and English. The If function checks if the marks are greater than 87 and gives to the candidate the **Very Good** note else the Good note is given.



	B	C	D	E	F	G	H	G
1	ICT/25	Maths/25	English/25	TOT/75	%	Testing		Testing
2	19	18	24	61	81.33333	Good		=IF(F2>87,"Very Good", "
3	23	20	23	66	88	Very Good		=IF(F3>87,"Very Good", "
4	22	20	23	65	86.66667	Good		=IF(F4>87,"Very Good", "
5	24	21	23	68	90.66667	Very Good		=IF(F5>87,"Very Good", "

Figure 1. 2. Use of if function to award grades

b. AND Function

The Excel **AND function** is a logical function used to test if two or many conditions are true. The result is **TRUE** if all the conditions are true else the result is **FALSE**

- **Syntax: =AND (Logical1, Logical2, logical3,…)**
- **Example:**

In the table below the **And function** checks if people in the table studied Education and that their age is greater than 18

	A	B	C	D
1	NAME	EDUCATION	AGE	APPROVED
2	Izabayo	Chemistry	21	TRUE
3	Kagabo	Geography	20	FALSE
4	Azabe	Chemistry	19	TRUE
5	Twahirwa	Math	23	FALSE
6	Uwera	Biology	21	FALSE
7	Cyusa	Biology	18	FALSE

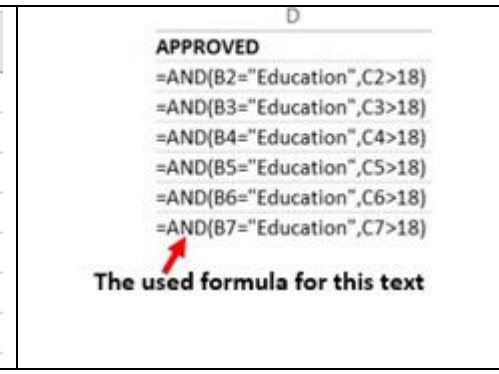


Figure 1. 3. Results of And function and on the left functions used

Note: the **And function** may have more than two arguments and for the results to be True all the arguments must evaluate to TRUE and if one of the arguments is false all the result is FALSE

Interpretation of the results:

The second, fourth, fifth and seventh rows evaluate to True as the education for all those rows is Education and the age is greater than 18 while the remaining rows evaluate to FALSE as they don't meet the two criteria.

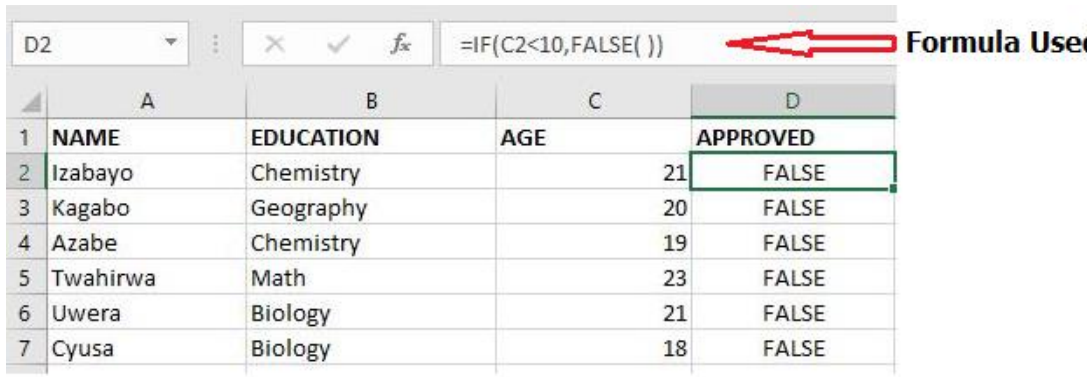
c. FALSE Function

The FALSE function takes no arguments and generates the Boolean value FALSE. It is used to compare the results of a condition or function that either returns true or false

- **Syntax: =False ( )**

The false function takes no argument but just returns the logical value False

•**Example**: The False function used in the example below returns FALSE if the age entered in C2 is less than 20 (C2<10)



	A	B	C	D
1	**NAME**	**EDUCATION**	**AGE**	**APPROVED**
2	Izabayo	Chemistry	21	FALSE
3	Kagabo	Geography	20	FALSE
4	Azabe	Chemistry	19	FALSE
5	Twahirwa	Math	23	FALSE
6	Uwera	Biology	21	FALSE
7	Cyusa	Biology	18	FALSE

Figure 1. 4. The use of the False function in Excel

Interpretation:

The used function "=IF(C2<10,FALSE( ))" will check if the C2 cell data is less than 10, if so it will return **False** as a result else it will return **True**. The same function will be applied to other cells by changing the cell position

d. NOT Function

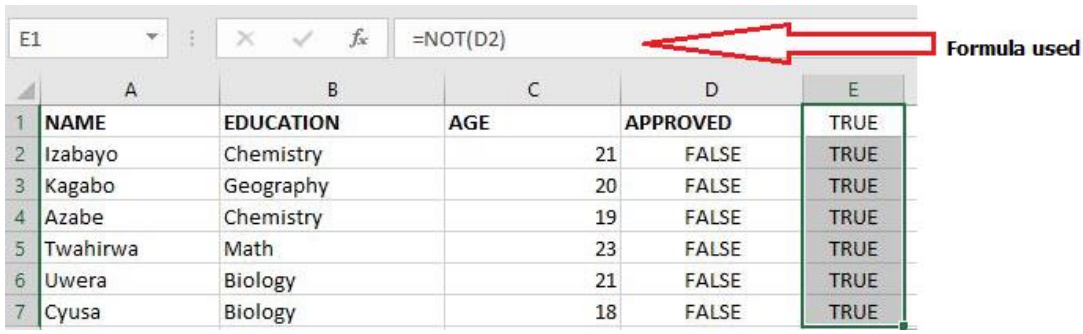
The Excel **NOT function** returns the opposite of a given logical or Boolean value. When given TRUE, NOT returns FALSE. When given FALSE, NOT returns TRUE. Use the NOT function to reverse a logical value.

- **Syntax: =NOT(Logical)**

The not function takes one logical expression as an argument. It returns an error if more than one argument is used.

- **Example**

The table below will have all its content returned to **True** by the use of the NOT function. If the results to reverse were got by using a formula the Not function can be put in front of the function/formula to make the latter an argument of the Not function.



	A	B	C	D	E
1	**NAME**	**EDUCATION**	**AGE**	**APPROVED**	TRUE
2	Izabayo	Chemistry	21	FALSE	TRUE
3	Kagabo	Geography	20	FALSE	TRUE
4	Azabe	Chemistry	19	FALSE	TRUE
5	Twahirwa	Math	23	FALSE	TRUE
6	Uwera	Biology	21	FALSE	TRUE
7	Cyusa	Biology	18	FALSE	TRUE

Figure 1. 5. Not function and its results

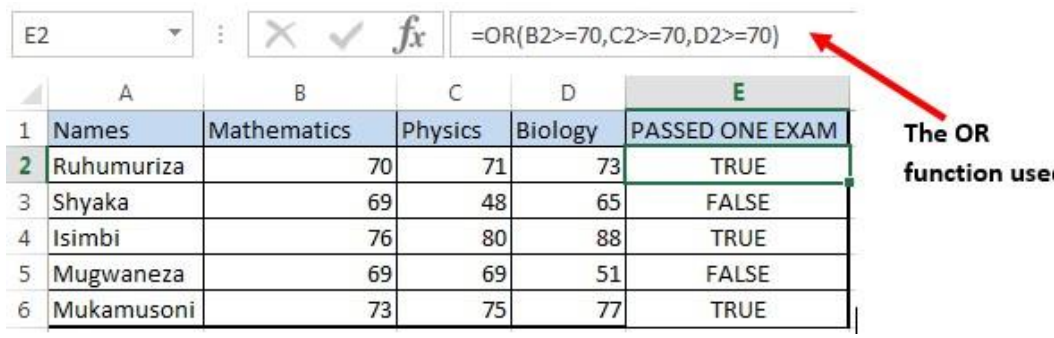
Note: If the results in column D2 were got by using the function "=IF(C2<10,FALSE( ))" the result in column E2 can be got by using the function "=NOT(IF(C2<10,FALSE( )))". As always the formula/function in one cell can be applied to other cells by pasting it in those cells

e. The OR function

The OR function is a logical function to test multiple conditions at the same time. OR returns either TRUE or FALSE.

- **Syntax: = OR(logical1, Logical2, …)**
- **Example:**

The **OR function** in the screenshot below checks for students who got more than 70% as the Pass mark in anyone of the three tests.



	A	B	C	D	E
1	Names	Mathematics	Physics	Biology	PASSED ONE EXAM
2	Ruhumuriza	70	71	73	TRUE
3	Shyaka	69	48	65	FALSE
4	Isimbi	76	80	88	TRUE
5	Mugwaneza	69	69	51	FALSE
6	Mukamusoni	73	75	77	TRUE

Figure 1. 6. The OR function to test if any of the arguments is true

APPLICATION ACTIVITY 1.1

1. Give the difference between IF and AND functions?
2. Which of these three functions in column B will give you TRUE as an answer?

	A	B
1	1	=AND(A1=1,A2=2)
2	1	=OR(A1=2,A2=1)
3		=IF(A1>1,"TRUE","FALSE")

1.1.2. Advanced Math Spreadsheet functions

ACTIVITY 1.2

You are given the following data in Microsoft Excel data sheet.

Name	ICT/50	English/50	Roman	Average	Square Root
Munezero	35	28			
Iradukunda	28	29			
Bagwaneza	40	33			
Bamurange	35	28			
Kwizera	27	33			
Butera	42	29			
Uwase	35	15			

Answer below questions:

1. Convert ICT marks into Roman style?
2. Discuss on how to calculate the modulus of the students' marks?
3. Calculate the square root of student average marks?
4. Discuss the conversion from roman style to Arabic style number?

Mathematical functions are used to calculate values basing on what is in cells, perform operations on a cell content, fetch values after an operation based on the search criteria and much more. Some of the functions to be seen here are Abs ( ), Arabic ( ), Roman ( ), Base ( ), Mod ( ) and Sqrt ( )

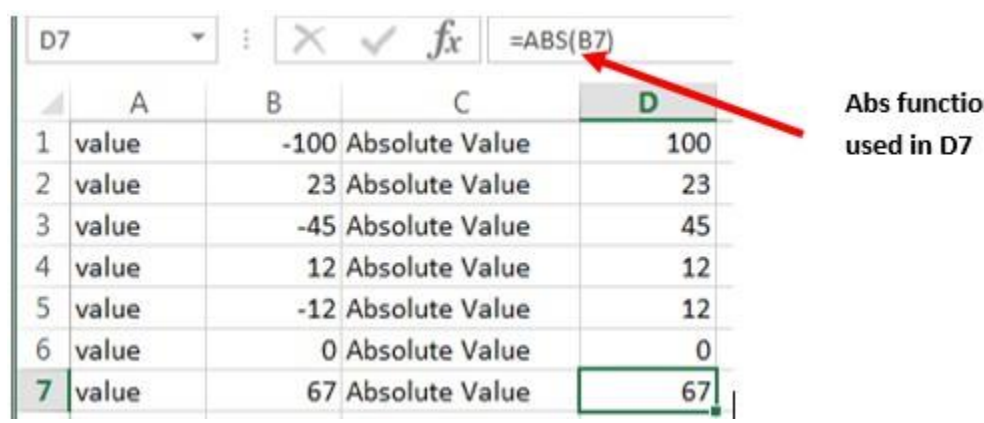
a. ABS

The Excel ABS function returns the absolute value of any provided number.

- **The syntax** of the function is: **ABS (number)**

Where the numerical argument is the positive or negative numeric value for which the absolute value is to be calculated.

Examples:



	A	B	C	D
1	value	-100	Absolute Value	100
2	value	23	Absolute Value	23
3	value	-45	Absolute Value	45
4	value	12	Absolute Value	12
5	value	-12	Absolute Value	12
6	value	0	Absolute Value	0
7	value	67	Absolute Value	67

Figure 1. 7. Example of the use of Abs Function

b. ARABIC

The Excel Arabic function converts a Roman numeral into an Arabic numeral. The syntax of the function is: **ARABIC (text)**

Where the text argument is a text representation of a Roman numeral not exceeding 255 characters.

Note that:

- If supplied directly to the function, the text argument must be encased in quotation marks;
- If an empty text string is supplied, the Arabic function returns the value 0;

- The Arabic function was only introduced in Excel 2013 and so is not available in earlier versions of Excel.

Below are five examples of converting ARABIC to NUMBERS

Formulas:

	A	B
1		=ARABIC("IV")
2		=ARABIC("-IV")
3		=ARABIC("MCXX")
4	MMXV	=ARABIC(A4)
5		=ARABIC("")

Results:

	A	B
1		4
2		-4
3		1120
4		2015
5		0

Figure 1. 8. Results of using an Arabic function

c. ROMAN

The Excel ROMAN function converts an Arabic number to a Roman number. This means that if a function is supplied with an integer, the function returns a text string showing the Roman numeral form of the number.

The syntax of the function is: **ROMAN** (Number, [form])

- Where **Number** is any Arabic number and the form specifies the presentation format of the Roman number to be calculated. The formats to choose from are displayed after writing the number to convert and writing the comma but the default (classic) is used.

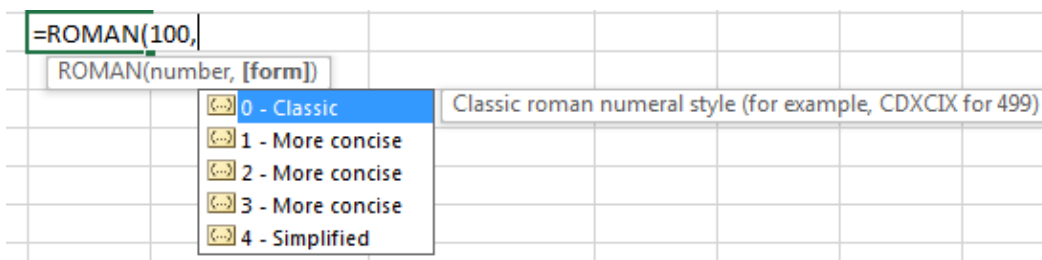


Figure 1.9. Different Roman numbers formats

- **Roman Function use examples**

In the following spreadsheet, the Excel Roman function is used to convert the number 1999 to different forms of Roman numerals.

	A	B
1	=ROMAN(1)	I
2	=ROMAN(5)	v
3	=ROMAN(23)	XXIII
4	=ROMAN(10)	X

Figure 1. 10. Results of a Roman function

d. BASE

The Excel Base function converts a number into a supplied base and returns a text representation of the calculated value. The Base function was introduced in Ms Excel 2013 and therefore, it is not available in earlier versions of Excel.

The spreadsheet below shows three examples of the Excel Base Function.

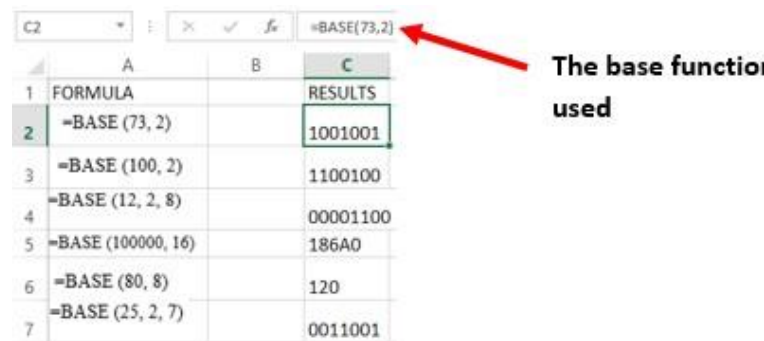


Figure 1.11. Results of a Base function

e. MOD

The Excel MOD function returns the remainder of a division between two supplied numbers.

The syntax of the function is: =**MOD (number, divisor)**

The spreadsheet below shows four simple examples of the Excel Mod function.

C	D	E	F
		=MOD(100,30)	10
		=MOD(10,6)	4
		=MOD(5,2)	1
35	4	=MOD(C8,D8)	3
34.5	34	=MOD(C5,D5)	0.5

Figure 1.12. MOD Function Results

f. SQRT

The Excel **SQRT Function** calculates the positive square root of a supplied number.

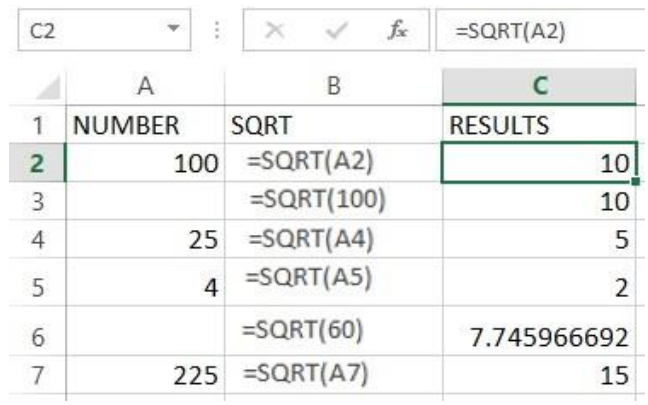
The syntax of the function is: **SQRT (number)**

- Where the number argument is the numeric value for which the square root is to be found.

If the supplied number is negative, the Sqrt function returns the **#NUM! Error**.

- **Excel Sqrt Function Examples**

The following spreadsheet shows three simple examples of the Excel Sqrt function.



	A	B	C
1	NUMBER	SQRT	RESULTS
2	100	=SQRT(A2)	10
3		=SQRT(100)	10
4	25	=SQRT(A4)	5
5	4	=SQRT(A5)	2
6		=SQRT(60)	7.745966692
7	225	=SQRT(A7)	15

Figure 1. 13. Results of a Sqrt function

APPLICATION ACTIVITY 1.2

1. Using Excel change the following Roman into Arabic style

   a. MCCIII
   b. XLIX
   c. CMV
   d. XXIII

1.1.3. Advanced Statistical Spreadsheet functions

ACTIVITY 1.3

The table below contains students' marks.

Name	ICT	Biology	Mathematics	Total Marks	Average
Rutikanga	98	78	95		
Mukagasana	99	86	60		
Murekatete	60	90	92		
Gatete	90	73	50		

Answer the questions that follow:

a. Calculate the average marks of every student

b. Give the name of the one who has more marks in:

i. ICT

ii. Biology

iii. Mathematics

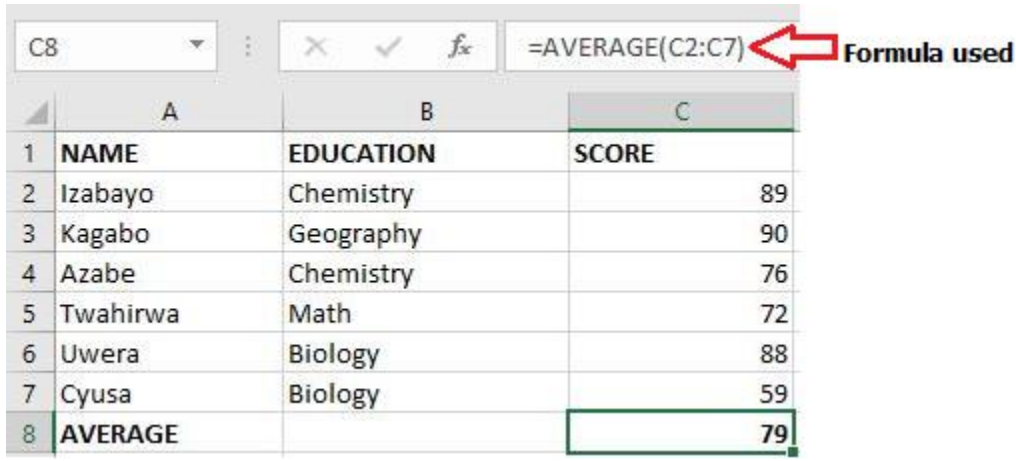
a. AVERAGE

The AVERAGE function in Excel returns the arithmetic mean of a list of supplied numbers, where the number arguments are a set of one or more numeric values, or arrays of numeric values, for which the average is to be calculated.

- ***Syntax of AVERAGE Function in Excel***

= Average (Number1, Number2, …)

An example of how Average function is used is displayed in the screenshot below:



	A	B	C
1	**NAME**	**EDUCATION**	**SCORE**
2	Izabayo	Chemistry	89
3	Kagabo	Geography	90
4	Azabe	Chemistry	76
5	Twahirwa	Math	72
6	Uwera	Biology	88
7	Cyusa	Biology	59
8	**AVERAGE**		**79**

Figure 1.14 Average function Results

b. AVERAGEIF

AVERAGEIF Function in Excel finds and returns the average of array that meets the specific condition. The AVERAGEIF function in Excel supports logical operators (>, <, <>, =)

- **Syntax of AVERAGEIF Function in Excel:**
  =AVERAGEIF (range, criteria, [average_range]) Where:
- **Range**: An Array of range to be tested against the supplied criteria.
- **Criteria**: The criteria or condition on which average has to be calculated.
- **[average_range]**: An optional array of numeric values for which the average is to be calculated.

Example of AVERAGEIF Function in Excel

In the Excel screenshot below the averages of cells meeting certain conditions have been calculated. Those conditions are: cells with scores greater than 70, average for Irasubiza and average for science courses.

	A	B	C
1	**NAME**	**EDUCATION**	**SCORE**
2	Karekezi	Biology	89
3	Cyiza	Chemistry	90
4	Shyaka	Biology	82
5	Irasubiza	Math	76
6	Dukundane	Biology	72
7	Shyaka	Chemistry	88
8	Irasubiza	Biology	83
9	Gakwandi	ICT	59
10	Irasubiza	Chemistry	87
11			
12	AVERAGE		80.66666667
13		**Folumas Used**	
14	Average of Score Greater than 70	AVERAGEIF(C2:C10,">70")	83.375
15	Average score of Irasubiza	AVERAGEIF(A2:A10,"Irasubiza",C2:C10)	82
16	Average score of Chemistry Subject	AVERAGEIF(B2:B10,"Chemistry",C2:C10)	88.33333333

Figure 1.15. The use of Averageif function

c. LARGE

The LARGE Function in Excel returns the largest value from an array of numeric values.

- **The syntax of LARGE Function is**

=LARGE (array, k)

Where:

- **Array** – An array of numeric values from which to find the K^{th} largest value.
- **K-** The index. Value of K that is passed to find the K^{th} largest value.

Example of LARGE Function in Excel:

1	**NAME**	**EDUCATION**	**SCORE**				
2	Karekezi	Biology	89				
3	Cyiza	Chemistry	90				
4	Shyaka	Biology	82				
5	Irasubiza	Math	76		2nd largest value	LARGE(C2:C10,2)	89
6	Dukundane	Biology	72		5th Largest value	LARGE(C2:C10,5)	83
7	Shyaka	Chemistry	88		Last	LARGE(C2:C10,9)	59
8	Irasubiza	Biology	83				
9	Gakwandi	ICT	59				
10	Irasubiza	Chemistry	87				
11							
12	AVERAGE		80.66666667				
13		**Folumas Used**					
14	Average of Score Greater than 70	AVERAGEIF(C2:C10,">70")	83.375				
15	Average score of Irasubiza	AVERAGEIF(A2:A10,"Irasubiza",C2:C10)	82				
16	Average score of Chemistry Subject	AVERAGEIF(B2:B10,"Chemistry",C2:C10)	88.33333333				

Figure 1.16. Use of LARGE function in Excel

Interpretation:

- First Example finds the 2nd Largest Value as 89
- Second Example finds the 5th Largest Value as 72
- Third Example finds the 7th Largest Value as 55

d. MEDIAN

MEDIAN function in Excel returns the statistical median or middle value of a list of supplied numbers.

Syntax of MEDIAN Function in Excel is: = MEDIAN (number1, [number2], …) Where the number arguments are a set of one or more numeric values for which to calculate the median.

An example of how the Median function is used in Excel is shown in the table below:

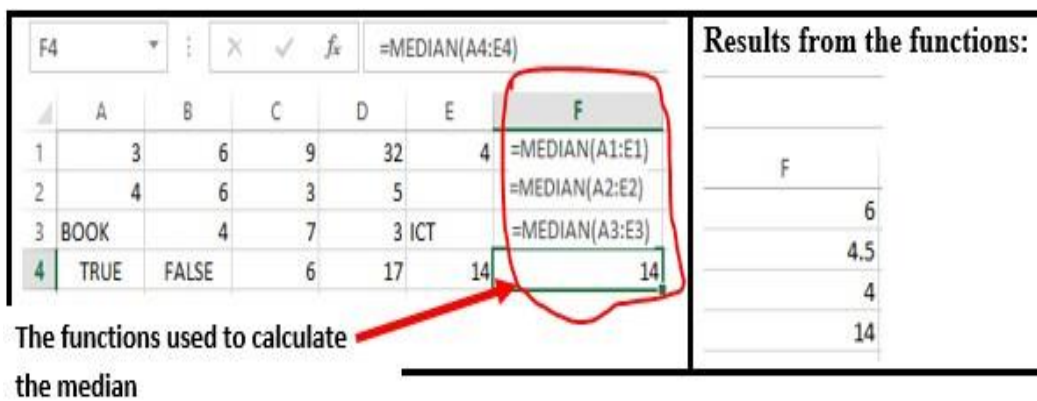


Figure 1.17. The use of the median function and the results

- When the total number of supplied values is odd, the median is calculated as the middle number in the group.

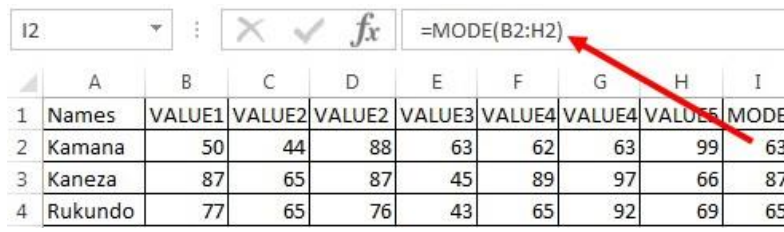
- When the total number of supplied values is even, the median is calculated as the average of the two numbers in the middle.
- Cells containing Text values, logical values, or no value are ignored.

e. MODE Function

MODE function in Excel returns the mode which is the most frequently occurring number in a group of supplied arguments.

The Syntax of MODE Function in Excel is =MODE (number1, [number2],…)

Where the number of arguments are a set of one or more numeric values for which you want to calculate the mode.



	A	B	C	D	E	F	G	H	I
1	Names	VALUE1	VALUE2	VALUE2	VALUE3	VALUE4	VALUE4	VALUE5	MODE
2	Kamana	50	44	88	63	62	63	99	63
3	Kaneza	87	65	87	45	89	97	66	87
4	Rukundo	77	65	76	43	65	92	69	65

Figure 1.18. The use of the Mode function

Cells containing Text values, logical values, or no value are ignored.

- Mode (most frequently occurring value) is calculated row wise in above example.

APPLICATION ACTIVITY 1.3

1.Using the below students records. Answer the following questions:

COND

	A	B	C	D	E	F	G	H
1	NAMES	ICT/40	ENGLISH/40	MATHS/40	AVERAGE	AVERAGEIF	LARGE	MEDIAN
2	MULISA	34	27	35				
3	MUTONI	25	30	32				
4	KABANDA	39	39	15				
5	KABERA	35	25	17				
6	KAGIRIMPUNDU	37	27	30				
7	MUTONI	25	39	38				
8	MUTETERI	26	36	36				
9	MUTONI	18	25	39				
10								

a. Calculate the average for each student?
b. Display the largest marks for KABERA?
c. Calculate the greatest average marks for Mutoni?
d. Calculate the median marks for ICT ?

1.1.4. Text spreadsheet functions

ACTIVITY 1.4

Mukamana, a human resource manager of a company in Rwanda received a file containing manpower names and phone numbers from one of their branches. Names in the file are not uniformly written and having many columns.

The file has more than 1000 rows (only 4 are shown) and looks like

the in Table 1 while she wants data to be arranged like in Table 2

	A	B	C	D	E	F	G
1	First Name	Last Name	MTN number	Tigo number		Names	Phone Number
2	claudine	uwimana	078327215	072327215		UWIMANA Claudine	078327215 or 072327215
3	fabien	Habingarwa	078497251	072327259		HABINGARWA Fabien	078497251 or 072327259
4	ERNEST	rukuNDO	078327179	072321793		RUKUNDO Ernest	078327179 or 072321793
5	GLORIOSE	ISIMBI	078168255	071320455		ISIMBI Gloriose	078168255 or 071320455
6	Table 1					Table 2	

a. Discuss what Mukamana will do to arrange data in Table 1 and make it look like the data in Table 2

b. Estimate the time required to do this if Table 1 has 1000 rows

c. Using functions make the data in Table 1 look like those in Table 2 d. For the 1000 rows to be reorganized discuss the amount of time

Excel has functions which facilitate an automatic manipulation of text which would take too much time if it was done manually.

For example in the case presented in the activity above if one has to combine data from two rows into one for a total of 1000 rows by copying data from one row and pasting it next to data in the other row and if one can do one row in
2 seconds, the whole exercise would take up to 33 minutes. Considering that some names which are in upper case must be in lower case and some in lower must be in upper which would require rewriting the names the whole exercise can take up to an hour.

That is where Excel ingeniosity comes in by providing functions which can allow one to do this in less than one minute. The section below explore the functions that can be used to do such a task

a. CHAR

The CHAR function returns the character based on the ASCII value. The CHAR function is a built-in function in Excel that is categorized as a String/Text Function.

The syntax for the CHAR function is:

- **CHAR(ascii_value)**

The ASCII value is used to retrieve the character.

Example: Explore how to use the CHAR function as a worksheet function in Microsoft Excel:

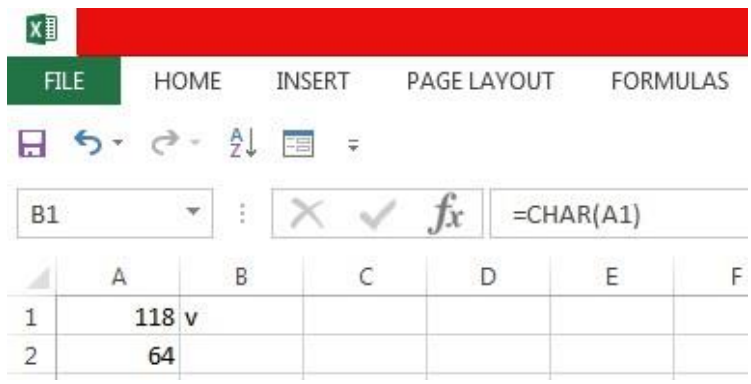


Figure 1.19. Illustration on the use of the CHAR function

Based on the Excel spreadsheet above, the following use of the CHAR function would return:

=CHAR(A1) : Gives Result: “v”

=CHAR(A2) : Gives Result: “@”

=CHAR(72) : Gives Result: “H”

=CHAR(109) : Gives Result: “m”

b. CONCATENATE

The CONCATENATE function in Excel is designed to join different pieces of text together or combine values from several cells into one cell.

The syntax of Excel CONCATENATE is as follows:

CONCATENATE (text1, [text2], …)

Where text is a text string, cell reference or formula-driven value.
Below is an example of using the CONCATENATE function in Excel in which data from two cells has been combined.
The simplest CONCATENATE formula to combine the values of cells A1 and B1 is as follows:
=CONCATENATE(A1, B1)

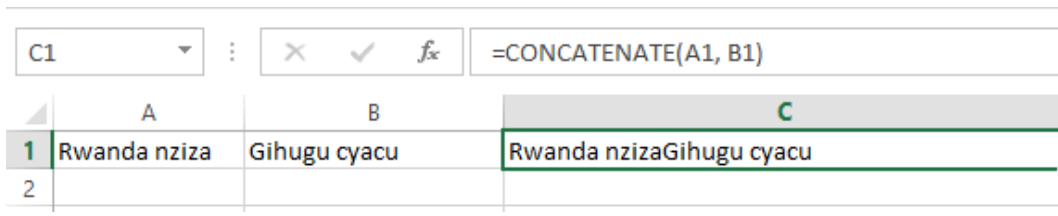


Figure 1.20. Use of the concatenate function

c. UPPER

The UPPER function is a built-in function in Excel that is categorized as a *String/ Text Function*. It converts a text (String) into uppercase

Example:

A1==" better technology for the best future"
=UPPER(A1)
Result: "BETTER TECHNOLOGY FOR THE BEST FUTURE"

d. LOWER

The LOWER function is used to convert text (String) into small cap text
Example: B1="EXCEL SCIENCES THROUGH TECHNOLOGY"
=LOWER (B1)
Result: excel sciences through technology

APPLICATION ACTIVITY 1.4

1. The text in A1 is KAREKEZI. The text in A2 is KALINDA. What would be the result of the following formula? =CONCATENATE (A1, A2)
   i. KAREKEZIKALINDA
   ii. KAREKEZI KALINDA
   iii. KAREKEZI, KALINDA
   iv. KAREKEZI, KALINDA
   v. KALINDA, KAREKEZI
2. Suppose you want to combine the street address in A1, with the city in A2 and the state in A3. Each component should be separated by a comma. What formula would be best?

1.2. Using formula & functions from different sheets

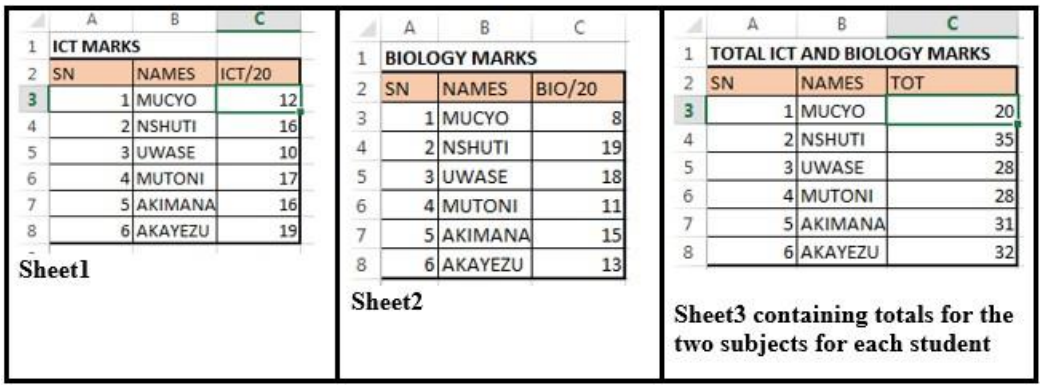
ACTIVITY 1.5

Suppose that you have a class of 15 students in Senior 5 . You have also the marks for those students in three separate sheets where each sheet contains marks for each term

When the workbook has many sheets there is a possibility to get data from one sheet into another by using formula or functions.

Example 1:

Consider the example below which are data from two different sheets named Sheet1 and Sheet2. These sheets contain marks for ICT and for Biology. The teacher wants to make totals for each student for the two subjects and keep those totals in a separate sheet “Sheet3”



	A	B	C
1	ICT MARKS		
2	SN	NAMES	ICT/20
3	1	MUCYO	12
4	2	NSHUTI	16
5	3	UWASE	10
6	4	MUTONI	17
7	5	AKIMANA	16
8	6	AKAYEZU	19

Sheet1

	A	B	C
1	BIOLOGY MARKS		
2	SN	NAMES	BIO/20
3	1	MUCYO	8
4	2	NSHUTI	19
5	3	UWASE	18
6	4	MUTONI	11
7	5	AKIMANA	15
8	6	AKAYEZU	13

Sheet2

	A	B	C
1	TOTAL ICT AND BIOLOGY MARKS		
2	SN	NAMES	TOT
3	1	MUCYO	20
4	2	NSHUTI	35
5	3	UWASE	28
6	4	MUTONI	28
7	5	AKIMANA	31
8	6	AKAYEZU	32

Sheet3 containing totals for the two subjects for each student

Figure 1.21. Different Excel sheets where data from two sheets has been added

To achieve this go to the table in Sheet3 where totals of data from the two sheets has to be done then in the TOT column cell C3 write the formula to use which is

=Sheet1!C3+Sheet2!C3

Meaning that data from cell C3 of Sheet1 is added to data from cell C3 of sheet2

You can do this by writing formula from scratch or by:

- Writing the equal sign in the cell where total is to be written
- Going to the cell containing the first data to be added and selecting it
- Writing the + sign
- Selecting second data to be added by going to the sheet containing that data and selecting the right cell and lastly hitting enter

The formulas used to calculate the totals for the example above are in the image below:

	A	B	C
1	TOTAL ICT AND BIOLOGY MARKS		
2	SN	NAMES	TOT
3	1	MUCYO	=Sheet1!C3+Sheet2!C3
4	2	NSHUTI	=Sheet1!C4+Sheet2!C4
5	3	UWASE	=Sheet1!C5+Sheet2!C5
6	4	MUTONI	=Sheet1!C6+Sheet2!C6
7	5	AKIMANA	=Sheet1!C7+Sheet2!C7
8	6	AKAYEZU	=Sheet1!C8+Sheet2!C8

Figure 1.22. Formula used to calculate totals in sheet3

Example 2:

Consider another example in which two sheets Sheet1 and Sheet2 contains data (score) on different subjects. The average of marks contained in the two sheets is going to be calculated and kept in Sheet1.

The formula used is

=AVERAGE (Sheet1:Sheet2! C2:C10)

	NAME	SUBJECT	SCORE
2	karenzi	Maths	89
3	Shyaka	Biology	90
4	Irasubiza	Physics	76
5	Uwera	Geography	72
6	Bukusenge	Physics	88
7	Ngenzi	Biology	70
8	Kamali	Geography	80
9	Murebwayire	Maths	55
10	Kamanayo	Biology	59

Sheet 1

	NAME	SUBJECT	SCORE
2	karenzi	Maths	89
3	Shyaka	Biology	90
4	Irasubiza	Physics	76
5	Uwera	Geography	72
6	Bukusenge	Physics	88
7	Ngenzi	Biology	70
8	Kamali	Geography	80
9	Murebwayire	Maths	55
10	Kamanayo	Biology	59
11			
12	The Average of both sheets		75.444444

Sheet 2

Figure 1.23. Calculating the average by using data from two sheets

APPLICATION ACTIVITY 1.5

Consider the screenshots of excel tables containing data from the three sheets Sheet1, Sheet2 and Sheet3

	Sheet1				
Names	English/25	Kinyarwanda/25	Mathematics/25	total	average
Mbabazi	12	23	25		
Karenzi	20	12	19		
Uwizeyimana	21	22	23		
irasubiza	25	12	18		
Mukashyaka	17	17	18		
Dusabimana	19	19	19		
Kagenzi	20	12	12		

	Sheet1				
Names	English/25	Kinyarwanda/25	Mathematics/25	total	average
Mbabazi	12	23	25		
Karenzi	20	12	19		
Uwizeyimana	21	22	23		
irasubiza	25	12	18		
Mukashyaka	17	17	18		
Dusabimana	19	19	19		
Kagenzi	20	12	12		

	Sheet3				
Names	English/25	Kinyarwar	Mathemat	total3	average3
Mbabazi	11	11	17		
Karenzi	20	20	19		
Uwizeyim	24	12	12		
irasubiza	12	11	11		
Mukashya	15	15	15		
Dusabima	15	15	15		
Kagenzi	21	10	10		

a. Calculate the total and average of every student per sheet

b. Calculate the total1, total 2 and total 3 into total 3 of the third sheet

c. Calculate the average1, average 2 and average 3 into average 3 of the third sheet

1.3.1. **Protecting & unprotecting worksheet;**

ACTIVITY 1.6

At the end of the school year, GS Kamucyo teachers receive student reports so that they may fill in marks for the third term, do totals and average for the whole year. However, the head teacher fears that teachers may mistakenly change even marks for Term I and Term II

a. Which advice would you give to the head teacher on what to do in order to avoid this?
b. If this advice is adopted, teachers won't be able to edit term I and II. What can be done to allow them to do it if it is found necessary?

Worksheet protection is to prevent other users from accidentally or deliberately changing, moving, or deleting data in a worksheet, you can lock the cells on your Excel worksheet and then protect the sheet with a password.

With worksheet protection, you can make only certain parts of the sheet editable and users will not be able to modify data in any other region in the sheet.

Rules to follow for protecting worksheets with strong protection

a. Protect your sheets with strong passwords that include different types of alpha numeric characters and special symbols. At that, try to make passwords as random as possible
b. Protect the workbook structure to prevent other people from adding, moving, renaming or deleting the sheets.
c. For workbook-level security, encrypt the workbook with different passwords from opening and modifying. If possible, store your Excel files with sensitive information in a secure location, e.g. on an encrypted hard drive.

To protect a sheet in Excel 2019, 2016, 2013 and 2010, perform the following steps.

a. Under the **Review tab** click on **Protect Sheet**.
b. Type the password and click on **Ok**
c. Reenter password and click on **Ok**

When a sheet is protected, anyone will be able to read data but will not be able to modify it and once data in that sheet is modified this message below will be displayed

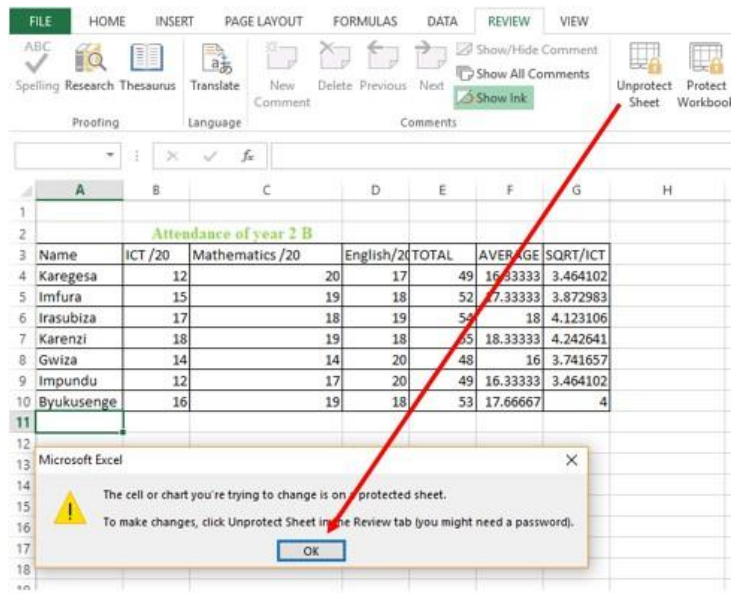


Figure 1.24 Unprotect a sheet

1.3.2. Lock &unlock cells, style, contents and other elements

a. How to Lock Cells for Editing and Protect Formulas

When a sheet is shared while some sheet cells must not be modified some rules have to be set so that data can be modified by anyone who wants it but not modified by someone who does not have the right to do so. In the table below a list of products will be sent to the customers. Customers will be able to modify some product records.

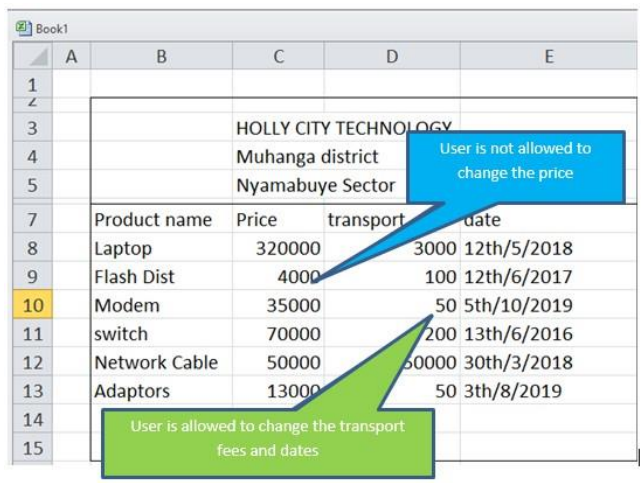


Figure 1.25 Table illustrates locked and unlocked cells

The great news is that you can lock cell, or a whole range of cells, to keep your work protected.

Here's how to prevent users from changing some cells.

- Type a password in the corresponding field.
- Be sure to remember the password or store it in a safe location because you will need it later to unprotect the sheet.

Select locked cells .

If only these two options are selected, the users of your sheet, including yourself, will be able only to select cells (both locked and unlocked).

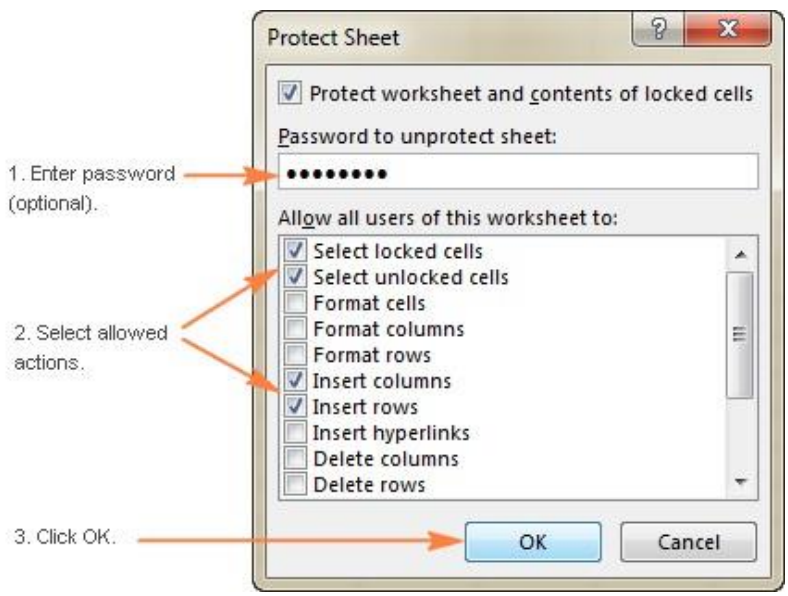


Figure 1.26 Options to choose for protecting a sheet

If the worksheet protection is nothing more than a precaution against accidental modification of the sheet contents by yourself or by the members of your local team, you may not want to bother about memorizing the password and **leave the password field empty**

Select the actions you allow the users to perform.

b. How to unprotect Excel sheet with password

To lock only specific cells and ranges in a protected worksheet

Follow these steps:

1. Select the cells you want to lock.
2. On the **Home** tab, in the **Alignment** group, click the small arrow to open the **Format Cells** popup window.

3. On the **Protection** tab, select the **Locked** check box, and then click **OK** to close the popup.
4. Right-click the sheet tab, and select **Unprotect Sheet f r o m** the context menu.

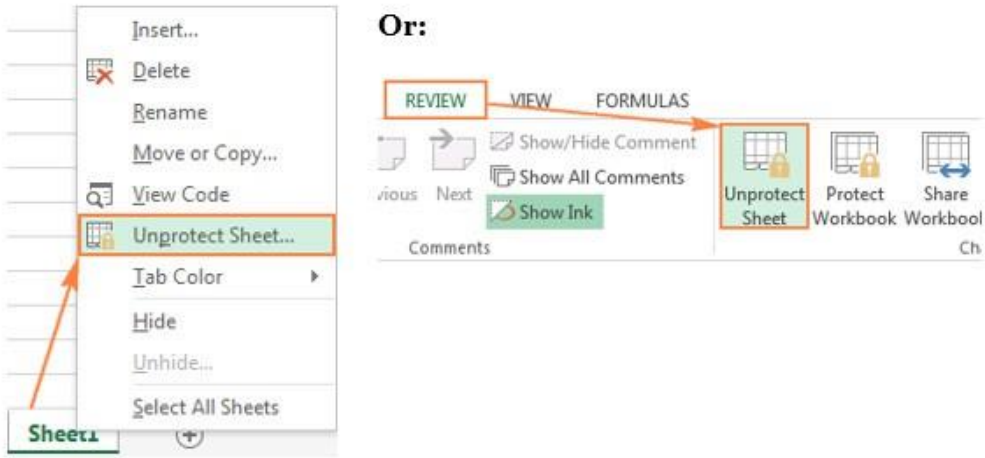


Figure 1. 27 Unprotect sheet

On the *Review* tab, in the *Changes* group, click **Unprotect Sheet**.

- On the *Home* tab, in the *Cells* group, click *Format*, and select **Unprotect Sheet** from the drop-down menu.

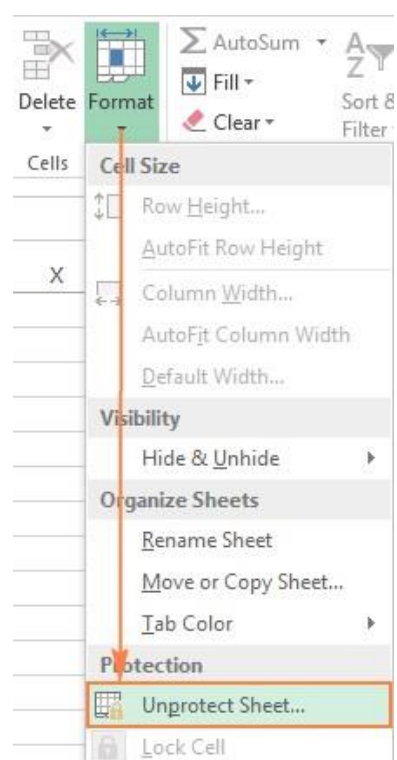


Figure 1.28. Unprotect sheet second method

APPLICATION ACTIVITY 1.6

Name	Age	School	Marks
Kalisa	12	G.S Mushubati	70
Gatete	15	G.s MWENDO	73
Kamana	20	Lycee de	70
Tumushime	17	GS MUHANGA	73

By considering the table above

1. Explain how the table can be protected?
2. Using MS Excel, protect marks and names columns?
3. What is the role of protecting a document?

1.4. Data validation

ACTIVITY 1.7

Trinity High school committee needs to record the parents' ID of their students and every ID has 16 digits.

Discuss about how committee will fix the numbers of digits

a) Discuss the message that will be appeared in case the entered records is not valid

Excel Data Validation is a feature that restricts (validates) user input to a worksheet. Technically, you create a validation rule that controls what kind of data can be entered into a certain cell.

Here are just a few examples of what Excel's data validation can do:

- Allow only numeric or text values in a cell.
- Allow only numbers within a specified range.
- Allow data entries of a specific length.
- Restrict dates and times outside a given time frame.
- Restrict entries to a selection from a drop-down list.
- Validate an entry based on another cell.
- Show an input message when the user selects a cell.

- Show a warning message when incorrect data has been entered.
- Find incorrect entries in validated cells.

For instance, you can set up a rule that limits data entry to 4-digit numbers between 1000 and 9999. If the user types something different, Excel will show an error alert explaining what they have done wrong. The window below shows a warning message that appears when data outside of the range (1000-9999) is entered.

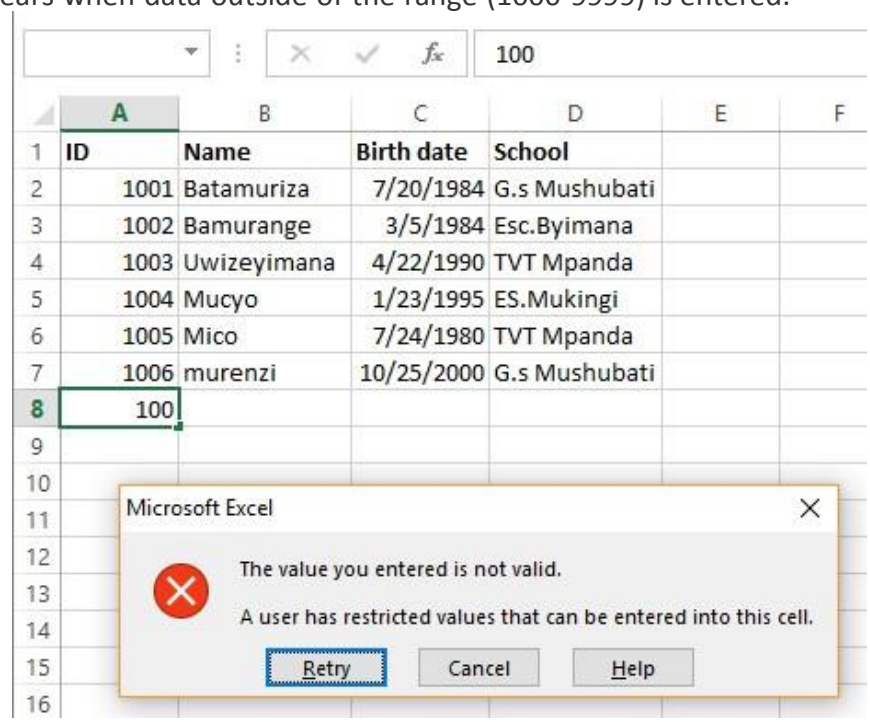


Figure 1.29 Data validation

How to do data validation in Excel

1. Select the cell(s) you want to create a rule for.
2. Select **Data >Data Validation**.

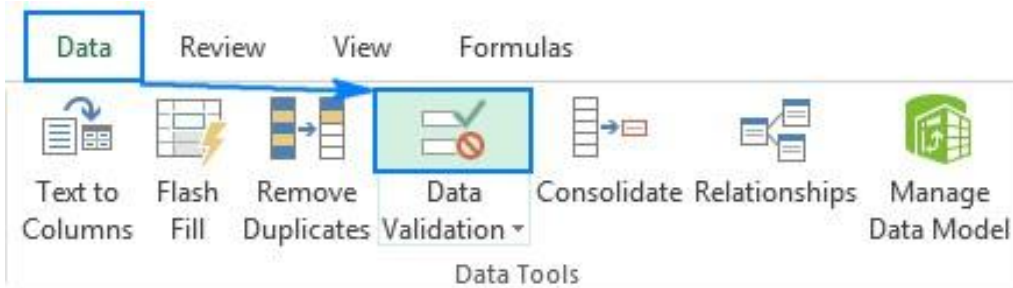


Figure 1.30 Data validation

3. On the **Settings** tab, under **Allow**, select an option.

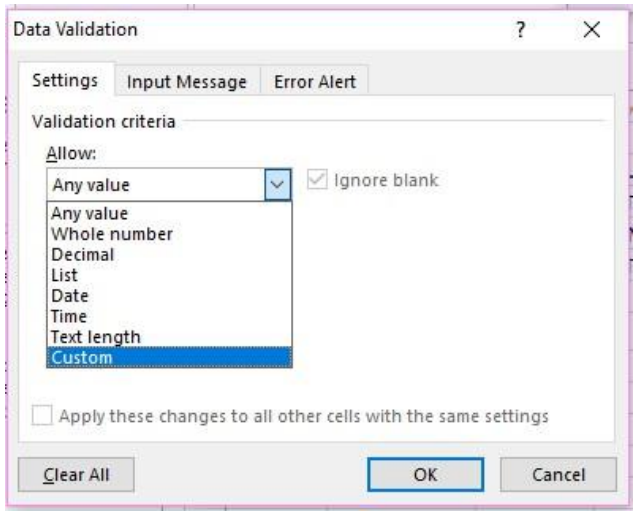


Figure 1. 31 Customize data

4. Under **Data**, select a condition:

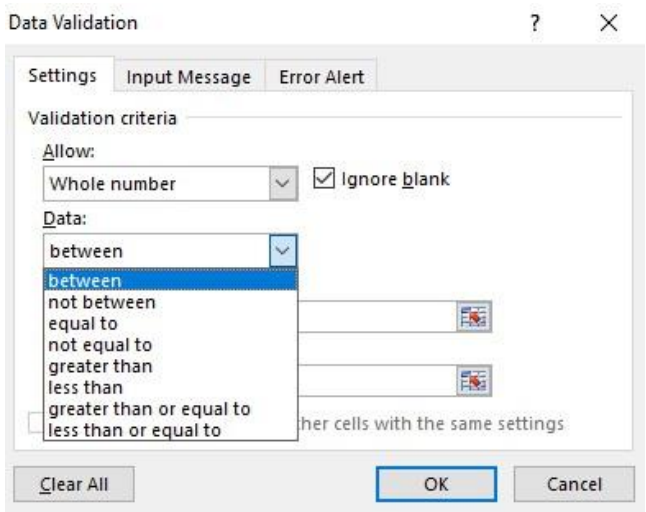


Figure 1. 32 condition of selecting range of numbers

5. On the **Settings** tab, under **Allow**, select an option:
6. Set the other required values, based on what you chose for **Allow** and **Data**. For example, if you select **between**, then select the **Minimum:** and **maximum:** values for the cell(s).

7. Select the **Ignore blank** checkbox if you want to ignore blank spaces.
8. If you want to add a **Title** and message for your rule, select the **Input Message** tab, and then type a title and input message.
9. Select the **Show input message when cell is selected** checkbox to display the message when the user selects or hovers over the selected cell(s).
10. Select OK.

As an example, let's make a rule that restricts users to entering a whole number between 1000 and 9999:

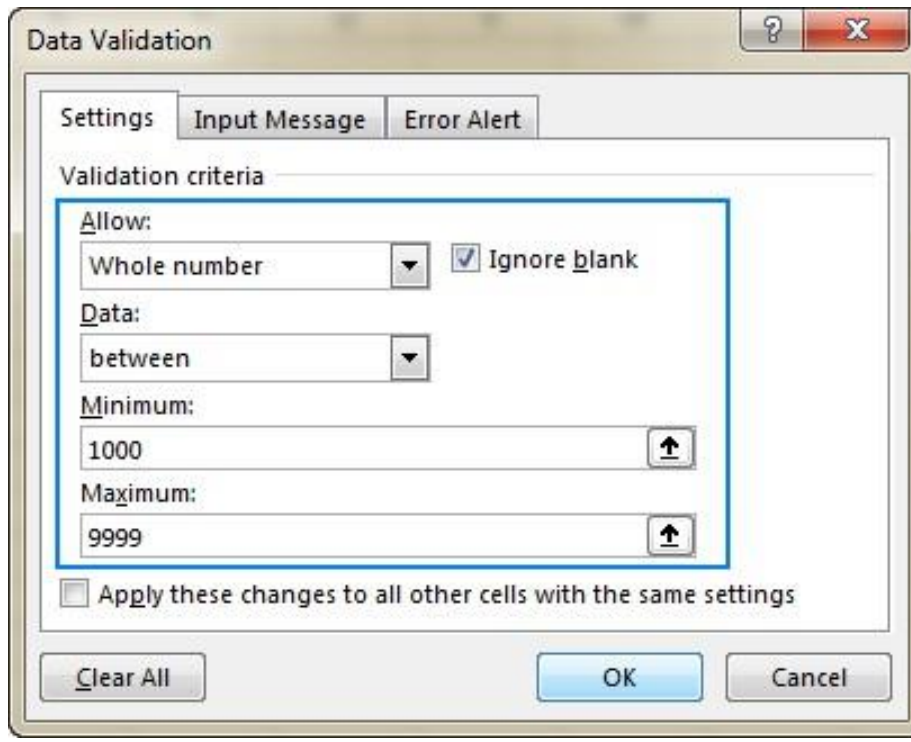


Figure 1.33 range number between 1000 to 9999

With the validation rule configured, either click OK to close the Data Validation window or switch to another tab to add an input message or/and error alert.

3. Add an input message (optional)

If you want to display a message that explains to the user what data is allowed in a given cell, open the *Input Message* tab and do the following:

- Make sure the Show input message when cell is selected box is checked.
- Enter the title and text of your message into the corresponding fields.
- Click OK to close the dialog window.

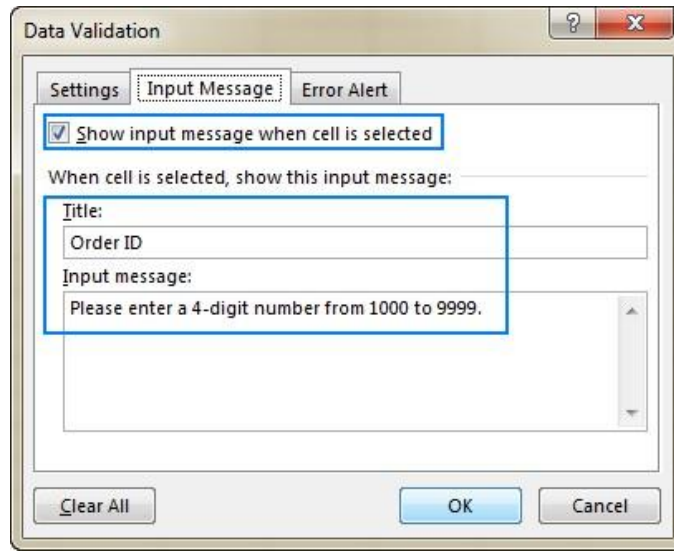


Figure 1.34 Input Message

As soon as the user selects the validated cell, the following message will show up:

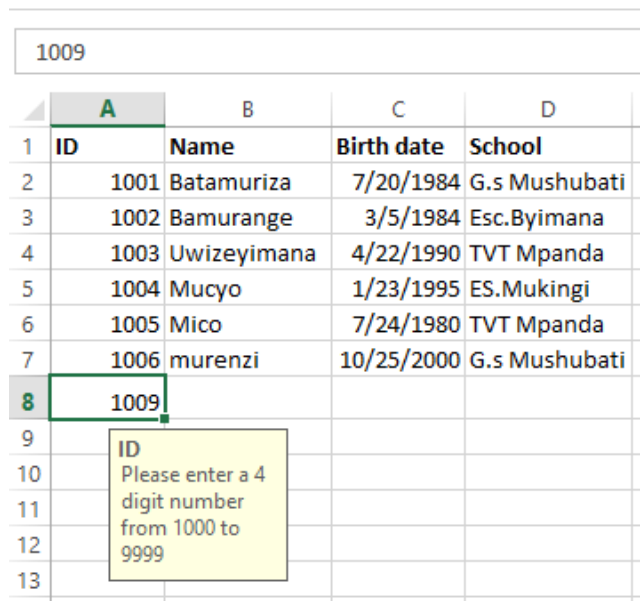


Figure 1.35. Message Box displayed

4. Display an error alert (optional)

To configure a custom error message, go to the *Error Alert* tab and define the

following parameters:

- Check the Show error alert after invalid data is entered box (usually selected by default).
- In the Style box, select the desired alert type.
- Enter the title and text of the error message into the corresponding boxes.
- Click OK.

Figure 1.36. Error Alert

APPLICATION ACTIVITY 1.7

1. Define the following Terms:
   a. Data validation
   b. Input message
   c. error Alert
2. What is the benefit of validating a document?
3. Analyze the table below and Apply an input message to IdNumber

IdNumber	District		
1001	Names	District	Salary
1002	Mutesi	Ruhango	80000
1003	Abayo	Muhanga	120000
1004	Murenzi	Nyagatare	105000
1005	Mutabazi	Rutsiro	300000
1006	Umubyeyi	Huye	82000

4.Validate column IdNumber so that the entered number must be between 1000 and 7777

1.5. Using other Excel templates

ACTIVITY 1.8

In the scenario below discuss the excel template to be used:

1. ICT Club members are trying to make a school calendar
2. Mbabazi, a Math teacher at Lycee de Nyanza wants to request for a loan of five million (5,000,000) from Umwalimu Sacco. The loan will be paid at the 11% interest rate in five years (5). The starting period of payment is 25/05/2019.

Do the followings:

a. By using loan amortization template, find out the last date of payment, number of months and years of payment.
b. What is the total interest to pay for this loan?

Microsoft Excel templates are a powerful part of Excel experience and a great way to save time. Excel templates can also help you create consistent and attractive documents that will impress your colleagues or supervisors.

Templates are especially valuable for frequently used document types such as Excel calendars, budget planners, invoices, inventories and dashboards.

a. Creating a workbook from an existing Excel template

Instead of starting with a blank sheet, you can quickly create a new workbook based on an Excel template. The right template can really simplify your life since it makes the most of tricky formulas, sophisticated styles and other features of Microsoft Excel that you might not be even familiar with.

To make a new workbook based on an existing Excel template, perform the following steps.

- Switch to the *File* tab
- Click *New*

Templates provided by Microsoft displayed.

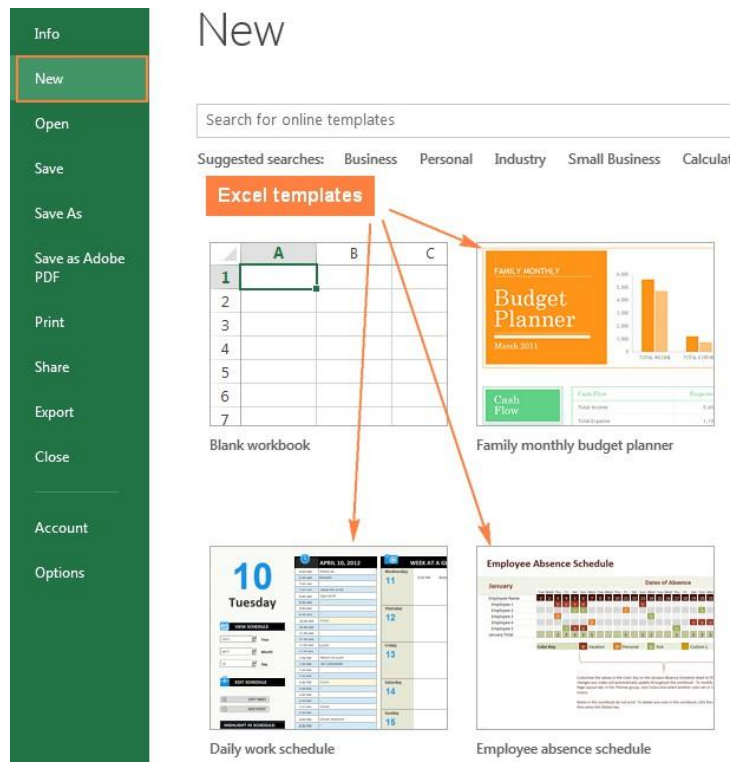


Figure 1.37. Different Excel template

1.To preview a certain template, simply click on it. A preview of the selected template will show up along with the publisher's name and additional details on how to use the template.

2. If you like the template's preview, click the **Create** button to download it.

For example, I've chosen a nice mini calendar template for Excel:

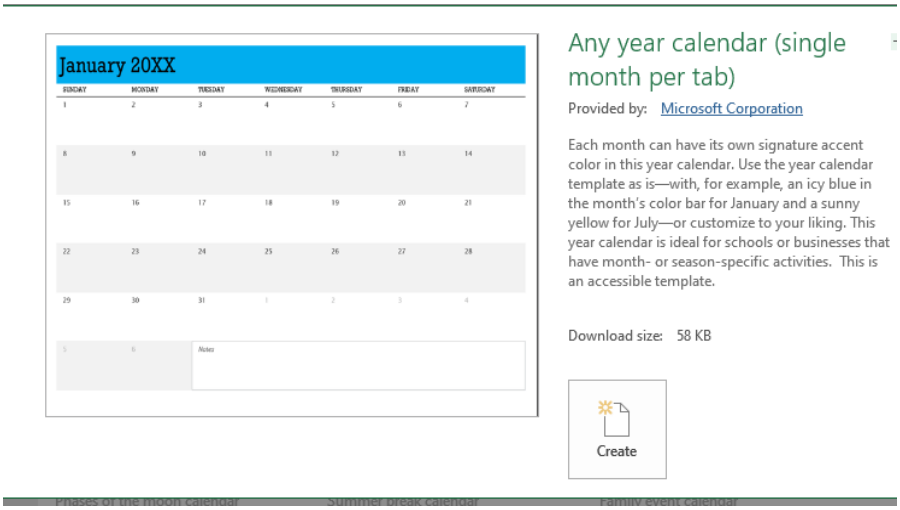


Figure 1.38. Creating a calendar by using the Mini calendar template app

That's it - the selected template is downloaded and a new workbook is created based on this template right away.

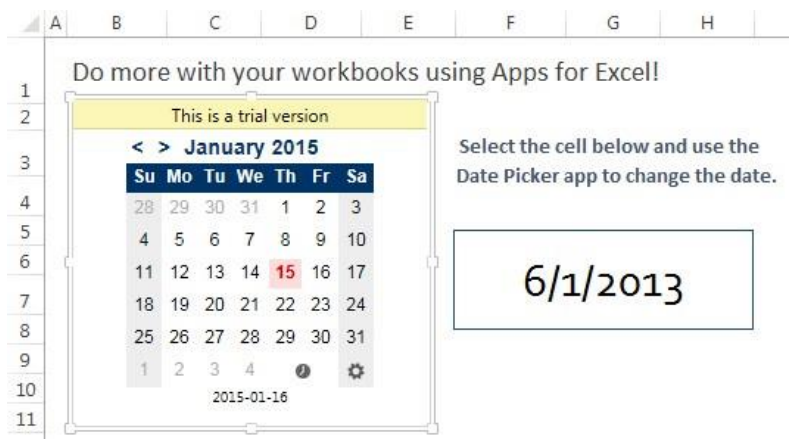


Figure 1.39. Calendar creation using excel templates

b. Finding more templates

To get a bigger selection of templates for your Excel, type a corresponding keyword in the search bar:

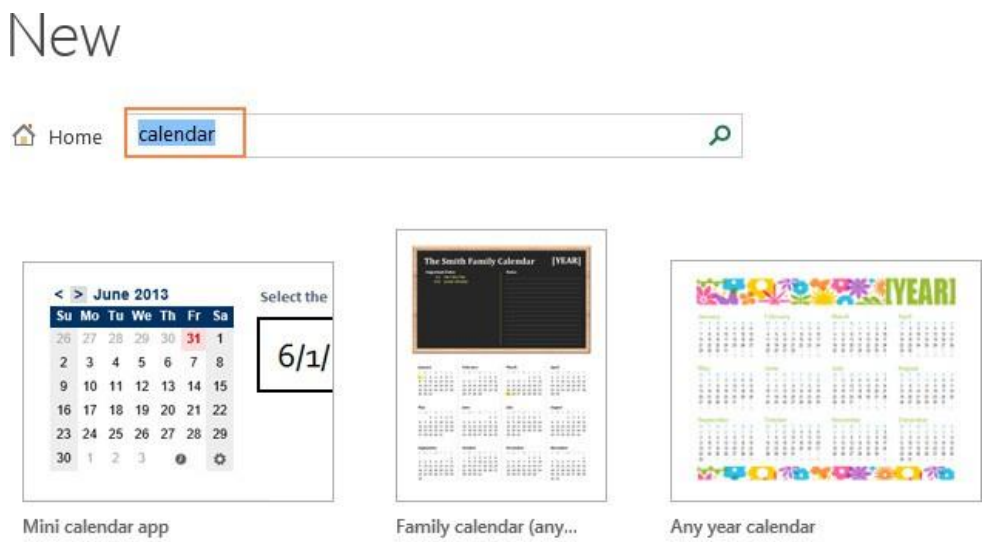


Figure 1.40. Different format of calendar

If you are looking for something specific, you can browse available Microsoft Excel templates by category. For example, see how many different calendar templates you can choose from:

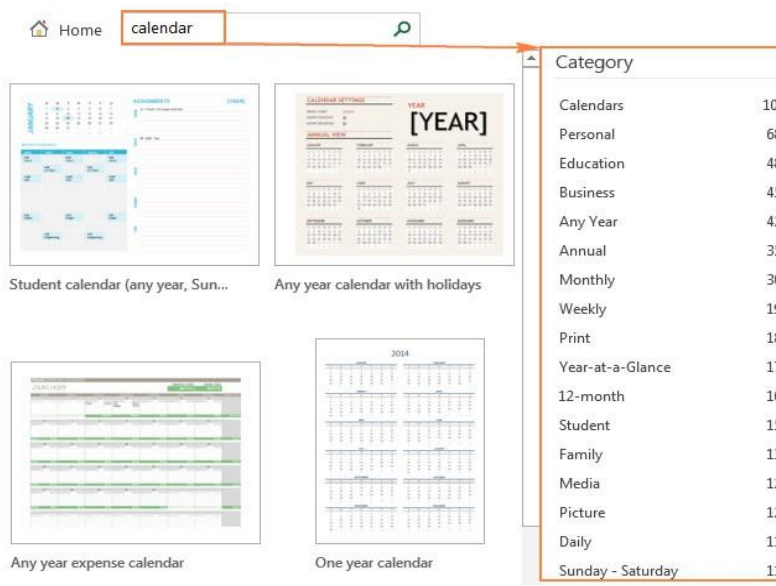


Figure 1.41. Format of Year calendar

Note. When you are searching for a certain template, Microsoft Excel displays all relevant templates that are available on the Office Store.

c. Making a custom Excel template

Making your own templates in Excel is easy. You start by creating a workbook in the usual way, and the most challenging part is to make it look exactly the way you want. It is definitely worth investing some time and effort both in the design and contents, because all formatting, styles, text and graphics you use in the workbook will appear on all new workbooks based on this template.
In an Excel template, you can use save the following settings:

- The number and type of sheets
- Cell styles and formats
- Page layout and print areas for each sheet
- Hidden areas to make certain sheets, rows, columns or cells invisible
- Protected areas to prevent changes in certain cells
- Text that you want to appear in all workbooks created based on a given template, such as column labels or page headers
- Formulas, hyperlinks, charts, images and other graphics
- Excel Data validation options such as drop-down lists, validation messages or alerts, etc.
- Calculation options and window view options.
- Macros and ActiveX controls on custom forms

Note: Once you've created the workbook, you just need to save it as a .xlt or .xltx file (depending on which Excel version you use) instead of usual .xls or .xlsx.

If you need the detailed steps, here you go:

- In Excel 2019,2016,2013, click *File*
- In the *Save As* dialogue, in the File name box, type a template name.
- Under *Save as type*, select **Excel Template (*.xltx)** if you are using Excel 2019,2016,2013, 2010 or 2007. In earlier Excel versions, select **Excel 97-2003 Template (*.xlt).**

If your workbook contains a macro, then choose Excel **Macro-Enabled Template (*.xltm).**

When you select one of the above template types, the file extension in the *File Name* field changes to the corresponding extension.

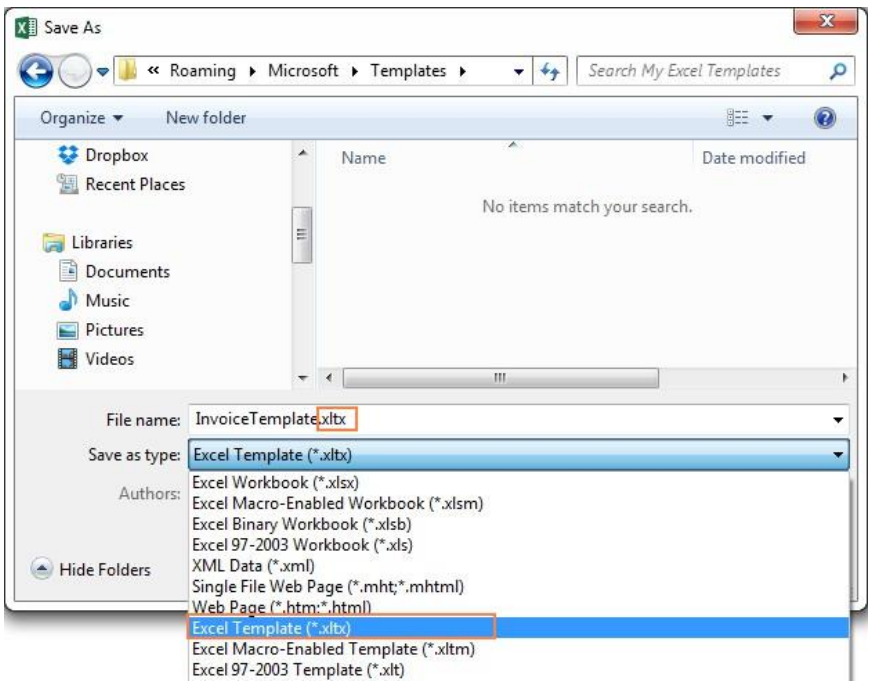


Figure 1.42. Dialogue box for saving a template

1.Click the *Save* button to save your newly created Excel template. Where to download Excel templates

As you probably know, the best place to look for Excel templates from Microsoft Office website (w w w . Office. com). Here you can find a great lot of free Excel templates grouped by different categories such as calendar templates, budget templates, invoices, timelines, inventory templates, project management templates and much more.

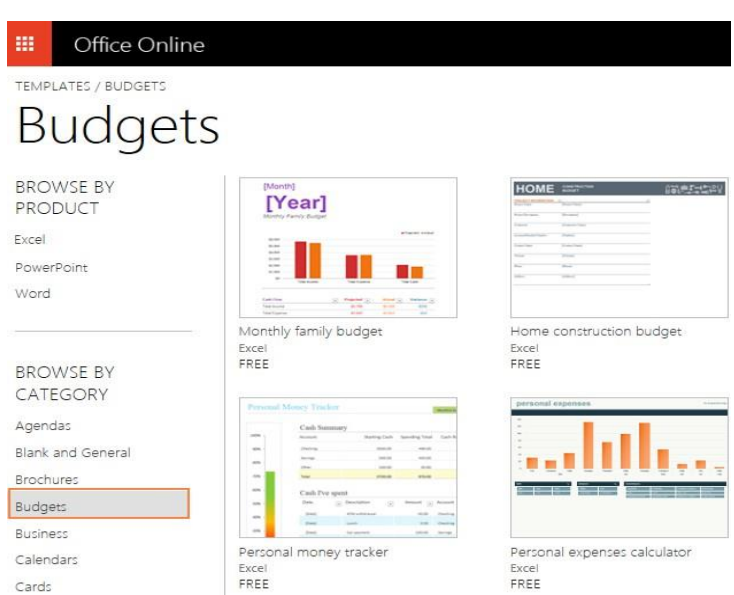


Figure 1.45. Download a template

To download a particular Excel template, simply click on it. This will display a brief description of the template as well as the *Open in Excel Online* button.

APPLICATION ACTIVITY 1.8

1. Define the following Terms:
   a. Microsoft Excel template
   b. Business
   c. Calendars
2. Design your personal Card using Microsoft Excel template (be specific)
3. You want to request a loan in BK,
   a. Using Loan Amortization template calculate the monthly payment
   b. In which year will you finish paying?
   c. Calculate the total interest to pay
   d. If you get more means and you want to pay one year before the end of your contractual payment how much money will you save on unpaid interest

END UNIT ASSESSMENT

Complete the table below

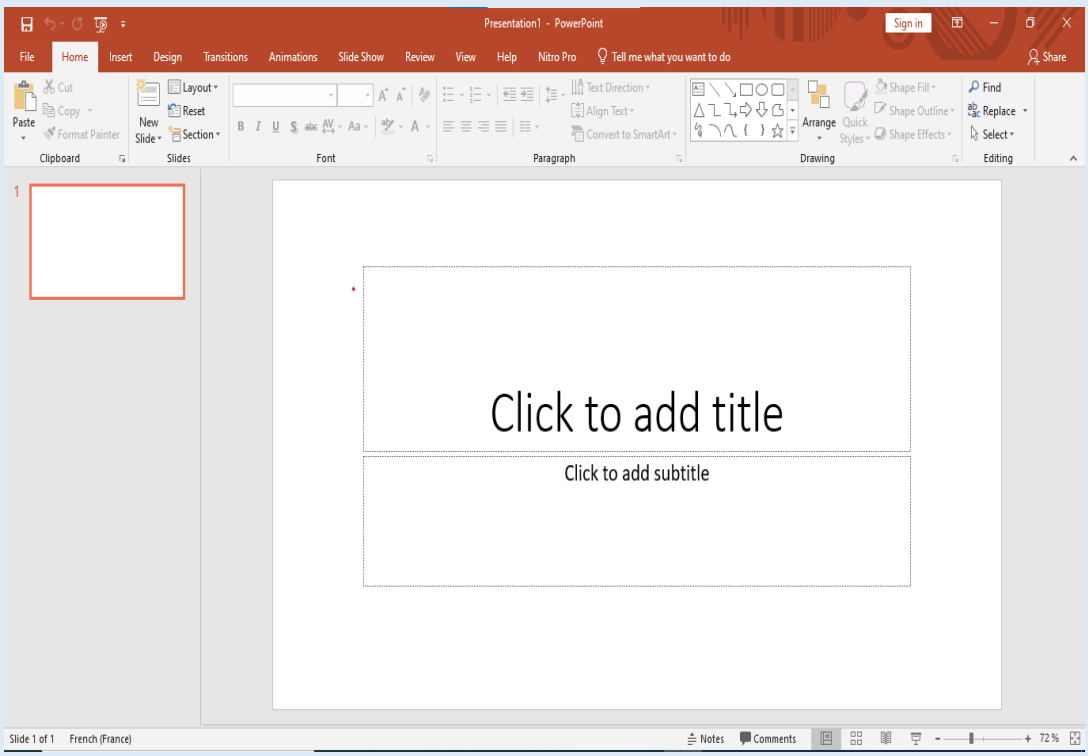
Names	Set	Maths	Averageif	Sqrt /set	Base/Maths
Kalisa	12	18			
KAMANA	18	17			
MUTONI	16	13			
MURENZI	10	20			

1. Calculate the averageif, Sqrt/set, Base/Math
2. Convert KAMANA, MUTONI and MERENZI into lower case
3. Concatenate Kalisa and MURENZI in a cell D:10
4. Before saving a sheet in a folder created on desktop protect a sheet with a password.
   i. Discuss Microsoft excel template
   ii. Create a school calendar using Microsoft template

UNIT 2: ADVANCED POWER POINT

2.0 INTRODUCTORY ACTIVITY

Observe the image below: and answer related questions



Answer the two question below and do what is requested in question 3

1. What is the application program that is opened in the projection?
2. What is the use of the opened program mentioned above?
3. Connect a projector to your computer and present your work

2.1. Create and Manage Presentations

ACTIVITY 2.1

1. Discuss elements that make a Good Presentation?
2. Create a PowerPoint presentation on "Good Money Habits" having two slides. Save the presentation on the desktop of your computer as "Good Money Habits"

A presentation is an organized report or message prepared as a talk before an audience, with the help of a computer program.

A presentation software is a program used to create slide shows for presentation on screen to an audience. Example of programs/software which can be used to create presentations are the following:

- Harvard Graphics,
- Corel Presentations,
- Lotus Freelance Graphics
- Microsoft PowerPoint

The role of Presentation applications is to help the presenter convey the message easily.

Microsoft PowerPoint is presentation software commonly used when planning to give a talk as a presentation. The purpose of the talk may be to inform, create awareness, present strategies or to sell a product or service.

A PowerPoint presentation is made by slides and it can be done on computer screen if the audience is very small and if the audience is large the computer can be connected to a projector that projects the image onto a large screen or a wall.

2.1.1 Starting PowerPoint Presentation

To start Microsoft PowerPoint 2013, 2016 & 2019 go through these steps:

- Click to the start icon
- Select and click on PowerPoint 2013 located on the startup menu
- Click on one of the PowerPoint templates.

Here click on **Blank Presentation.** The PowerPoint screen appears as in the image below:

Figure 2.1: First slide of a PowerPoint presentation

In the new slide write the slide title and write the content in the appropriate zone. Resize the writing zones accordingly to make the title area small and the content area bigger.

2.1.2 Creating and inserting a slide in a presentation

The opened PowerPoint presentation has now one slide and each slide has to have its title set and have the content. Once this is finished a need to have more slides may arise. To create a slide in an existing presentation, click on the **Insert tab** then click on **New Slide** then choose the slide theme to apply.

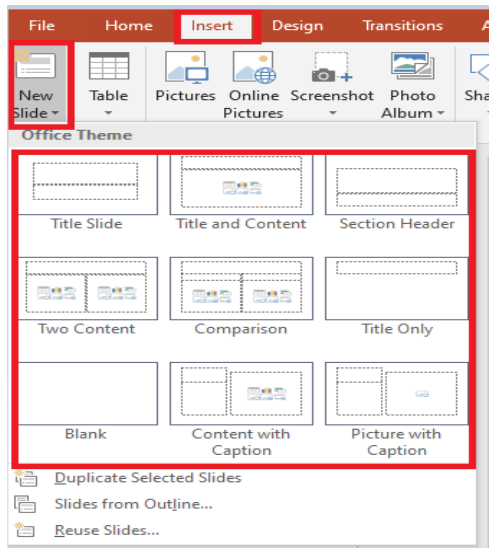


Figure 2. 2. Window illustrating the steps for inserting a new slide

A new slide can also be inserted by selecting the slide behind which a new one is to be inserted and hitting the **Enter key**.

The created presentation will be saved by clicking on the Save icon then choose the location where to save and specifying the name of the presentation.

2.1.3 Copying a slide

A slide can be copied in the same presentation or copied to a new presentation in order to avoid rewriting that presentation from scratch.

To copy a slide, do the following:

- Open the presentation containing the slide to copy
- In the left pane outlining the slides select the slide to copy
- Do a Right click and click on copy
- In the left pan click in the location where to put the copied slide so as to have a red line and do a right click and click **Paste**

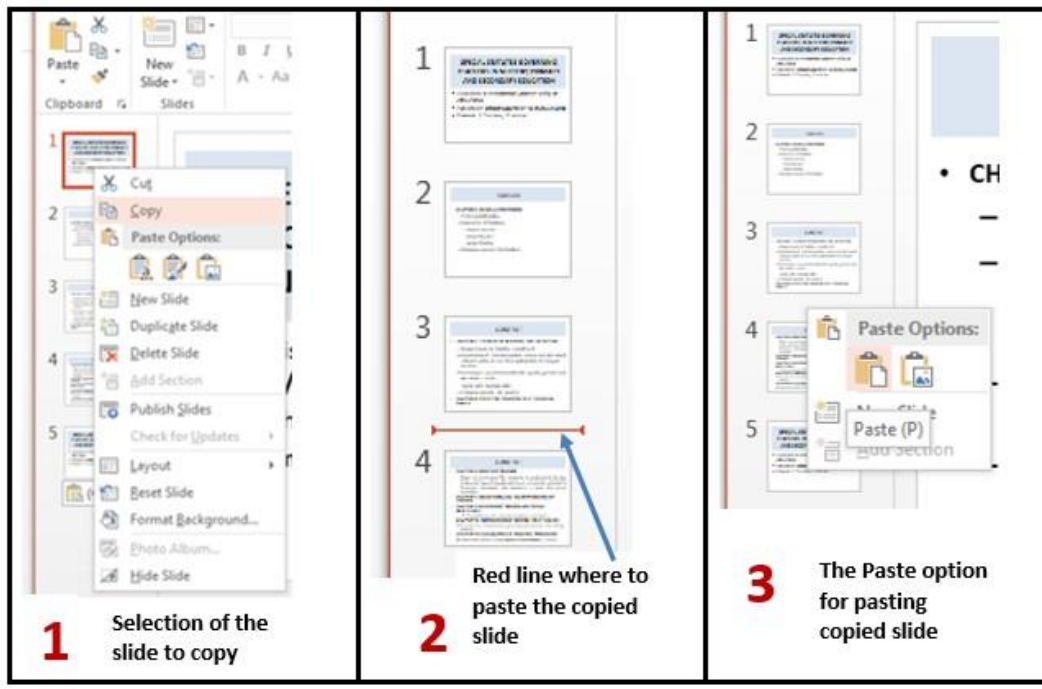


Figure 2. 3. Images illustrating selection of a slide to copy, location and paste options

APPLICATION ACTIVITY 2.1

1. Create a PowerPoint presentation on " Kwita Izina" event
2. Using a computer connected to the projector present the created presentation to the class
3. Discuss the difference between presentation using ICT tools to normal presentation using paper notes

2. 2. Managing Slides

ACTIVITY 2.2

Create a PowerPoint presentation of not less than 10 slides. The title of the presentation is" The importance of ICT in Education sector"
Instruction:
Hide two last slides of the above presentation

Once the slides are created, one needs to know how to manipulate them by hiding some slides, moving in slides, rearrange slides, delete some slides, dividing slides into sections, etc.

a. 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.

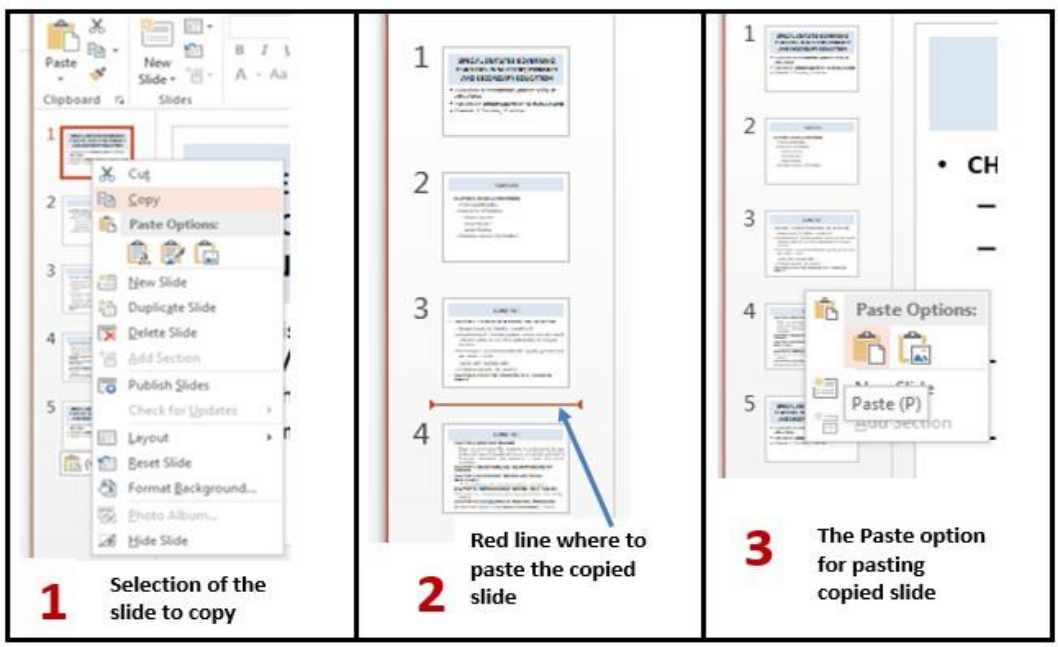


Figure 2. 4. Options gone through in hiding a slide

b. Moving in slides

A slide that will be displayed on the computer screen or on the projector is the one which is selected.

In the Normal view to move from one slide to another use the **Arrow keys** found on the keyboard. The **Up key** will move to the previous slide while the **Down key** will move to the next slide. One can go to any slide without needing to serially go through all slides by just clicking the slide to go to.

In the Slide Show view also use the same keys but not that the Escape Key can be used to end the presentation in the Slide Show View mode and switch to the **Normal view**. Once the last slide is reached hitting the **Down key** will switch to the Normal View.

c. Rearranging slides

Slides are not stationary, they can be moved and rearranged making for example the first slide be the third. To rearrange slides, select the slide, hold down the left button and move the slide by moving the mouse up or down.

d. Deleting slides

A slide that is no longer needed can be completely deleted by selecting it and hitting the **Delete key** or selecting that slide, doing a Right click and clicking on **Delete Slide**.

e. Dividing slides into sections

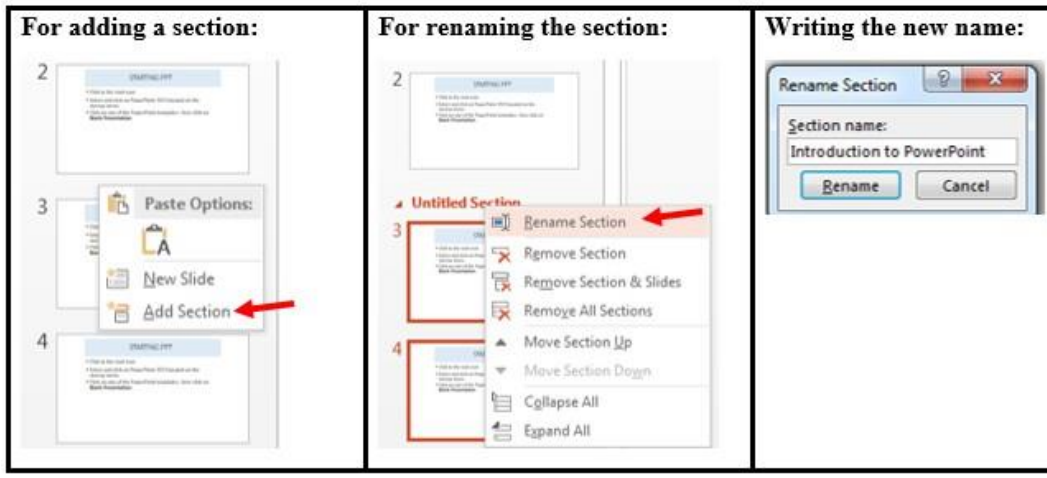
Sections are subdivisions in a PowerPoint presentation slides used preferably for bigger presentations that can be logically grouped. Slides in the same group should be logically related so as to facilitate their understanding during presentation or while reading them.

Putting slides into sections can also be done when slides are to be presented by different people thus each person presents his/her section.

- **Creating a 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 it and clicking on **Rename.** The default name of a section is **Untitled Section**.
4. Write the new name and click **Rename**



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.

APPLICATION ACTIVITY 2.2

Create a PowerPoint presentation on the role played by ICT in the country development with 3 distinct sections in the presentation where each section is about the following:

a. Benefits of using ICT in Rwanda as a country
b. Importance of technology in the development of the country
c. Role of ICT in bringing about changes

2.3. Apply Design Themes and Format Background

ACTIVITY 2.3

Discuss tips you can use to make effective and more attractive for a PowerPoint presentations

a. Design theme

PowerPoint provides a variety of design themes which are predefined colors, fonts and visuals that can be applied to slides to make them have a beautiful look without doing a lot of formatting work.

The Themes gallery can be reached by clicking the **DESIGN** tab and themes will immediately be viewed.

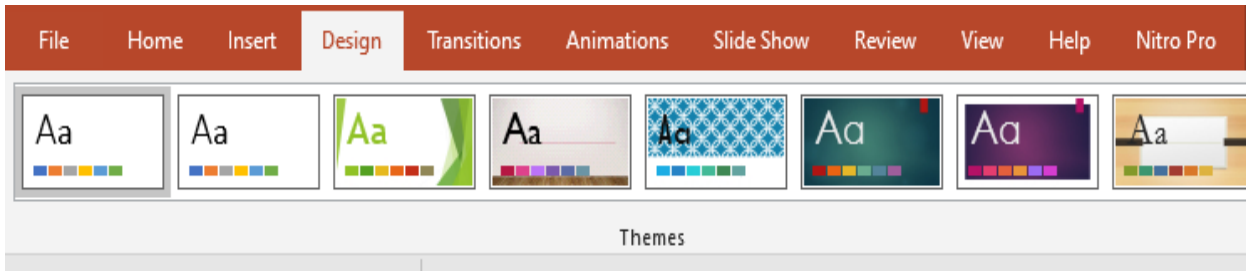


Figure 2.5 Some of PowerPoint 2019 design themes

To apply a given theme to a presentation just open that presentation and select the desired Theme. In the image below the Theme "Facet" has been applied.

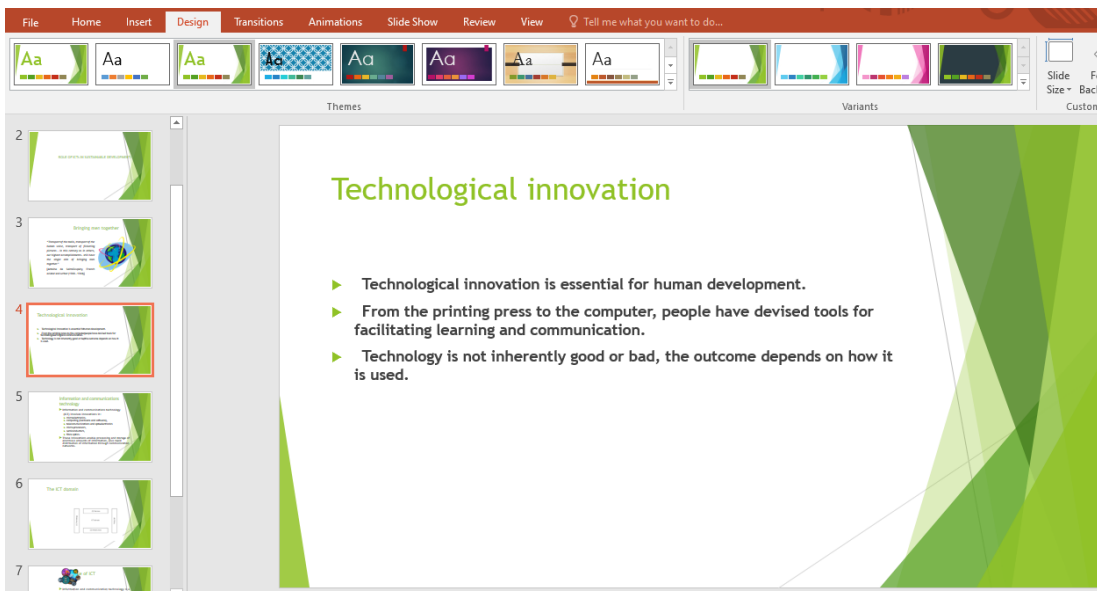


Figure 2.6 A PowerPoint presentation in which "Facet" theme has been applied

b. Format background

A background is an object which can be just a color, an image behind whatever text, charts, images in a PowerPoint presentation.

To set a presentation's background follow these steps:

- Open the presentation for which the background is to be set
- Under the **DESIGN** tab Click on **Format Background**
- Choose one of the provided options and customize those options accordingly

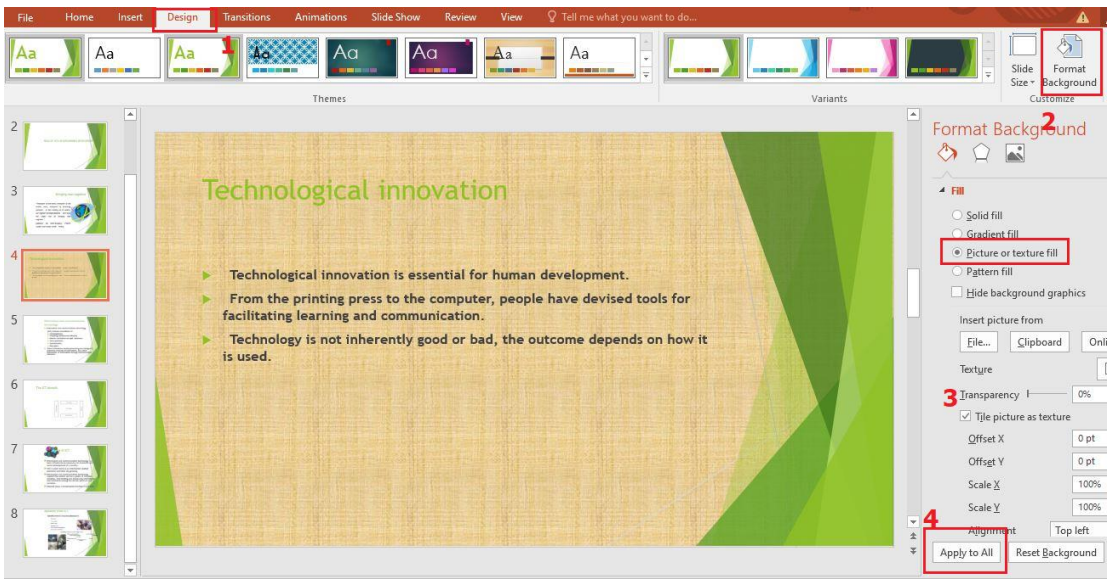


Figure 2.7: Slide in which the Picture or Texture Fill has been applied

APPLICATION ACTIVITY 2.3

Create a PowerPoint presentation "Understanding Gender Equality" containing at least 10 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 "Gender equality in the development of Rwanda" with 5 slides
5. Give the section should have "Main event" as the theme of a presentation.
6. Apply new theme with colour and font to the working presentation

2.4. Adding Notes and Comments, Inserting Header and Footer

ACTIVITY 2.4

Using Ms Power Point create a presentation containing 15 slides which has the title “In Born Reflexes”

Apply the followings to the presentation:

- Add notes and comments to created slides that will help you while presenting
- Add header as “Inborn reflexes” on every slide

a. 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**

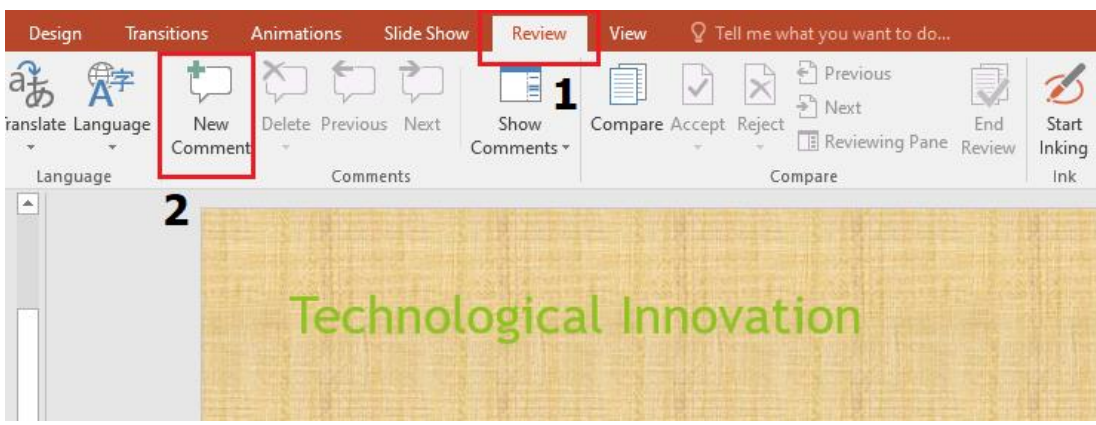


Figure2.8: Insert comment options

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 simpler method of clicking at the **Comment** option located at the bottom middle of an opened PowerPoint window.

b. Adding notes

In a PowerPoint presentation **Notes** are words/text 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

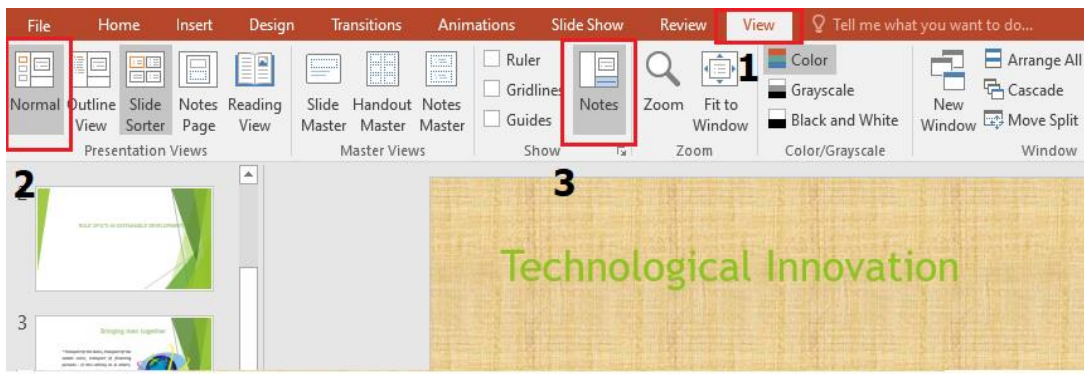


Figure 2.9: Adding Notes and Comment Window

Note: A simple way to add notes is to use the Notes option located at the bottom middle of an opened PowerPoint window

c. 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

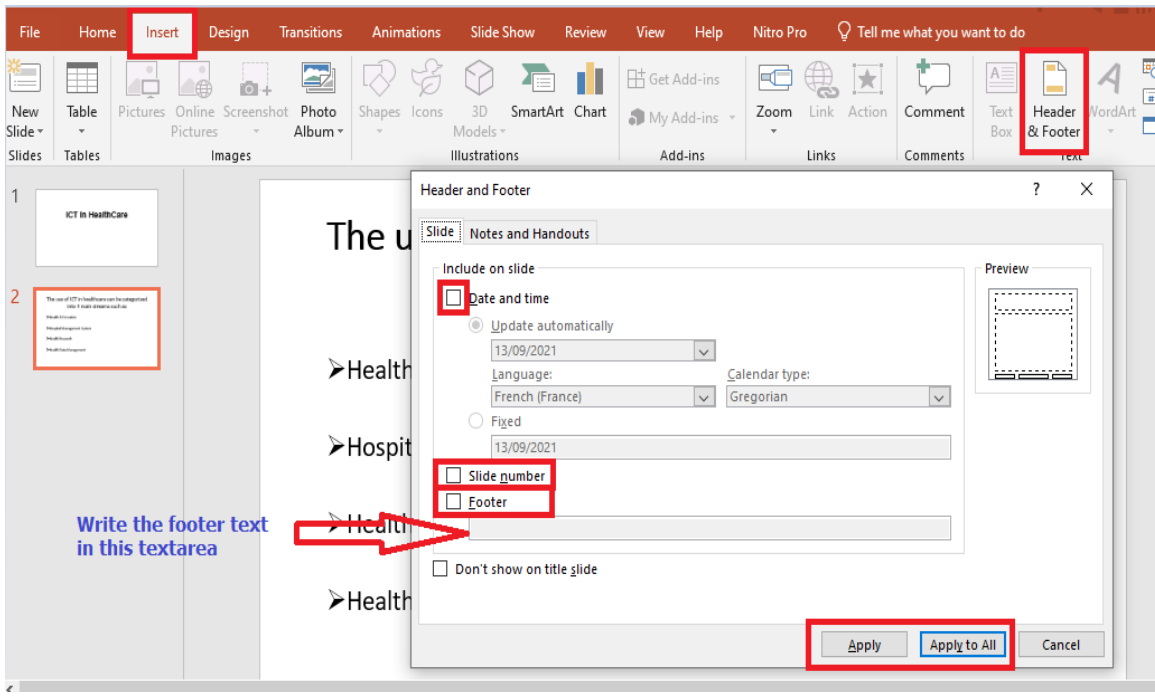


Figure 2. 10. PowerPoint Insert header and footer window

APPLICATION ACTIVITY 2.4

1. What is the difference between header and footer?
2. Discuss the importance of notes and comments in a PowerPoint presentation
3. Create a PowerPoint presentation on "Quality and Accessibility of ICT services in Rwanda "that you will present to the class. Add notes and comments to slides that will help you while presenting

2.5. Add Sound and Animation to Slides

ACTIVITY 5.1

1. Give the benefits of adding multimedia into a presentation
2 Improve the PowerPoint presentation created on "Quality and Accessibility of ICT services in Rwanda " by adding in images

2.5.1. Animate text and picture in slides

In PowerPoint, it is possible to **animate** text and **objects** such as clip art, shapes and pictures on the slide. Animation or movement on the slide can be used to **draw the audience's attention** to specific content or to make the slide easier to read.

a. Inserting pictures

To insert pictures in a slide, select the **Insert** tab, and then click the **Pictures** command. Browse where the images are located and select one image and click **Insert**.

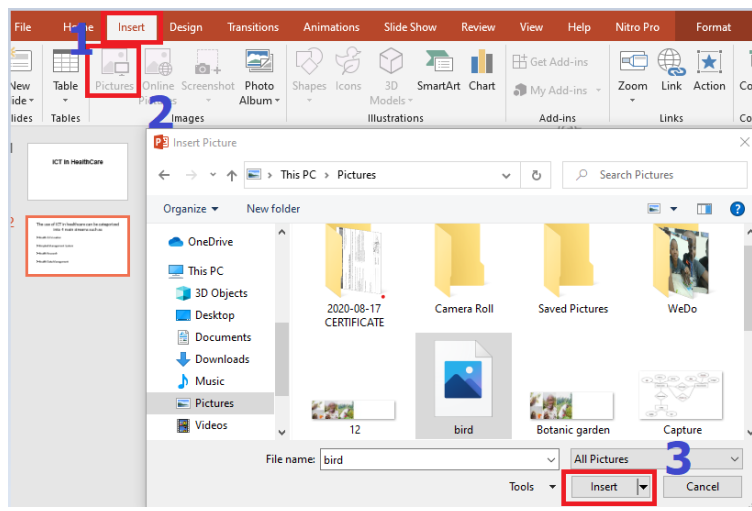


Figure 2. 11. PowerPoint Insert picture options

b. Animating a text or a picture.

When a text is written in a slide or an image inserted they can be animated using the options available in PowerPoint. There are many types of animations available and each is used for different reasons like making the message come to the screen in a certain way (entrance animation) or bringing an emphasis to that message (emphasis animations). The image below shows some of the animations available in PowerPoint 2013.

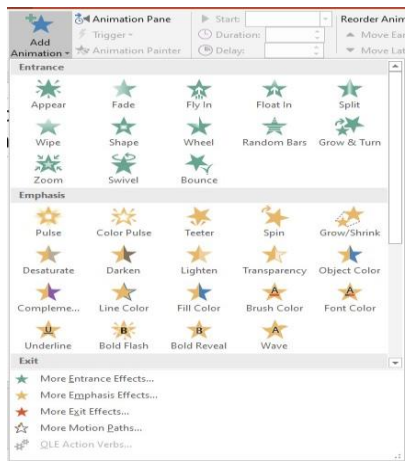


Figure 2. 12. Different animations available in PowerPoint

For animating a text or an image do this:

a. Select the text or picture to animate
b. In the **Animation** tab choose one of the available options like Float In, Split, etc. The selected animation is immediately applied

In the next images below the title has been animated with "**Fly In**" animation, the text is animated with "**Split**" and the image is animated with "**Zoom**".When the whole slide is opened in **Slide Show** mode each element has its own animation which helps attract more the attention of the audience.

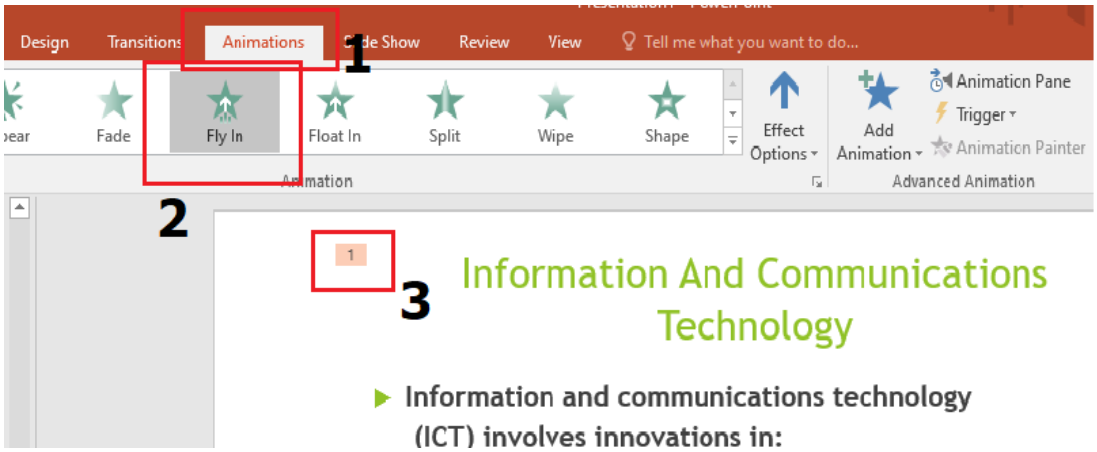


Figure 2. 13. The Title's animation is set to "Fly in"

Now that the title's animation is **Fly In**, the text's animation is going to be set to "**Split**" by selecting the text and choosing **Split** which is under the **Animations** tab

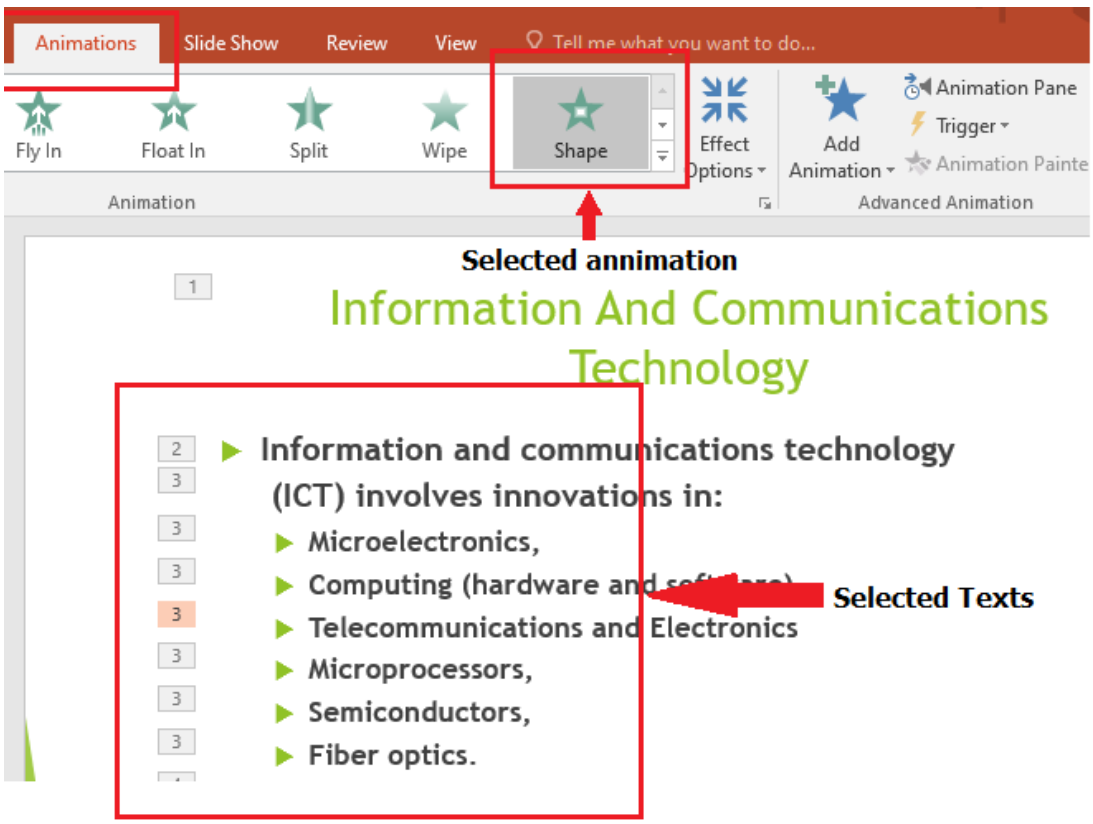


Figure 2. 14. The slide content animation set to Split

Now is the time to animate the image by also selecting it and choosing the desired animation

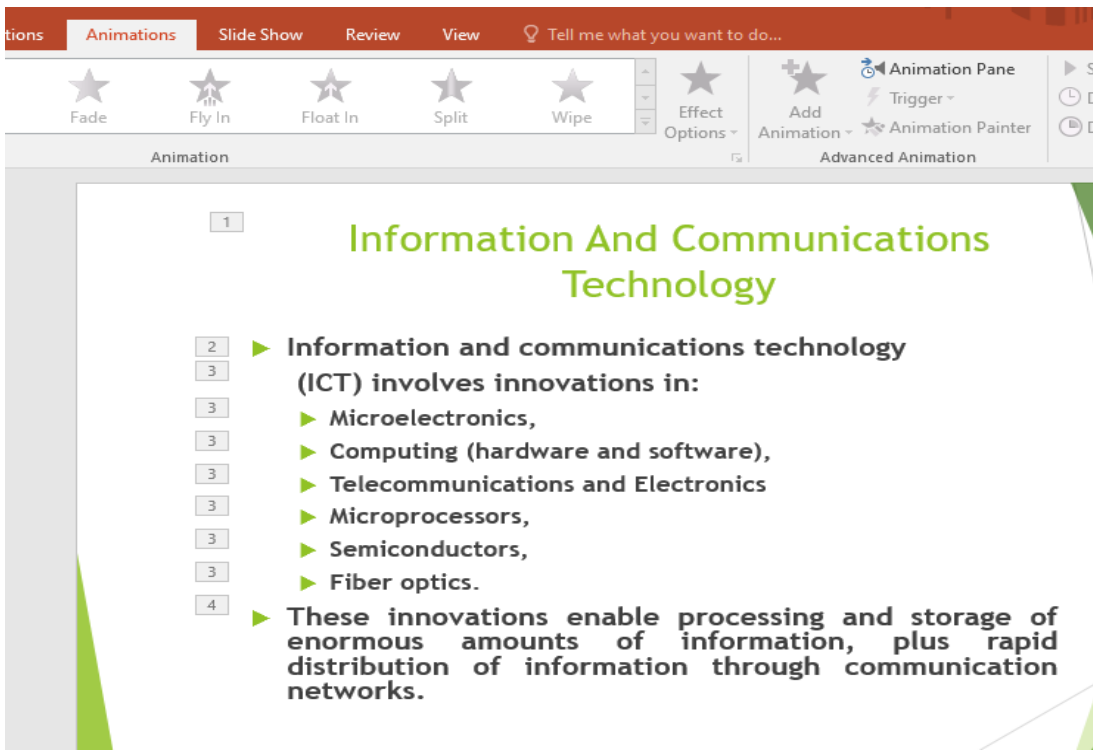


Figure 1Figure 2. 15. The image animation is set to Zoom

Opening the above animated slide in Slide show mode will look like in the sequenced images below:

Figure 2.16 Screen sequence of an animated slide containing text and image

Interpretation: the above animated slide when opened in Slide view mode will show in this way:

a. A blank black screen will open and rapidly the black color will cede place to the white background of a normal document
b. The text in the slide will come from left and right to meet in the middle c. The image will appear as a small image that will grow from the center
c. The title of the slide will appear from the bottom of the slide, sliding upward

B.1. Setting the delay of an animation

The default duration of a text or image animation can be changed to make the animation slower or quicker. The delay cannot be greater than 59 seconds. To set a delay click on **Animations** tab and in the Timing group specify the duration and the delay.

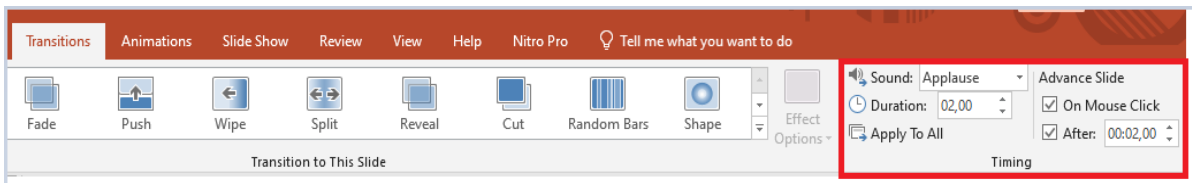


Figure 2. 17. Options to set an animation

c. **Customize animation effects**

It is possible to apply multiple animation effects to a text, an image or a picture. When working with multiple animation effects, it helps to work in the Animation Pane, where a list of all the animation effects for the current slide is displayed.

Figure 2. 18. Some of the animation effects available in PowerPoint

APPLICATION ACTIVITY 2.5

Create a PowerPoint presentation that have at least 10 slides on

"The use of ICT in teaching science in the classroom".

1. Insert a picture in each slide.
2. Animate the presentation as follow:
   a. The title to "Fade",
   b. The text to "Appear"
   c. The image to "Pulse"

2.6 Add audio and Video Content to Slides

ACTIVITY 2. 6

Create a presentation with a slide "Video in PowerPoint". Insert a video as the only content on the slide. Play the presentation in the slideshow

PowerPoint allows to use images, **audio and video** to have a greater visual impact. These visual and **audio** cues may also help a presenter be more improvisational and interactive with the audience.

Animation applied to text or objects in a presentation gives them **sound** or **visual effects**, including movement. It is possible to use animation to focus on important points, to control the flow of information, and to increase viewer interest in a presentation.

a. Inserting an audio or a video

To insert an audio or a video do the following:

1. On the **Insert** tab click on **Media**
2. Choose the media to use which can be a video, an audio or a recording which is taken using a computer

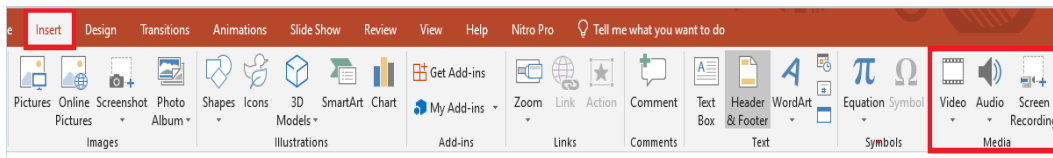


Figure 2. 19. PowerPoint tabs used to insert media in a presentation

Browse the location where the audio or video to insert is located.

3. Select the media to use and click on **Insert**

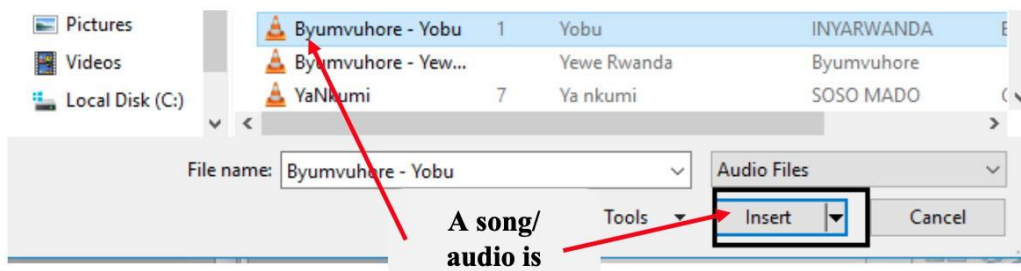


Figure 2. 20. Insertion of an audio in a presentation

The slide where audio has been inserted will have a graphic as shown in below. Play using the media buttons displayed.

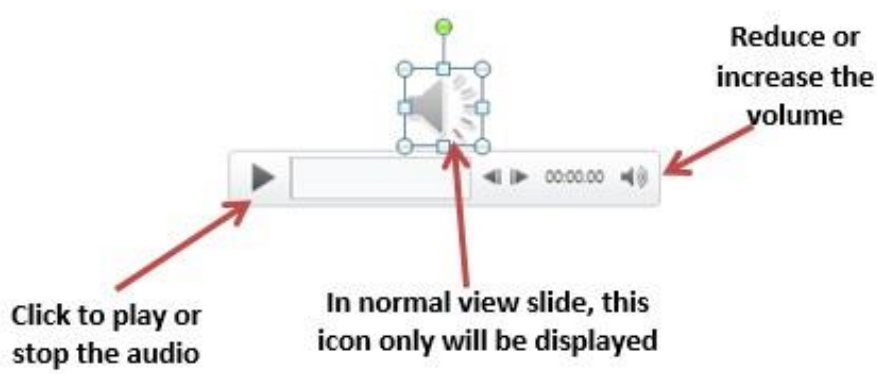


Figure 2. 21. Icons for playing a media inserted in a PowerPoint presentation

A media inserted in a PowerPoint presentation can have the role of providing more clarification for efficient understanding, it can be the only content in the slide, it can

be a recording of the screen activity when for example one wants to show the steps to do a certain think using a computer. It can also be a readout of the slide's text.

b. Inserting a recording

A recording is taken using the computer microphone and is inserted much the same way as other audio except that instead of browsing the audio to insert, the audio has to be recorded. To insert a recording go through the following steps:

1. Under the **Insert** tab click on **Media**
2. Click on **Audio** then on **Record Audio**

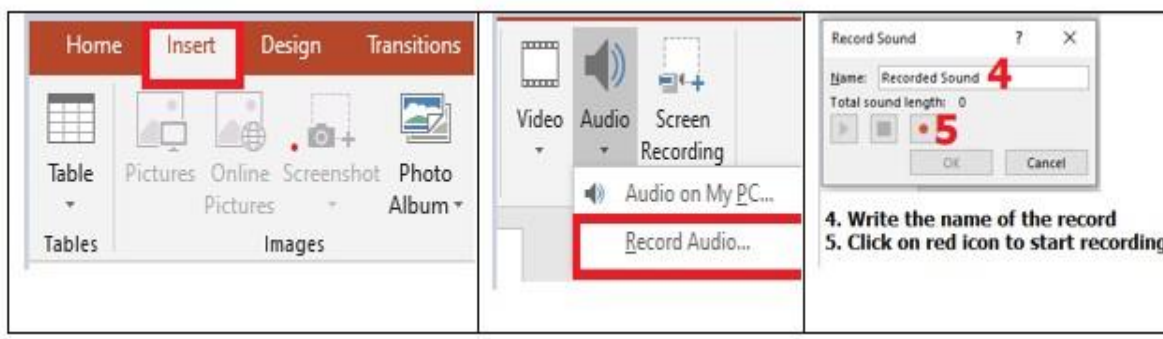


Figure 2. 22. Steps to record an audio to insert in a PowerPoint presentation

The recorded audio can be set to play as the slide is opened or to play when clicked on. It can also be trimmed to fit in the desired time frame.

To trim the recording:

1. Click on the microphone icon then under the Audio tools go to **Playback**
2. Click on **Trim audio** then on **OK**

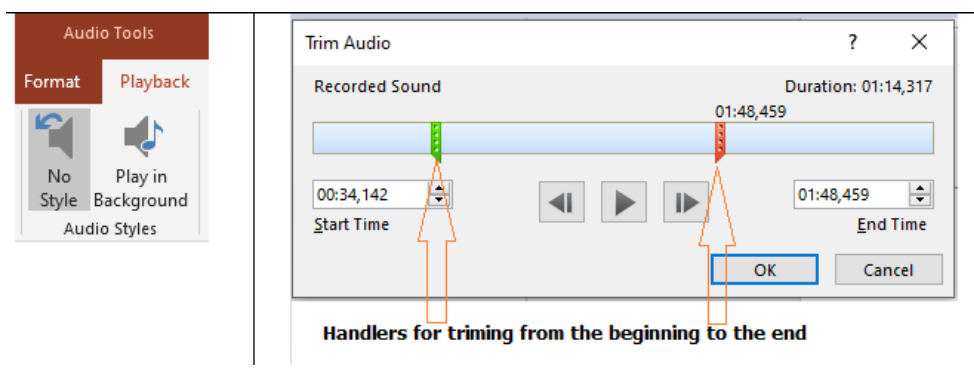


Figure 2.23. Trimming a PowerPoint recorded audio

c. Inserting a screen capture

Capturing a screen can be very important for many reasons but the main is when you want to make an instructional video that shows the steps that are being done on the screen. This can be combined with capturing an audio describing what is being done.

***Note**:* Thus, for future student teachers this functionality can prove very useful.

Steps to capture the screen:

1. Click on Insert then under the Media group go to Screen Recording

Figure 2. 24. Dialog box for capturing the screen

2. Choose among the available options in the dialog box that will appear, click on **Select Area** to choose which portion of the screen to be recorded and click on **Record**
3. To end the recording use the combination keys **Window key with shift key and Q**

APPLICATION ACTIVITY 2.6

Create a PowerPoint presentation explaining how to insert audio and video into a presentation. Your presentation should contain a text stating the steps to follow and the audio of these steps should be heard on the display of the presentation. A screenshot of the steps to follow must be visible.

2.7. Slide Transitions

ACTIVITY 2.7

Create a PowerPoint presentation “Tubungabunge Umuco wacu” of 5 slides.

1. Apply different slide transitions: Slide 1=” Blind”, Slide 2=” Clock”, Slide 3=” Ripple” Slide 4=” Honeycomb”, Slide 5=” Reveal”,
2. Add sound to the slide3
3. Add time transitions to make them last for 2 seconds

A **slide transition** is the visual effect that occurs when moving from one **Slide** to the next during a presentation. Hereby one can control the speed, add sound, and customize the look of **transition** effects.

a. Types of transitions:

In PowerPoint 2019 there are two main slide transitions namely subtle, exciting and dynamic content

In **Subtle** transition simple transitions are used to move from one slide to another, for **Exciting** additional visual effects are used to catch the eye of the audience while for **Dynamic** content will move only the placeholders, not the **slides** themselves.

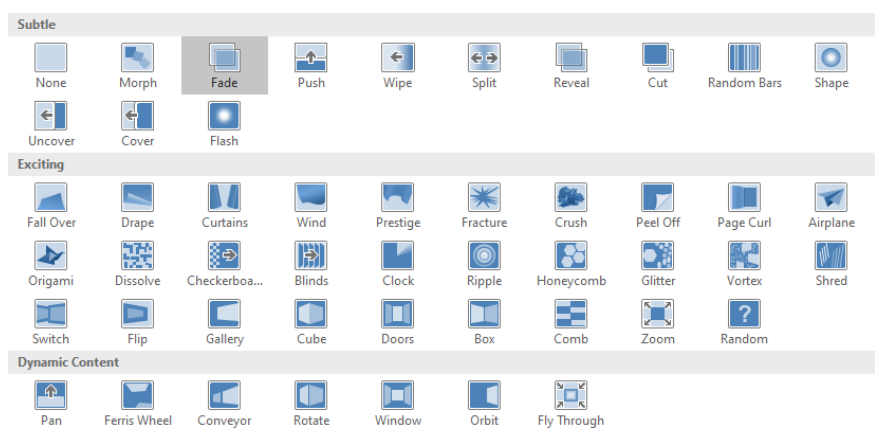


Figure 2. 25. Types of transitions available in PowerPoint 2019

b. Using a transition

To use the different transitions, do the following:

- To select the text or image on which to apply the transition
- Click on the **Transition** tab then choose one of the transitions. In the image below the chose n transition is "**Dissolve"**

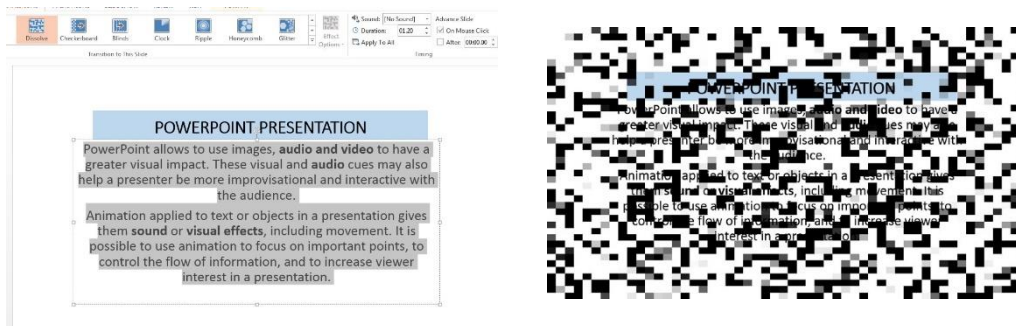


Figure 2.6 Setting a transition (left) and slide appearance once played before it is properly arranged and visible

Once the transition has been set it can be modified by selecting the text having a particular transition and choosing the new transition to apply. It can also be removed by choosing the **None** transition.

APPLICATION ACTIVITY 2.7

Create a presentation on" Education for all" which contain 10 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

2.8 Presenting Using PowerPoint

ACTIVITY 2.8

You are tasked to present to an audience of 300 people in the school hall on how to improve your schools discipline.

1. Discuss the plan of your presentation by focusing on the organization of the presentation that of the session, plan to gather feedback and plan to make the group more participative and attentive.
2. Discuss the effectiveness of this presentation if you use papers and not a projector in your presentation

Microsoft PowerPoint can add a visual dynamic to a business meetings and presentations. The best way to share a PowerPoint presentation with a large group is to project slides on screen using a digital projector connected to the computer's video output.

a. Presenting using a projector

A projector is an output device that can take images generated by a computer and produce them by projection onto a screen, wall or another surface.

A projector is connected to the computer through the VGA port but new projectors and computers can be connected using the HDMI ports

Figure 2. 27. Diagram of a computer connected to a projector

Steps for connecting a laptop to a projector

1. Make sure the laptop is turned off
2. Connect the video cable(VGA) from the laptop's external video port to the projector
3. Plug the projector into an electrical outlet and press the "power" button to turn it ON.
4. Turn on the laptop

There are different presentation modes while using a computer connected to a projector. One can use the **Projector only**, **duplicate** (both the projector and computer), **Extend** and **Disconnect the projector.**

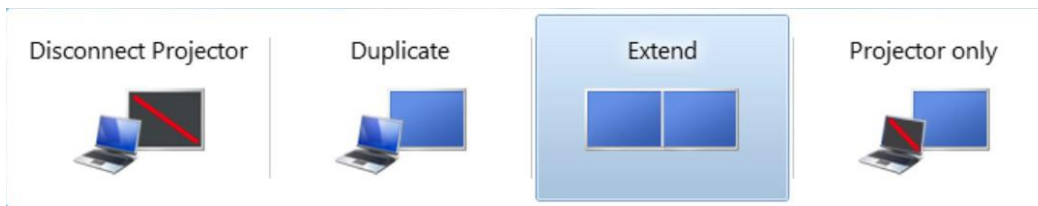


Figure 2. 28. Different options to use a projector connected to a computer

b. Printing and distributing handouts

A handout is a piece of printed information provided to the audience so as to give a summarized information on a given topic.

Handouts are distributed to an audience so as to help them follow the presentation and take some notes on what is being presented.

It is a good practice to give the presentations to the audience at the end of the session so as to review what was presented to them.

c. Conducting the presentation

When everything is in order; the projector is properly connected and working, the handouts have been distributed and everyone is properly seated it is then time to start the presentation.

For a presentation to be effective, the PowerPoint document have to have these qualities:

- Make the PowerPoint presentation short. Slides will contain short and concise sentences which are bulleted,
- Highlight important points by using animations and transitions wisely not randomly as these are used with a purpose like attracting attention on certain section, notifying of the change in the topic, etc
- For long slides provide short partial synthesis to make the audience keep track of what is so far presented
- Rehearse the presentation and use scripts and notes to help you not forget the important points to mention
- Be polite and use appropriate language.

APPLICATION ACTIVITY 2.8

1. List the qualities a presentation should have?
2. List available options to use when a projector is connected to a computer?

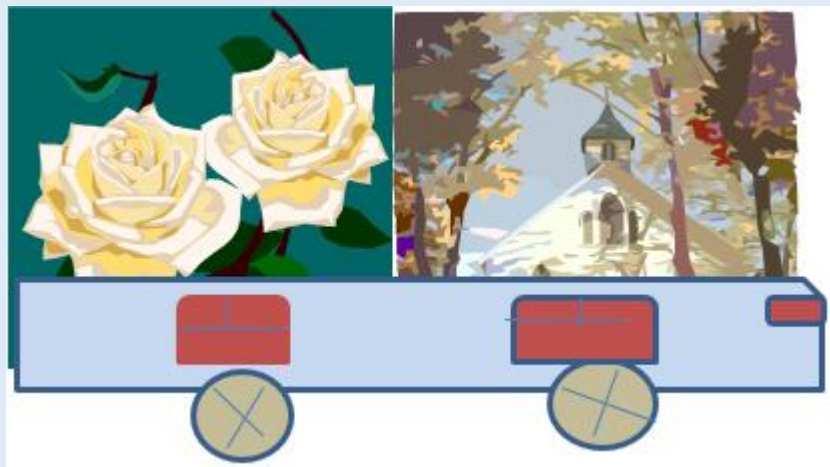
END UNIT ASSESSMENT

1. Create a presentation of 12 slides on the topic "Nature-Protect". Do the following:
   a. In first slide describe the environmental protection in the World
   b. In the second two slides describe the environmental protection in Rwanda
   c. To give a good appearance and make slides more understandable insert images related to environment where applicable. Change theme, font and color to your presentation appropriately
   d. In third three slides, describe the advantages of forest in environment and use a related audio/song that will play in the background.
   e. In the fourth two slides discuss special cases where nature destruction by human exploitation had severe consequences
   f. In the last two slides state what should be done for a better human future provided by livable environment. End with one conclusion slide and a Thank you slide.

UNIT 3: COMPUTER GRAPHICS TOOLS

3.0 Introductory Activity

Observe the picture below and answer the following questions:



1. Describe what you see.
2. Differentiate a picture to an image
3. How do you measure the size of each picture?
4. Describe how the pictures inside are arranged. Are these pictures created using the same material?
5. What is the importance of modifying a picture? Give one example of an application that can be used to modify a picture

3.1. Introduction to Computer Graphics

Activity 3.1

Scan your students ID card and use a smart phone to take a picture of the same students ID card. After, save both pictures in one folder

Observe carefully both picture and give the difference that you find between them.

Explain what could be the cause of that difference.

Modifying a hard drawing can be hard, swapping colors or resizing a picture on such a drawing is more complicated. That's why it is more efficient to draw a picture on a computer screen and the drawing is now a piece of digital information which is easy to modify.

Computer Graphics involves the ways in which images can be displayed, manipulated and stored using a computer.

Computer graphics provides the software and hardware techniques or methods for generating images.

3.1.1. Definitions of Different Terms

Computer graphic: This is the use of a computer and specialized programs to produce and manipulate pictorial images.

Pixel: is the smallest unit of a digital image or graphic that can be displayed and represented on a digital displayed device. Is also known as a picture element. A pixel can have different colors produced by mixing the three colors RGB (Red, Green and Blue) and each of the three colors can take values ranging from 0 to 256.

2D (2Dimensional) images are objects that are rendered visually on paper, film or on screen in two planes representing width and height (X and Y). Two-dimensional structures are also used in the construction of 3D objects.

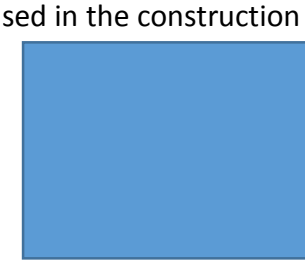


Figure 3. 1. An example of a 2D image

3D computer graphics or three-dimensional computer graphics, (in contrast to 2D computer graphics) are graphics that use a three-dimensional representation of geometric data (often Cartesian) that is stored in the computer for the purposes of performing calculations and rendering 2D image.

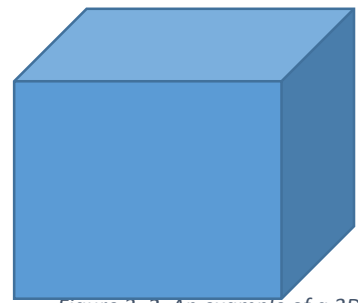


Figure 3. 2. An example of a 3D Image

Morphing: is a technique which involves using a computer to make an image on film or television appear to change shape or change into something else. For example a human face may be transformed into a lion one and the human eye will find it unbelievable how the human has changed him/herself.

Random scan:

Random Scan System uses an electron beam which operates like a pencil to create a line image on the CRT (Cathode Ray Tube) screen. The picture is constructed out of a sequence of straight-line segments. Each line segment is drawn on the screen by directing the beam to move from one point on the screen to the next, where its x & y coordinates define each point. After drawing the picture. The system cycles back to the first line and design all the lines of the image 30 to 60 time each second.

The process is shown in figure:

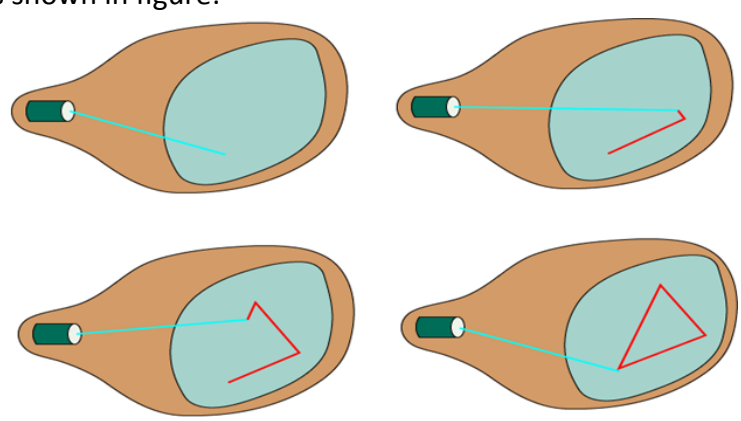


Figure 3. 3. Illustration of how Random scan works

Source: https://www.javatpoint.com/

Raster scan

A raster scan display is based on intensity control of pixels in the form of a rectangular box called Raster on the screen. Information about On and Off pixels is stored in a refresh buffer or Frame buffer. Televisions in homes are based on Raster Scan Method. The raster scan system can store information of each pixel position, so it is suitable for realistic display of objects. Raster Scan provides a refresh rate of 60 to 80 frames per second.

Frame Buffer is also known as Raster or bit map. In Frame Buffer the positions are called picture elements or pixels. Beam refreshing is of two types. First is horizontal retracing and second is vertical retracing. When the beam starts from the top left corner and reaches the bottom right scale, it will again return to the top left side called at vertical retrace. Then it will again more horizontally from top to bottom. The figure below illustrates the process

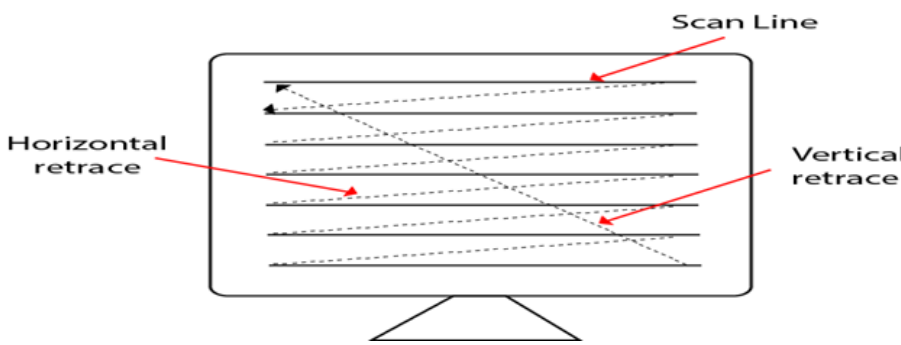


Figure 3. 4. Illustration of the working of a Raster scan screen

Source: www.javatpoint.com

Comparison between Random scan and Raster Scan:

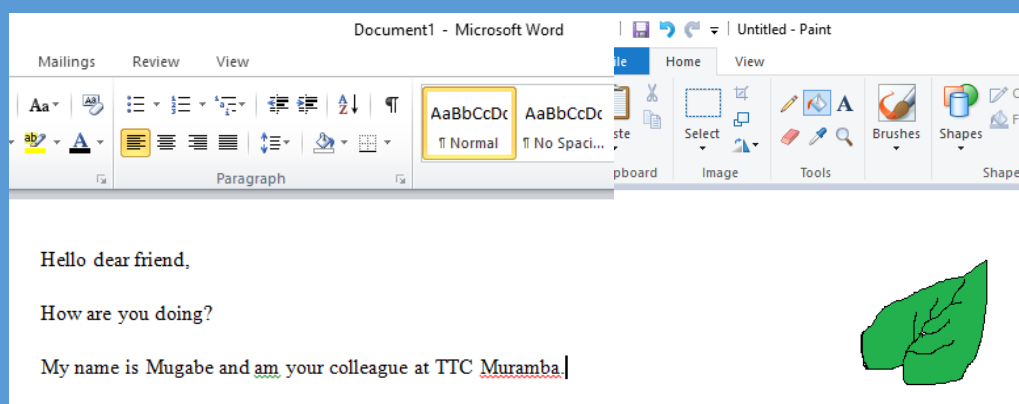
Random Scan	Raster Scan
It has high Resolution	Its resolution is low.
It is more expensive	It is less expensive
Any modification if needed is easy	Modification is tough
Refresh rate depends or resolution	Refresh rate does not depend on the picture.
Only screen with view on an area is displayed.	Whole screen is scanned.

Application activity 3.1

1. Using an example, give the difference between 2D images to 3D image?
2. Define morphing and give an example
3. With comparison, differentiate Random scan and Raster scan?
4. Discuss how computer graphics can be used in decoration services?

3.2. Image Format

Activity 3.2



1. Observe the above images and describe what you see
   a. Are those images having the same formats? Explain
   b. Discuss the importance of saving a document with a proper file extension

3.2.1. DEFINITION

Image file formats are standardized means of organizing and storing digital images. Image files are composed of digital data in one of the formats that can be rasterized for use on a computer display or printer.
There are 4 main formats in which to store images including TIFF, JPEG, GIF and PNG.

Their differences are given in the table below:

IMAGE FILE FORMAT	DESCRIPTION
TIFF	TIFF stands for Tagged Image File Format. TIFF images create very large file sizes. TIFF images are uncompressed and thus contain a lot of detailed image data (which is why the files are so big) TIFF is the most common file type used in photo software (such as Photoshop), as well as page layout software (such as Quark and InDesign), again because a TIFF contains a lot of image data.
JPEG	JPEG stands for Joint Photographic Experts Group, which created this standard for this type of image formatting. JPEG files are images that have been compressed to store a lot of information in a small-size file. Most digital cameras store photos in JPEG format, because then you can take more photos on one camera card than you can with other formats.
GIF	GIF stands for Graphic Interchange Format. This format compresses images but, as different from JPEG, the compression

	is lossless (no detail is lost in the compression, but the file can't be made as small as a JPEG).
PNG	PNG stands for Portable Network Graphics. It was created as an open format to replace GIF, because the patent for GIF was owned by one company and nobody else wanted to pay licensing fees. It also allows for a full range of color and better compression.

Table 3. 1. Different image formats and their descriptions

3.2.2 Image compression

Image compression is minimizing the size in bytes of a graphic file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the Internet or downloaded from web pages. Know an image's file size and dimensions before or after uploading it into the Library

Image compression techniques Lossy and Lossless

Lossless: The compression technique where compressed data (byte) will be the same replica of actual data. In this case, compressed file is required to be reproduced exactly when get decompressed again.

Lossy: File compression results in lost data and quality from the original version. Lossy compression is typically associated with image files.

3.2.3 Viewing an image's file size and dimensions

The determination of an image's file size and dimensions depends on an Operating System being used.

Open the image in Windows Explorer to check dimensions and file size by clicking the Windows Start button on the taskbar.

Right clicking the icon of the image file,

In the pop up menu, click on property and details.

The result will look like below. The wanted information are circled with red line.

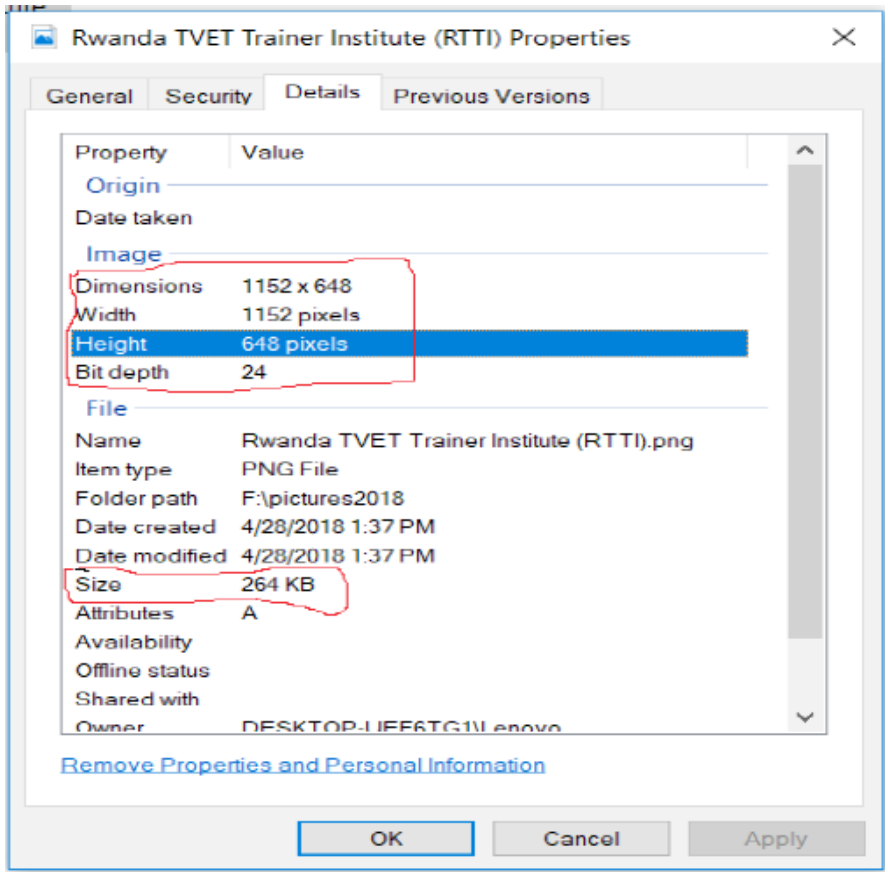


Figure 3. 5. Window for viewing the image size

3.2.4 Calculating size of an uncompressed image file

Computer storage and memory is measured in Megabytes (MB) and Gigabytes (GB). A **bit** is the smallest unit of measurement used to quantify computer data and **byte** is a group of 8 binary digits.

Unit of memory size.

1Byte= 8bits

1KB= 1024Bytes

1MB = 1024 KB

1GB=1024 MB

1TB=1024 GB

It takes 2 to 3 bytes to store one pixel of a color image. The pixels in an image store a color at a given point in the image, but it takes 2 to 3 bytes of storage to record this value. If we consider 3 bytes of storage, the file size of a color image is equivalent to:

width * height * 3

Example: Let's consider an image whose Width is 1152 and height is 648.
If we consider 3 bytes of storage, the file size of a color image is equivalent to: **width * height * 3 which is =**1152*648*3 = 2,239,458 which gives the file size in bytes. This file size number is so big, it needs to be converted in Kilobytes or even megabytes. There are 1,024 bytes in a kilobyte and 1,024 kilobytes in a megabyte which makes this file have the size of 2.187 Kilobytes

Application activity 3.2

1. Define an image.
2. Compare GIF to PNG image formats. Which is the best format to use and why?
3. Explain the term "compressing an image"
4. How an image size is calculated?
5. Mugabo has a flash disk of 32GB. How many films each having 600MB can his flash disk store? How many word documents each of 900Kb can it keep?

3.3 Image Capturing Tools

Activity 3.3

1. Observe the above pictures and describe each
2. Which device is most used in our daily life? Explain why

The process of obtaining a digital **Image** from a vision sensor, such as camera usually entails a hardware interface known as a frame grabber, which **captures** single frames of video, converts the analogue values to digital, and feeds the results into the computer memory.

3.3.1. Digital Camera

The first digital camera was invented by STEVEN SASSON in 1975. Digital cameras are normally used to capture pictures or video through the use of an electronic image sensor.

There are two types:

- **SLR**: Single Lens reflex camera; which is a camera that typically uses a mirror and a prism system that permits the photographer to view through the lens and see exactly what will be captured.
- **DSLR:** is a digital camera that combines the optics and the mechanisms of a single lens reflex camera with a digital imaging sensor.

a. Definition

A digital camera is a camera which produces digital images that can be stored in a computer and displayed on screen. It records and stores photographic images in digital format.

These stored images can be uploaded to a computer immediately or stored in the camera to be uploaded into a computer or printed later.

Digital cameras use an image sensor instead of photographic film.

Figure 3. 6. Parts of a Digital camera

Digital camera parts

There are 10 basic camera parts to identify in today's digital world. These parts will inevitably be found on most cameras being digital compact or single-lens reflex camera (SLR)

Lens

The lens is one of the most vital parts of a camera. The light enters through the lens, and this is where the photo process begins. Lenses can be either fixed permanently to the body or interchangeable. They can also vary in focal length, aperture, and other details.

Viewfinder

The viewfinder can be found on all digital single-lens reflex cameras (DSLR) and some models of digital compacts. On DSLRs, it will be the main visual source for image-taking, but many of today's digital compacts have replaced the typical viewfinder with Liquid Crystal Display (LCD) screen.

Body

The body is the main portion of the camera, and bodies can be in different shapes and sizes. DSLRs tend to be larger bodied and a bit heavier, while there are other consumer cameras that are a conveniently smaller size and even able to fit into a pocket.

Shutter Release

The shutter release button is the mechanism that “releases” the shutter and therefore enables the ability to capture the image. The length of time the shutter is left open

Aperture

The aperture affects the image’s exposure by changing the diameter of the lens opening, which controls the amount of light reaching the image sensor. Some digital compacts will have a fixed aperture lens, but most of today’s compact cameras have at least a small aperture range.

Image Sensor

The image sensor converts the optical image to an electronic signal, which is then sent to the memory card. There are two main types of image sensors that are used in most digital cameras: Complementary Metal-Oxide-Semiconductor (CMOS) and Charge-Coupled Device (CCD) Both forms of the sensor accomplish the same task, but each has a different method of performance.

Memory Card

The memory card stores all of the image information, and they range in different size and speed capacity. Memory cards can be taken out of the camera and inserted in a computer memory card bay for reading.

LCD Screen

The LCD screen is found on the back of the body and can vary in size. On digital compact cameras, the LCD has typically begun to replace the viewfinder completely. On DSLRs, the LCD is mainly for viewing photos after shooting, but some cameras do have a “live mode” as well.

Flash

The on-board flash will be available on all cameras except some professional grade DSLRs. It can sometimes be useful to provide a bit of extra light during dim, low light situations.

User Controls

The controls on each camera will vary depending on the model and type. The basic digital compacts may only have auto settings that can be used for different environments, while a DSLR will have numerous controls for auto and manual shooting along with custom settings.

c. Importing pictures using USB cable

The images taken by using a camera are stored automatically in its memory. However, for different purposes, the images can be printed or inserted in documents for

illustrations. The camera is then connected to the printer or the computer by using a USB cable appropriately designed for such action. The fact of taking pictures from the camera to the computer is called importing pictures.

The following steps are followed to successfully import a picture from camera to computer by using a USB cable.

Step 1: Connect one end of the USB cable to the port in your camera.

Step 2: Connect the other end of the USB cable to the USB port in the computer. This may be in the front or back of the computer.

Step 3: Turn on the camera

Step 4: A dialog box may appear on the screen. If it does, select "View Files" or "Open Folder." If the dialog does not appear, click the Windows "Start" menu, select "Computer" and then choose the drive labeled for the connected camera.

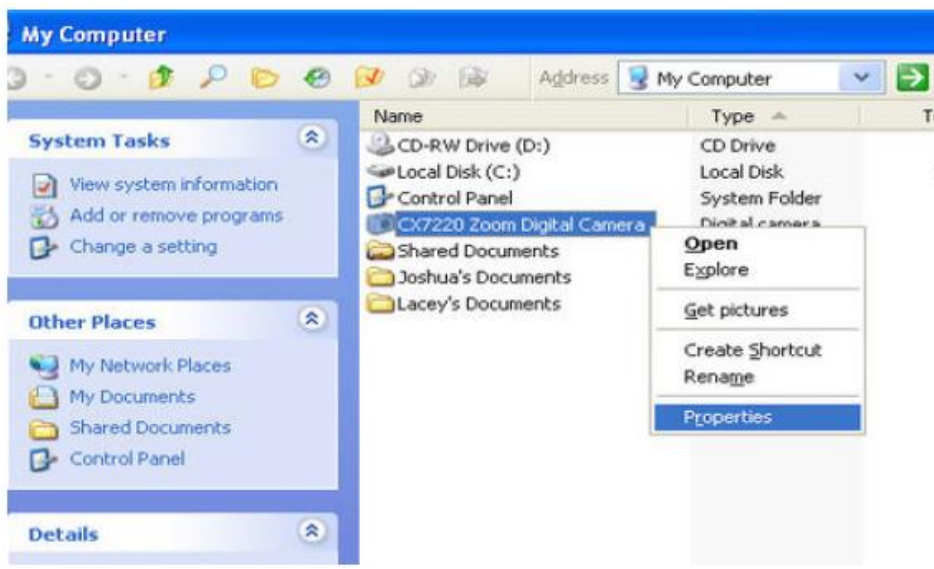


Figure 3. 7. Window for viewing the camera connected to a computer

The pictures are probably located in a particular photo folder on the camera. Open that folder. Drag individual photos from the folder to the desktop or some other folder on the computer. All the photos can be selected by pressing "Ctrl-A" and then pasted into a folder on the computer by pressing "Ctrl-V."

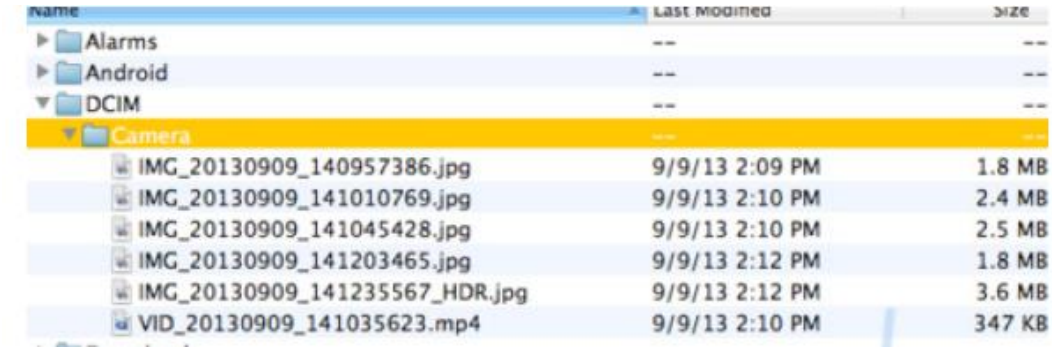


Figure 3. 8. Many photos in the folder of a camera

3.3.2 Scanner

A scanner is an electronic device which can capture images from physical items (printed text, handwriting, photographic prints, posters, magazine pages, and similar sources) and convert them into digital formats, which in turn can be stored in a computer and viewed or modified using software applications.

Very high resolution scanners are used for scanning for high-resolution printing, but lower resolution scanners are adequate for capturing images for computer display.

b. The different parts of scanner

A scanner has the following five parts visible externally:

(1)Start button, (2) Copy button, (3) Scan to E-mail button, (4) Scan to Web button, (5) Scanner cover

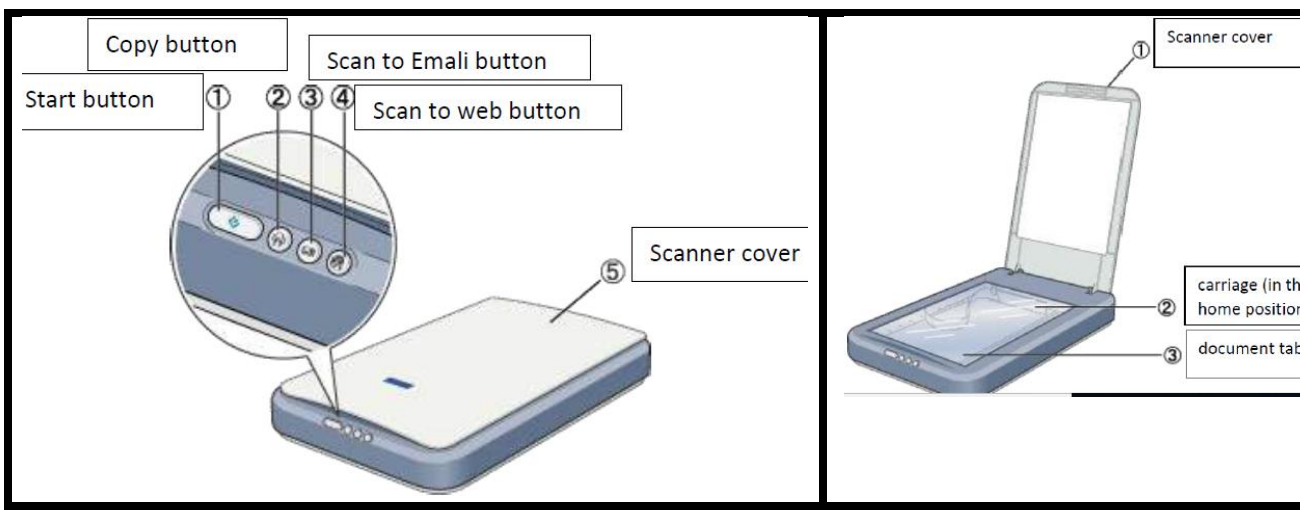


Figure 3. 9. Different parts of a scanner (left) and a scanner with an opened cover (right)

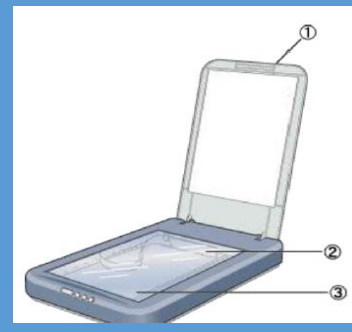
Note:

Parts, size and looks of scanners vary depending on the type of scanner and some scanning and photocopying functionalities are combined in one physical device therefore some of the parts mat not be visible

Some scanners have touch screen capabilities therefore they may not have some of the buttons

Application activity 3.3

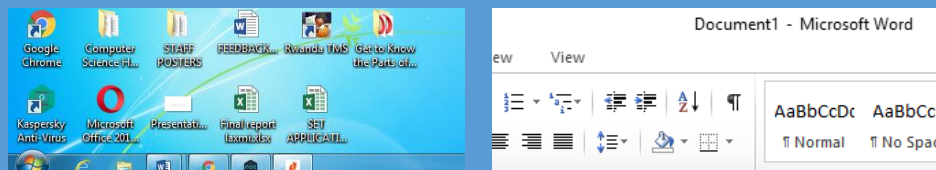
1. Compare digital camera to scanner?
2. Discuss the importance of digital camera in computer graphic.
3. With your camera, take a picture of the school computers, import it in your computer and insert it in one of your text documents created in MS Word.
4. At your school, what are the advantages and disadvantages of keeping scanned documents?
5. Give the names of the 3 scanner parts indicated in the following image.



3.4 Screenshots Capturing

Activity 3.4

Observe the image below and answer related questions



A screenshot is an image of a computer desktop that can be saved as a graphic file. (The mouse cursor is not included in the image). The main ways used to get the screen of computer is to use the **Print Screen key** (PrtSc) or the **Snipping Tool**

3.4.1. Use of Print Screen Key

A print screen is a computer key which is used to copy to the clipboard an image of the screen and paste it in any other application for saving or manipulation

Steps to follow in screen shot capturing using Print screen key:

Open the screen that is going to be copied.

Press the Print Screen key PrtScn

Paste (CTRL+V) the **image** into an Office program or any other application.

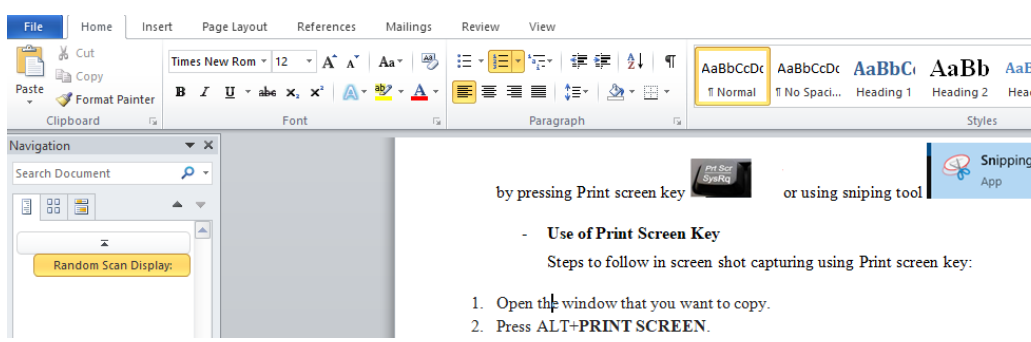


Figure 3. 10. A copied screen shot using PrtSc Key

The taken image can be edited depending on the options provided by the program in which it is pasted.

For example in word an image can be edited using the **Picture Tools** available on the word menu when the image has been selected.

3.4.2 Use of Snipping tool

Snipping Tool is a Microsoft Windows screenshot utility included in Windows Vista and in later versions. It can take still screenshots of an open window, rectangular areas, a free-form area, or the entire screen.

To open the Sniping tool:

Click on **Start**

Write **Snipping Tool** in the search box and once found click on it to launch or click on **All Programs** then click on **Accessories** and click on the snipping tool

An opened Sniping tool will look like in the image below:

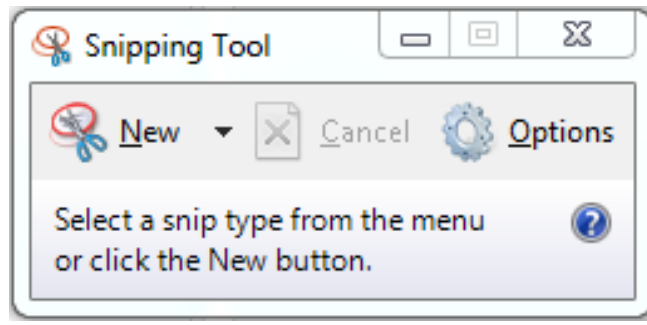


Figure 3. 11. Snipping tool window

To take a screenshot using Snipping tool

To take a screenshot in the opened Snipping tool

- Click on **New** tab and choose among the snipping options (free form, Rectangular, Window, Full screen)
- Hold down the left button and hover over the screen area to take.
- Release the cursor to take the snip

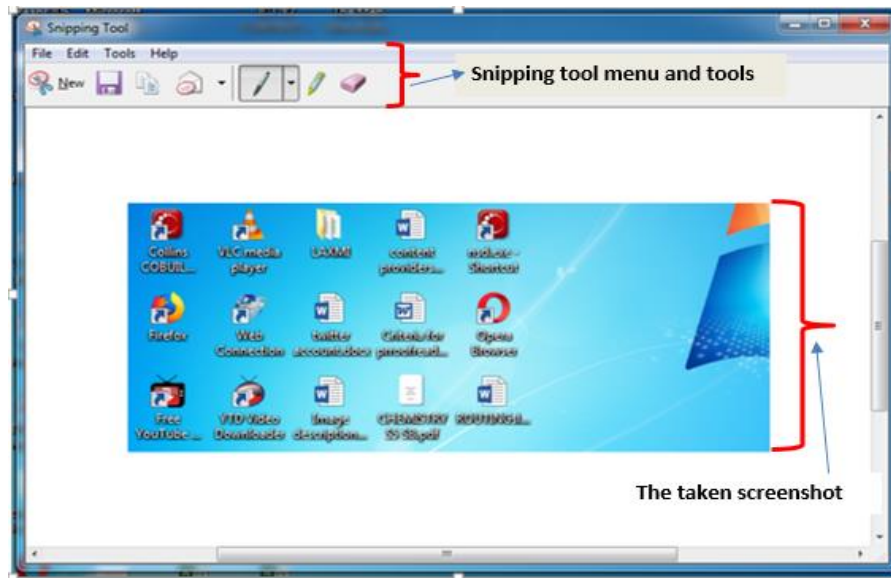


Figure 3. 12. Screenshot taken using snipping tool

Options with a taken screenshot

As provided by the Snipping tool menu a taken screenshot can be saved using the Save tool, can be copied using the copy tool, can be sent via email by using the message

Application activity 3.4

1. What is the difference between a snip and an image?
2. Take a screenshot of the start menu of your computer and save it as JPEG on the desktop
3. Take a screenshot of Office MS Word environment and label its different parts using the pen tool

3.5. Graphic Software-Paint

Activity 3.5

Describe what you see on the pictures below

1. Discuss how such an image can be created and modified?
2. Which tools can you use to create and modify a picture?

In computer graphics, graphics software refers to a program or a collection of programs that enable a person to manipulate images on a computer.

Examples of such programs include Adobe Photoshop, Microsoft Publisher, Paint, Etc.

3.5.1. Starting and saving a Paint file

A paint program is a software graphics program that allows the user to draw or paint bitmapped images on a computer.

To start Paint go through the following steps:

- Type Paint in the search box which appears in the startup menu
- Click Paint to open the program. The following window will appear

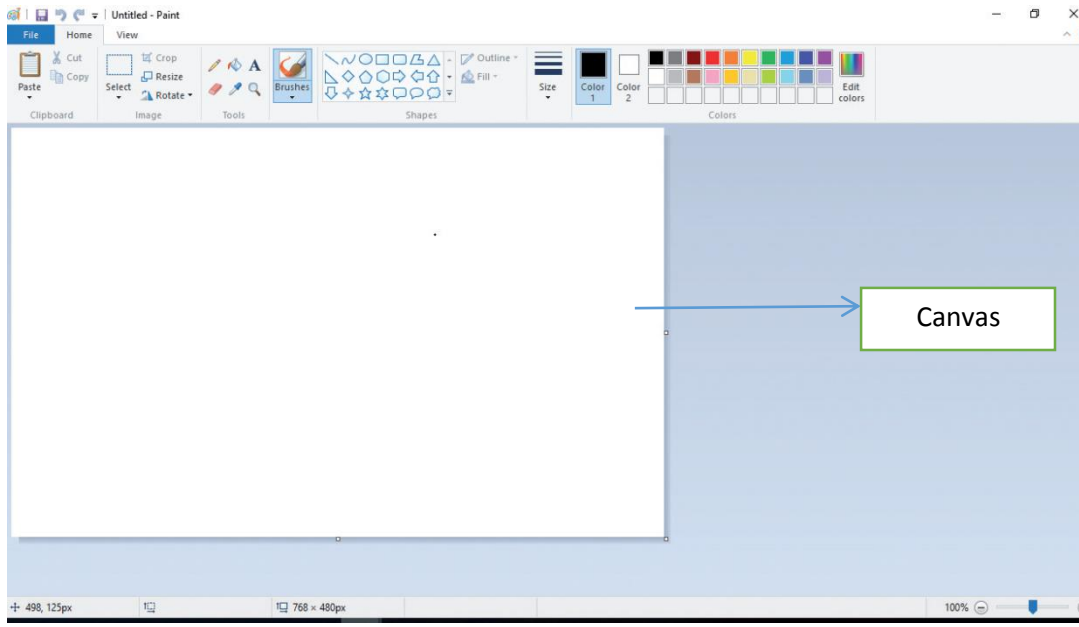


Figure 3. 13. Microsoft Paint at start

Understand the canvas

When Paint launches, the white "canvas" will appear on the screen. Imagine this canvas as a piece of paper to draw or write on. The size of the canvas can be adjusted before starting to create images.

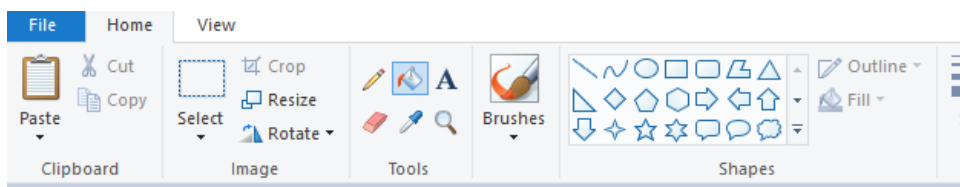


Figure 3. 14.A flower drawn in Canvas

The flower above has been drawn using the Pencil tool which was used to draw lines and the Fill with color tools was used to fill the red color on the leafy part of the flower.

Saving a paint file

- From File menu, choose Save as.
- From a dialog box, choose **PNG picture** or any other image file format

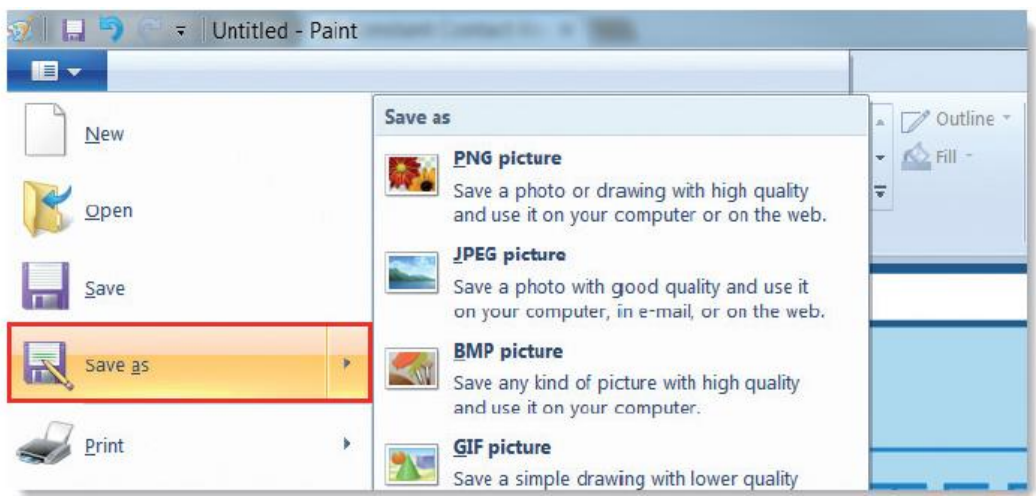


Figure 3. 15. Different image file formats

In the next window type the file name, choose file format then click on save button.

3.5.2. Paint tools

The paint program has got many tools which help its user manipulate images and do any activity Paint is supposed to do. Some of the Paint tools are shown in the image below:

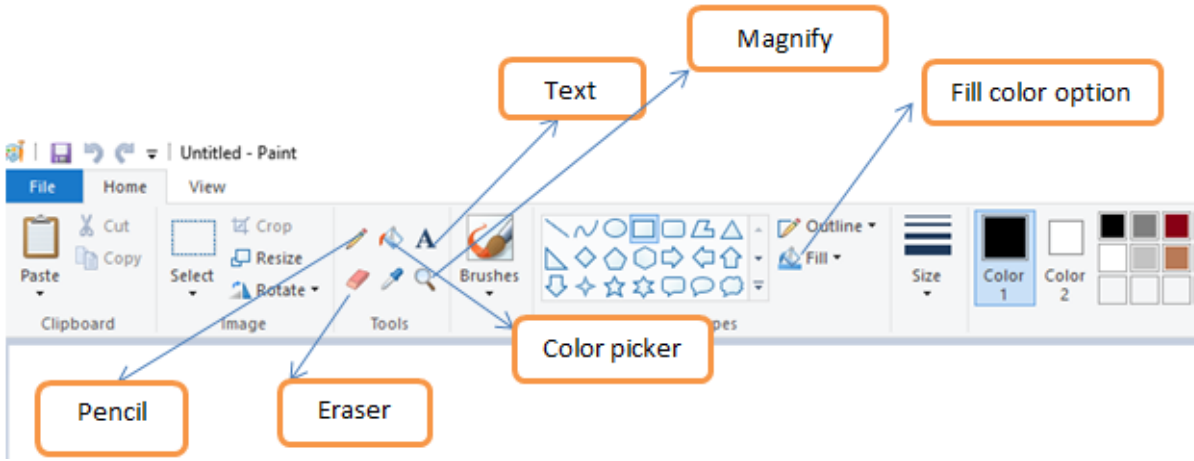


Figure 3. 16. Different paint tools

Text tool: The tool allows **text** to be typed onto the current layer using the primary color. The text controls in the Toll Bar can be used to change the font, the size of the font, formatting.

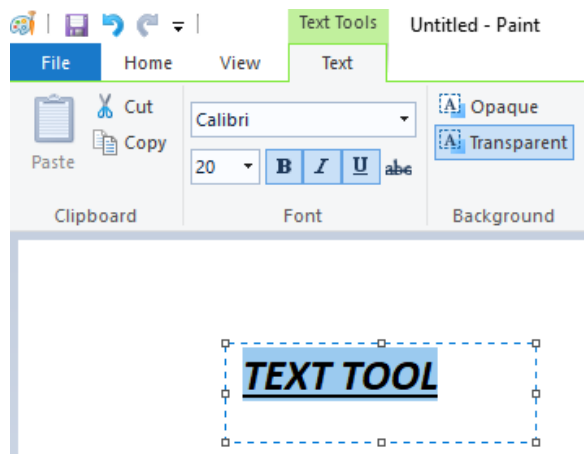


Figure 3. 17. Text tool in Paint

The pencil tool: is a freehand drawing tool, much like an actual pencil. The width of the line can be adjusted by clicking the Size menu and selecting a different line width.

To draw, simply press the mouse button as you move the mouse on the canvas.

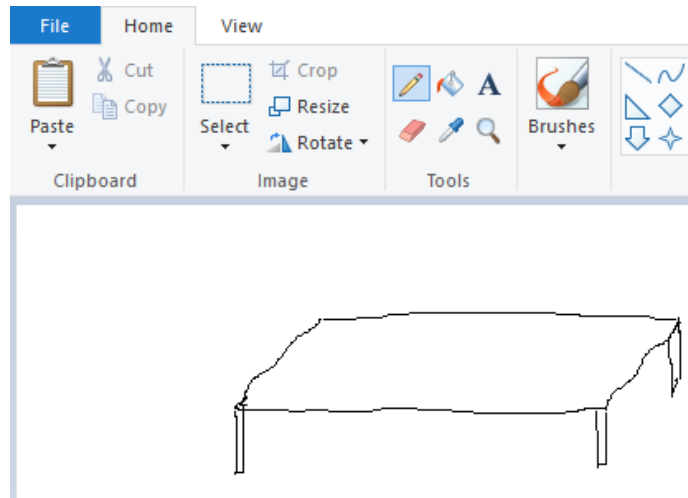


Figure 3. 18. A table drawn using Pencil

Eraser tool: This tool is used to remove parts of the active layer or selection like in the image below

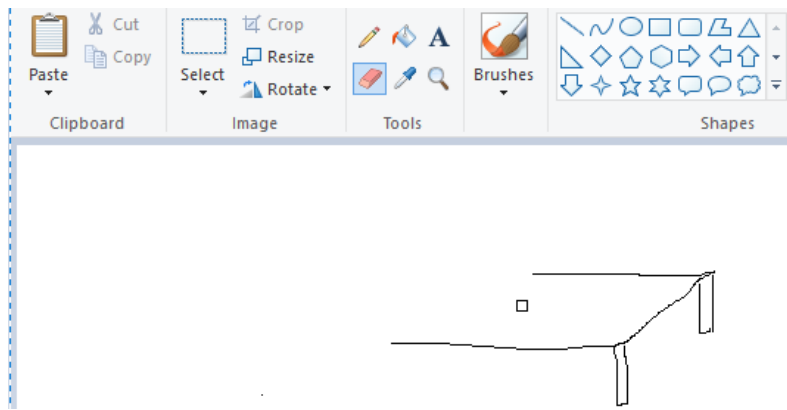


Figure 3. 19. Use of eraser tool

Fill color tool: Is used to fill an area of similar color with another color.

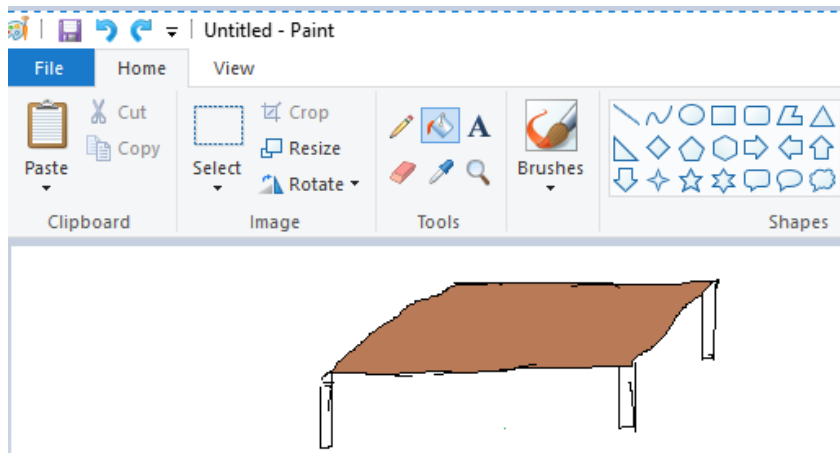


Figure 3. 20. A table colored by fill color tool

Color picker tool: is used to select a **color** on the active **layer**. By clicking a point on a layer,

You can change the active **color** to that which is located under the pointer.

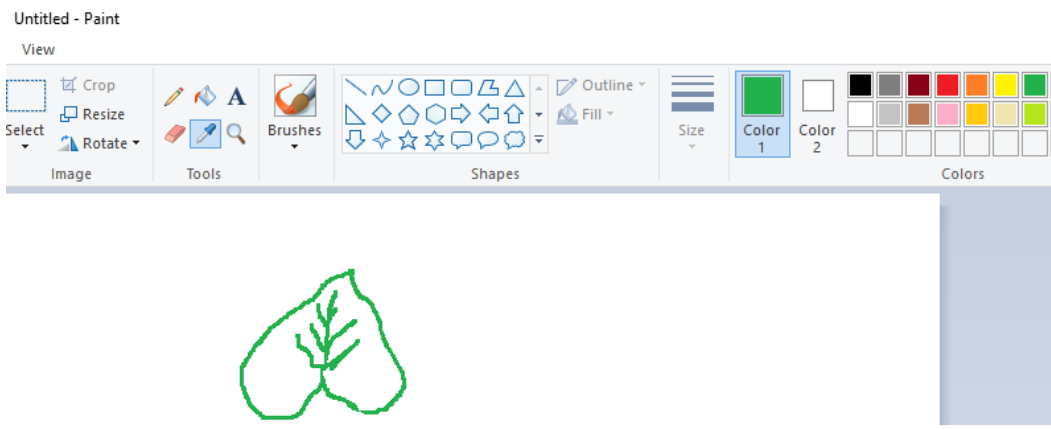


Figure 3. 21. A drawing in which color picker has been used

Magnifier: next to the "Pick color" button is the "Magnifier" button, which looks like a magnifying glass. Selecting this tool will allow the user to zoom in and out of an image.

3.5.3. Insertion of Shapes

A shape is a geometric figure such as square, triangle or rectangle. Using illustrator's shape to draw can be an effective way to create smooth paths and predictable results. Below are different shapes in Paint:

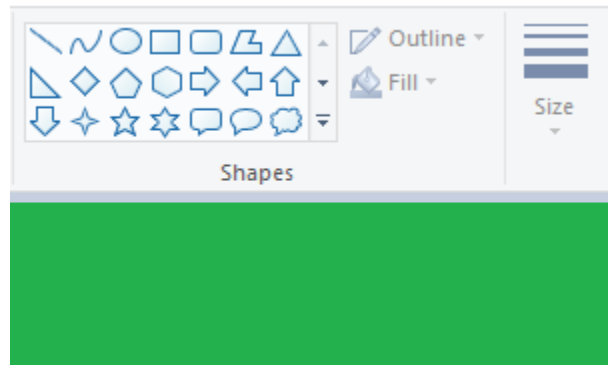


Figure 3. 22. Different shape types in Paint

Select any shape from the toolbar to draw that shape. Once you've chosen a shape, you'll notice some options for the shape's appearance.
Click the "Outline" and "Fill" menus to view your options.
Select your preferred outline and fill options,
Then, click the canvas where you'd like to place your shape.
Hold down the mouse button as you drag the cursor to enlarge the shape.
Let go of the mouse button when reach the desired shape size.
After choosing a shape with an outline, the color of the outline will be the current foreground color. If the shape has a solid filling, the fill color will be the background color.

3.5.4. Select, Cut, Copy, Paste and Crop

a. Copy and Paste

Press and hold down the left mouse button inside the selection box and move the picture to relocate the image.

If you wish to **copy** the image:

- Right-click inside the selection box
- And click "**Copy**."

An image can be **pasted** to another **paint** document or in another program.

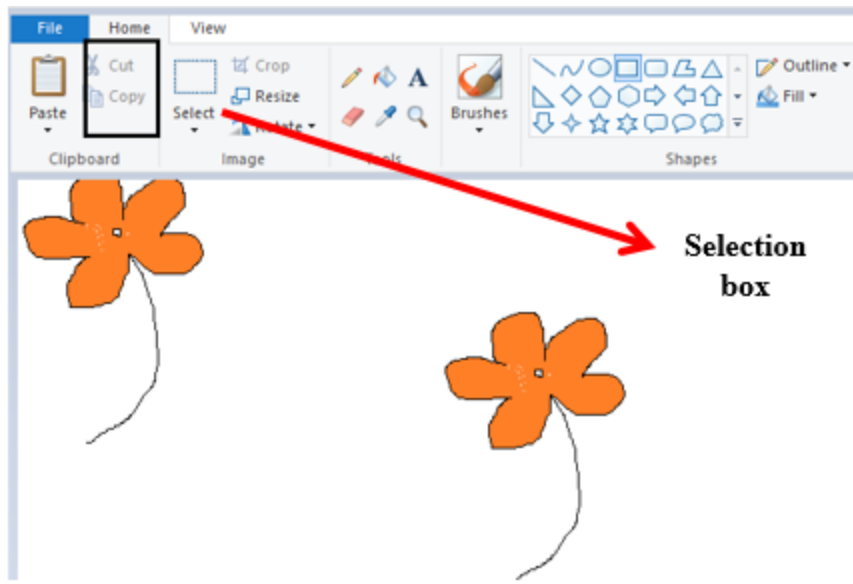


Figure 3. 23. Paint document with a copied image (Flower)

b. Cut and Paste

Click on the area of an image you want removed, click and hold the mouse to drag the box as far down and over as needed

- Press and hold "Ctrl" and "X" to cut the selection.
- Press and hold "Ctrl and "V" to paste the selection, either elsewhere in the same document or in a separate document.

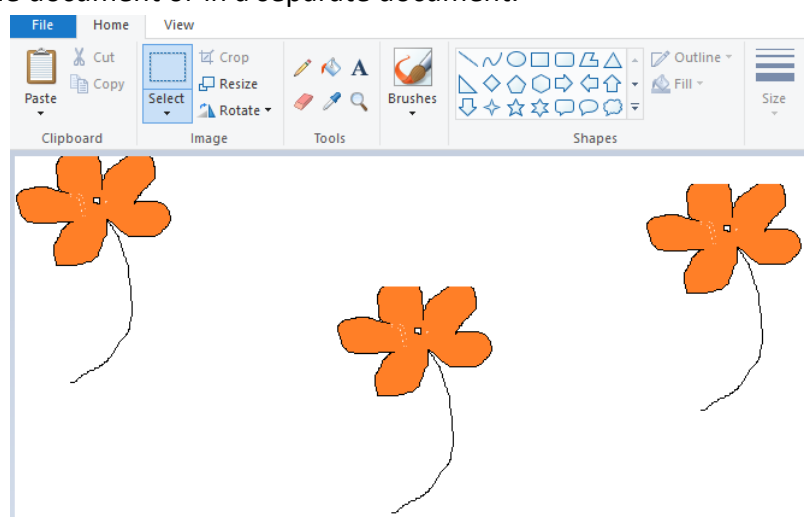


Figure 3. 24. A pasted image in Paint document

- Paste in Ms Office word

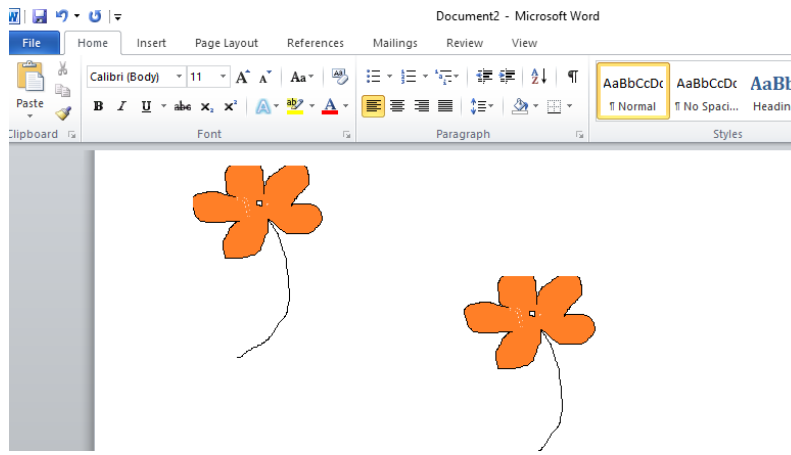


Figure 3. 25. Copied image in Ms Word document

After cutting in Paint

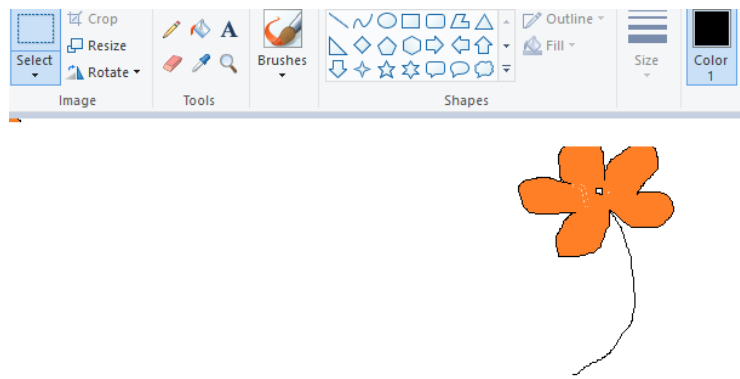


Figure 3. 26. Paint image after cropping unwanted parts

c. Crop

Select the portion of the image you want to **crop** using the Select tool.

Once selected right-click with the mouse anywhere in the image selection and select **Crop** or go to Crop in tools bar.

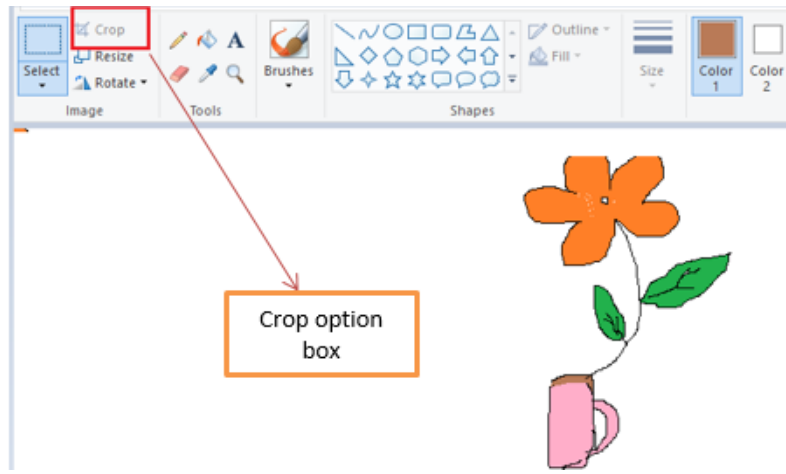


Figure 3. 27. Image before crop

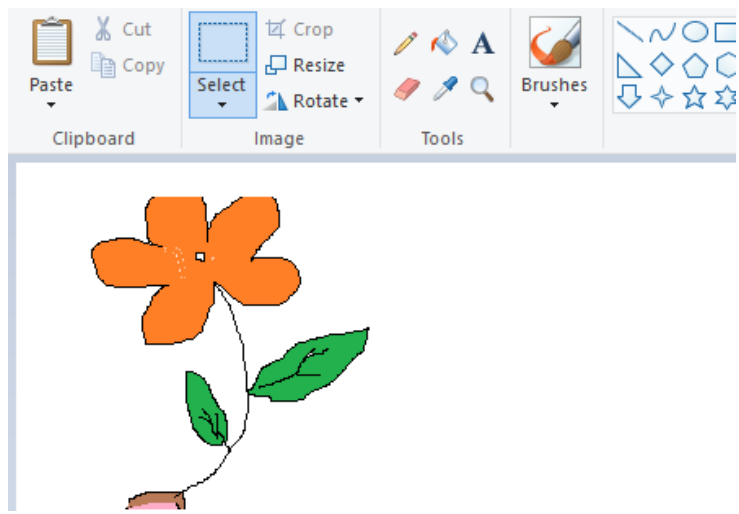


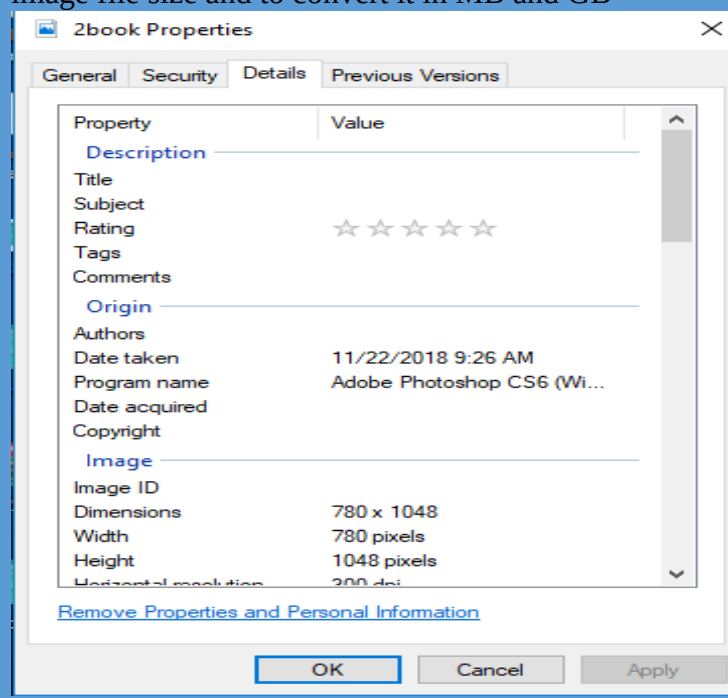
Figure 3. 28.Image after crop

Application activity 3.5

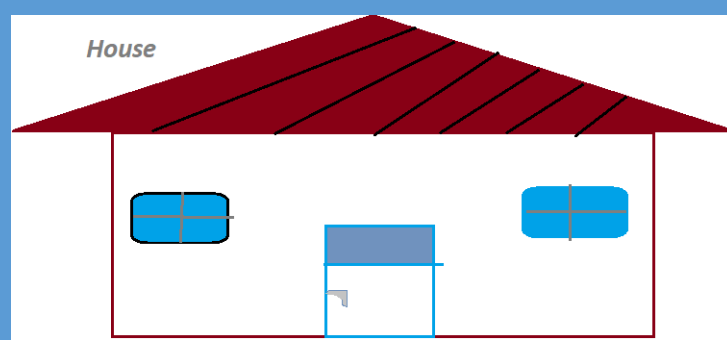
1. Differentiate computer graphics to Paint
2. What is the importance of Ms Paint in computer graphics?
3. Discuss the use of Ms Paint and its importance in advertisement
4. Differentiate the use of Fill Color and Pick Color tools.
5. Draw a red flower in Paint and save it on desktop
6. As a student teacher who is going to teach the parts of the human body draw a human on a paper, scan the image and put labels on it using the Insert, Shapes options available in word Paint and Word

END UNIT ASSESSMENT

1. Define the following terms:
    a. Pixel,
    b. snipe,
    c. Morphing,
    d. Paint
    e. Aperture
2. Explain the following abbreviations:
    a. JPEG
    b. CMOS
    c. PNG
3. Discuss the importance of computer graphics in decoration services
4. Based on information on figure below, you are requesting to calculate the image file size and to convert it in MB and GB



5. Using Ms Paint, draw the following picture and put labels on it to show its different parts (roof, door, window)



6. Use any available photo on your computer change its color, copy and paste it in Ms word.

UNIT 4: E COMMERCE, SOCIAL MEDIA AND ONLINE SERVICES

4.0 INTRODUCTORY ACTIVITY

Holly City Technology Ltd manager needs to buy computer spare parts products from outside of Rwanda. The manager doesn't have time to go out of the country and he decided to search on the Internet the websites which sell computer spare parts.

1. Discuss ways the manager can use to communicate with the supplier to obtain the price of the goods
2. Discuss the type of business conducted via the Internet
3. Give social media platforms used for daily communication
4. Discuss the way that can be used for payment

4.1. E- commerce

ACTIVITY 4.1

1. Kamikazi wants to buy a Psychology 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. Finally, she realized that the book is available online on amazon. com and the price is at 15,000 RWF.
   a. Discuss the process Kamikazi will go through in order to buy that book and have it delivered to her
   b. Brainstorm the other local and global online platforms that can be used to buy goods and services
2. What do you understand by Customer to Business relationship?

4.1.1. Understanding E -Commerce

a. History

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. This commerce provides to buying parties physical goods but also electronic materials (goods) where possible.

The history of ecommerce dates back to the invention of the very old notion of “sell and buy”, electricity, cables, computers, modems, and the Internet. Ecommerce became possible in 1991 when the Internet was opened for commercial use

At first, the term ecommerce meant the process of execution of commercial transactions electronically with the help of the leading technologies such as Electronic Data Interchange (EDI) and Electronic Funds Transfer (EFT) which gave 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.

b. Some Ecommerce platforms

With ecommerce the buying and selling parties don’t need to meet at the same location, the buyer does not go to the store but there is an electronic platform that is used as a market where the buyer and the seller meet. An example of such a platform is amazon.com.

Figure 4.1. Amazon.com one of the most known Online shopping platforms

To buy goods on amazon.com or any other online chopping platform (ecommerce website), the buyer must have an Amazon account, must log in using that account, choose among the list of provided goods, choose location where the goods are to be delivered and pay using acceptable payment means like Credit cards.

As of September 2021, the online shopping platforms available in Rwanda are among others vubavuba.rw and kikuu.com. Through this platforms one can buy food (Vuba Vuba) or clothes (kikuu.com).

Figure4.2.MaininterfacesoftheshoppingplatformsinRwanda(vubavuba.rwandrw.kiku.com)

c. Buying on an e-commerce platform case of kikuu.com

As stated earlier kikuu.com is one of the platforms available in Rwanda with which one can buy available goods and have them delivered to his/her preferred location in Kigali. To buy with Kikuu, as it is a principle for other e-commerce the buyer has to have an account. To create that account, go through these steps:

1. In the address bar write kikuu.com and once the platform loads click on Register to create a login account. Fill in the provided form the requested details. Or
2. If the user account is already created login

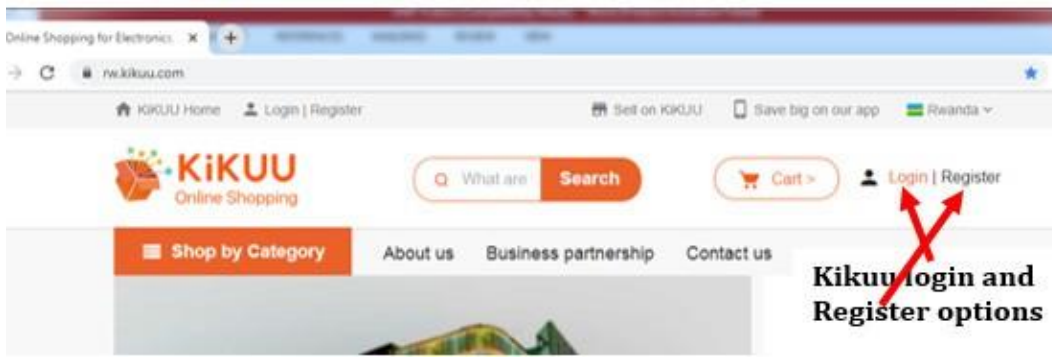


Figure 4.3. Kikuu login and Register options

1. Once the login is successful choose goods to buy.

For most platforms goods have pictures and accompanying image and for selecting the goods just click on its image. Select the goods specifications carefully so as to get what is wanted. In the case of the shoes chosen like in the image below the customer has to choose the shoe's color and the size.

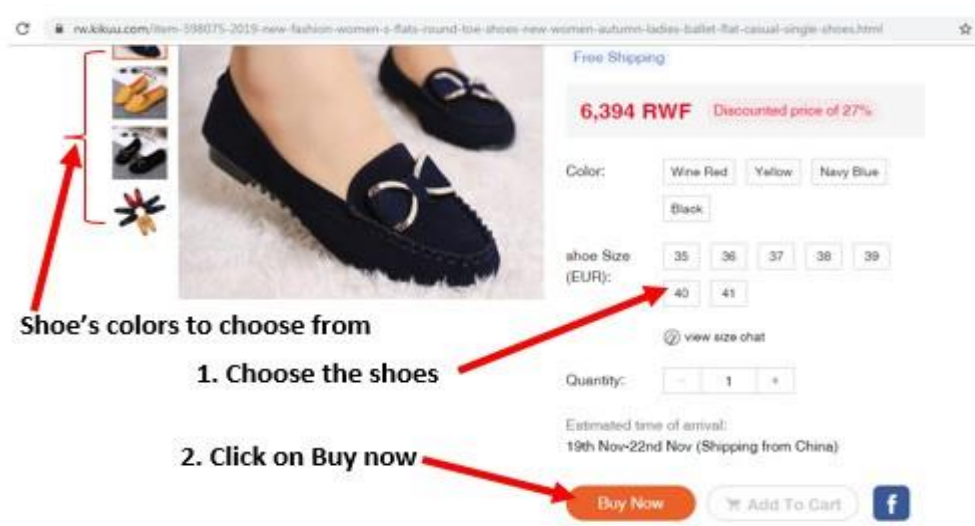


Figure 4. 4. Screen to choose shoe specifications

2. Pay the amount due by using the preferred payment method

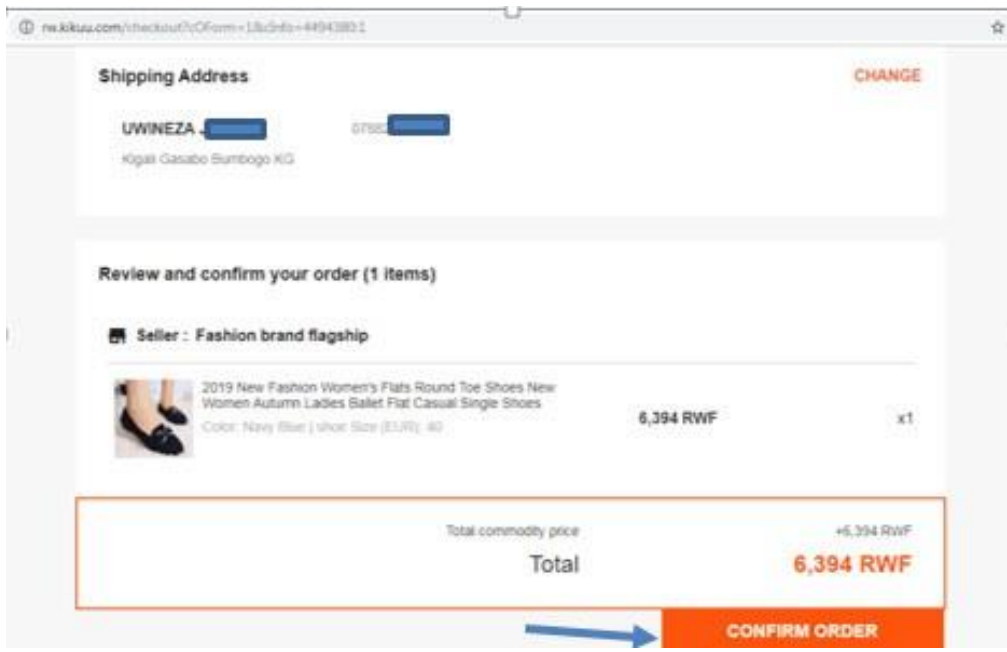


Figure 4. 5. Shipping address and confirm order Window

in the next two screens choose the payment method and click on **PAY <Amount>**. In the other screen as MTN Money has been chosen as payment method fill the account and click **PAY <Amount>**

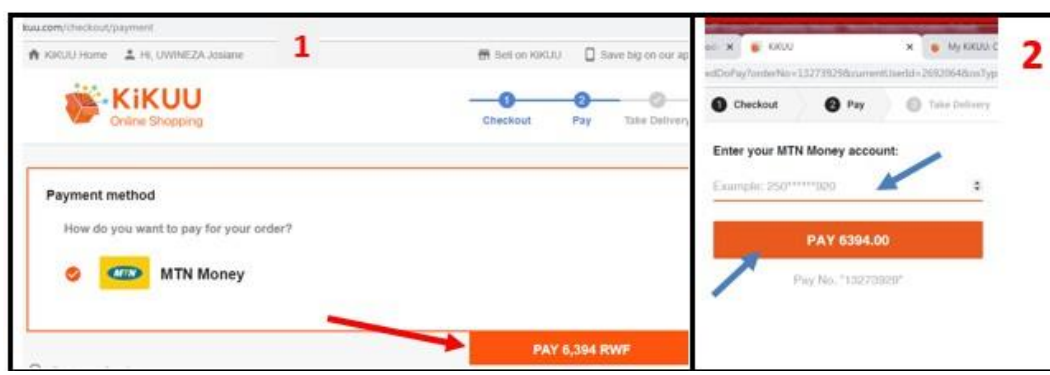


Figure 4. 6. Screens for choosing the payment methods and paying

d. Advantages and disadvantages of e commerce

There is no good thing without a bad side. Ecommerce presents to its users many advantages but has also disadvantages.

a. Advantages of E-commerce

- Does not require physical displacement of the buyer hence saving money and time
- Products and services are easy to find on the platform rather than moving in so many stores, warehouses or supermarkets
- Transactions can be done all the time of the day and the week (24/7).
- No geographical limitations translate as a bigger customer reach.
- Higher quality of services and lower operational costs.

b. Disadvantages of E-commerce

- No guarantee of product quality as the product is not physically viewed
- Customer loyalty becomes a bigger issue as there is a minimal direct customer-seller interaction.
- Anyone can start an online business, which sometimes leads to scam and phishing sites.
- Hackers target web shops which may lead to disruption of service.

4.1.2. 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.

For example an IT freelancer who demos and sells his software to a company.

APPLICATION ACTIVITY 4. 1

1. Discuss the major benefits of E-commerce
2. What are two advantages of electronic commerce over traditional commerce?

4.2. Online Payment Methods

ACTIVITY 4.2

Observe the picture below that shows the different online payments methods

Answer the below questions:

1. Among the above payment method, list payment method use in Rwanda
2. Discuss steps to make payments online

Is the way that a buyer chooses to compensate the seller of a good or service that is also acceptable to the seller. Typical payment methods used in a modern business context include cash, checks, credit or debit cards, money orders, bank transfers and online payment services such as PayPal.

1. Cash Payment

Buying online requires using electronic means which are acceptable by the selling companies for example as seen in previous sections buying with Kikuu requires using MTN Money. Other online platforms may require special cards known as debit or credit cards.

In Rwanda, banks provide means to pay using those cards. For example, Bank of Kigali provides options to buy on POS (Point of Sale) or on ecommerce platforms using Visa or MasterCard debit cards.

a. Debit & credit cards

A debit/credit card is a plastic card normally issued by a financial institution to allow its user to pay at Points of Sale in order to complete a purchase. They also allow the same purchase on online shopping platforms.

Debit and credit cards look alike and it is not easy to identify them simply by liking at them except when it is written on them. The main difference is where money is got from: for the debit cards money is immediately got from the owner bank account while for the credit card money is charged to the customer's credit line.

The image below shows the front and back side of a credit/debit card

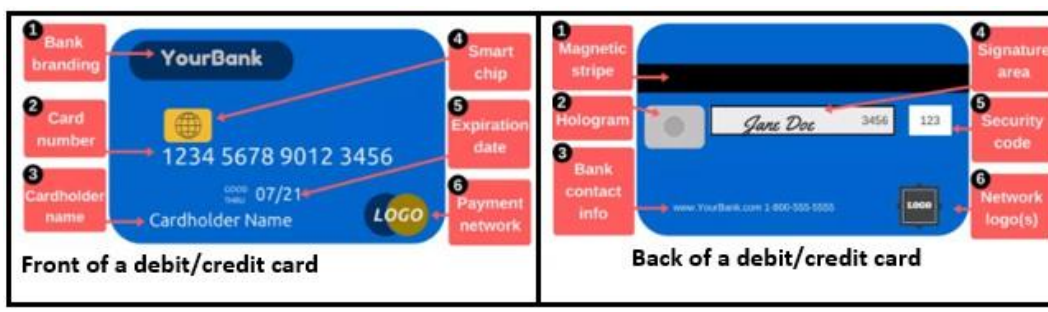


Figure 4. 7. Parts of a debit/credit card

The parts found on the front side of the credit card are:

1. **Bank branding** which identifies the bank name that issued the card
2. **Card number** which is unique and identifies the client with the bank.

The card number are the ones provided while purchasing online.

Note: Keep the card number a secret as that number can be used by ill-intentioned people

3. **Card holder name** is the name of person authorized to use that card
4. **Smart ship** is the electronic circuit (processor) which stores some information. The smart ship feature makes cards more secure than the magnetic-stripe-card only
5. **Expiration date** is the date after which the card is no longer usable. The reason for this is mainly for the purpose of providing new cards which are more

technologically advanced. The expiry date is necessary while purchasing online as most platforms require this information and when it is wrong the transaction can't be done

6. **Payment network logo** is the type of card and this can be MasterCard, Visa and Discover. Services specify which types they accept for payments and knowing the card's type is very essential.

The parts found on the back side of the credit card are:

1. **Magnetic stripe:** the black strip contains information about the card and its owner, and specialized devices known as card readers gather that information when the card is inserted
2. **Hologram:** is a mirror-like area showing a three-dimensional image that seems to move as the viewing angle changes. Holograms are security features which help merchants identify valid cards
3. **Bank contact information**
4. **Signature panel** is the place where the user's signature is put
5. **Security codes** is an additional code to help ensure that anybody using the card number has a legitimate, original card
6. Network logos

An example of a typical debit card is found below:

Figure 4. 8. B.K MasterCard debit card

b. 1. Using a debit/credit card to purchase

The following are the steps of using a Debit/Credit card in online shopping:

1. Enter the address of the website where to purchase from in the address box of the browser's window.
2. Select items to purchase and click the appropriate button used for purchasing the item.
3. Enter the shipping, billing and debit/credit card details.
4. Click the appropriate button to complete the transaction.
5. Print the confirmation screen or proof of purchase received uponcompleting the transaction, and keep it until the item arrives.

For using debit cards at POS or ATMs insert the card and follow the prompts

c. Mobile Phone based Money

Also called Mobile money is a technology that allows people to receive, keep and spend money using a mobile phone. It's sometimes referred to as a **'Mobile Wallet'** or by the name of a specific service

There are more different mobile money services around the world. Although they are most popular in Africa, Asia and Latin America. Mobile money is a popular alternative to both cash and banks because it's easy to use, secure and can be used anywhere there is a mobile phone signal.

Mobile money keeps funds in a secure electronic account linked to a mobile phone number. In some cases, the mobile money number will be the same as the phone number. Mobile money is often provided by the same companies that run the mobile phone services and it is available to both pre-pay and contract customers.

APPLICATION ACTIVITY 4.2

1. List 5 public services that are paid using Mobile money here in Rwanda
2. Discuss the payment method at your school used to pay school fees?
3. What are the advantages of Mobile money payment method over paying cash at the bank counter?

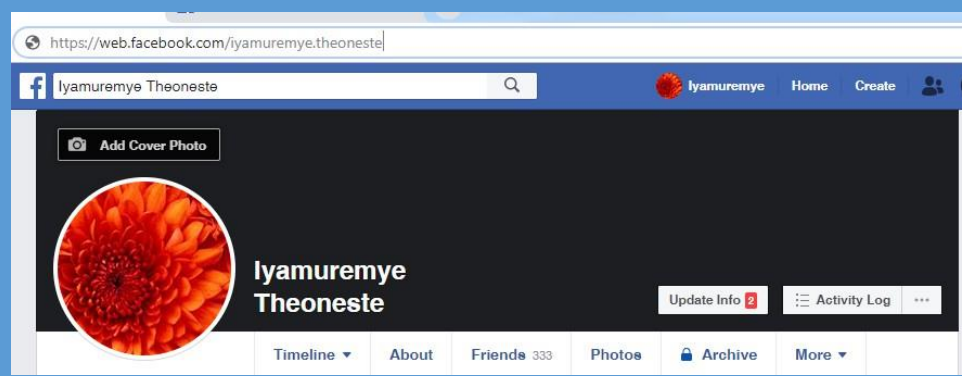
4.3. Facebook

Social media is the collective of online communications channels dedicated to community-based input, interaction, content-sharing and collaboration which enable users to create or share content or participate in social networking.

Examples of social media are: **Facebook, twitter, Instagram** and **WhatsApp**

ACTIVITY 4.3

Observe the image below and answer the questions below:



Discuss the nature of the window above

1. What do you understand by the term “Social media”?
2. Discuss the positive and negative impacts the social media has to the Rwanda Society

Facebook is one of the most popular free social networking websites. It allows registered users to create profiles, upload photos and videos, send messages and stay in touch with friends, family and colleagues.

- **Creating a Facebook account**

For most social media before using them an account must be created. An account identifies the user as different from other users in the system.

The following steps are followed to create a Facebook account:

1. Open Facebook Home page by entering in the browser's address bar the link www.Facebook.com
2. The first page provides the option to login or sign up. Fill in the form the required information and click on sign up
3. Enter personal information (First name, Last name, email or phone number, Birthday and gender)
4. Enter the code provided through SMS or the provided email

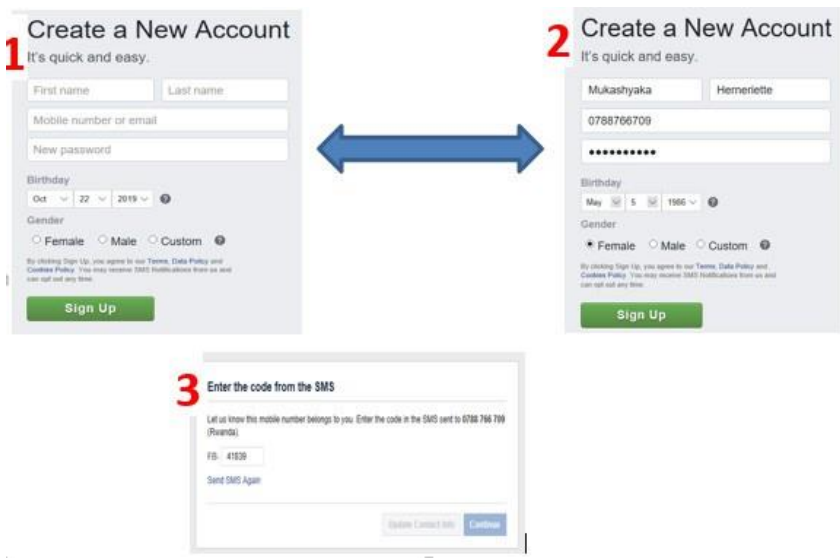


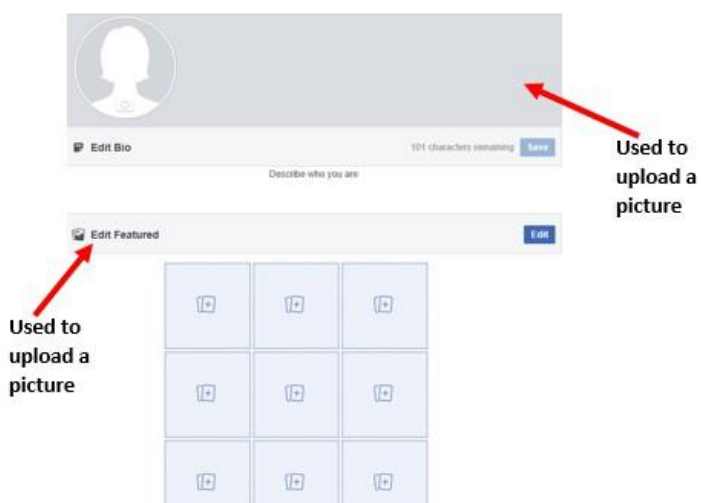
Figure 4. 9. Filling forms for creating Facebook account

1. Open the verification email that is sent to the email provided while creating the account

2. Edit the profile information by logging into the new account and clickingon **Edit profile**

Figure 4. 10. Edit profile window

The following table will be appeared.



Note: The account has been created you are able to login into your Facebook account:

Go to Facebook.com and in the top right form fill in the email and the password

then click on:

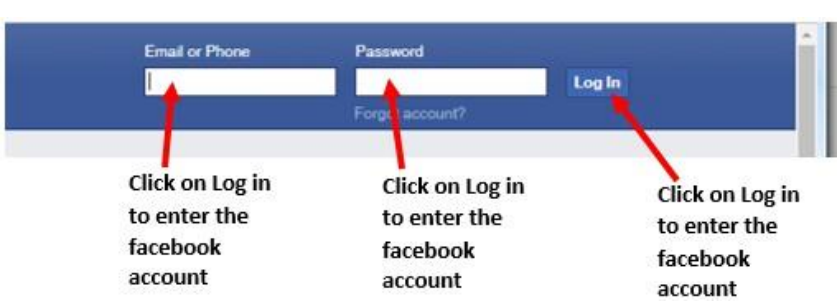


Figure 4. 12. Facebook Window for login

- **Connecting with friends**

Facebook has millions of users, all users are in the public and appear like anonymous to you. As a Facebook user you are allowed to search for other users, viewing their profiles, friends, and photos. You can immediately message them inbox but once the account owner sets some restrictions on his/her account a non-friend user may view nothing among these.

In order to be able to fully communicate with another Facebook user, you just need to be a Facebook friend.

To have a friend on Facebook go through this process:

- In the Facebook search box enter the account of the friend to be

Figure 4. 13. Window to search for an account to make a friend

- Once the account is entered in the search box choose the correct Facebook account among the many options and click **Add Friend**. In the image above the account chosen is **Shyaka Emmanuel**

- **Sharing pictures**

A Facebook account holder can upload pictures on his/her Facebook account, share them or share pictures uploaded by others.

Steps to upload a picture in your account are:

- In the menu click on **Photo** then on **Add Photos/Video**

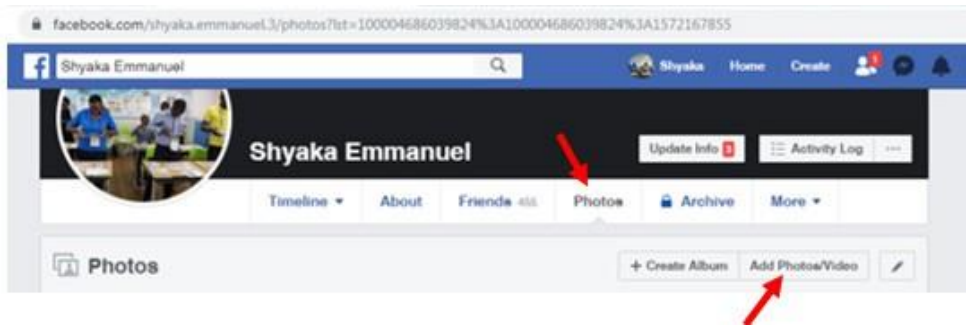


Figure 4. 14. Add photo options in Facebook

- In the new window that will appear browse for the picture to upload and open it so that it gets uploaded.

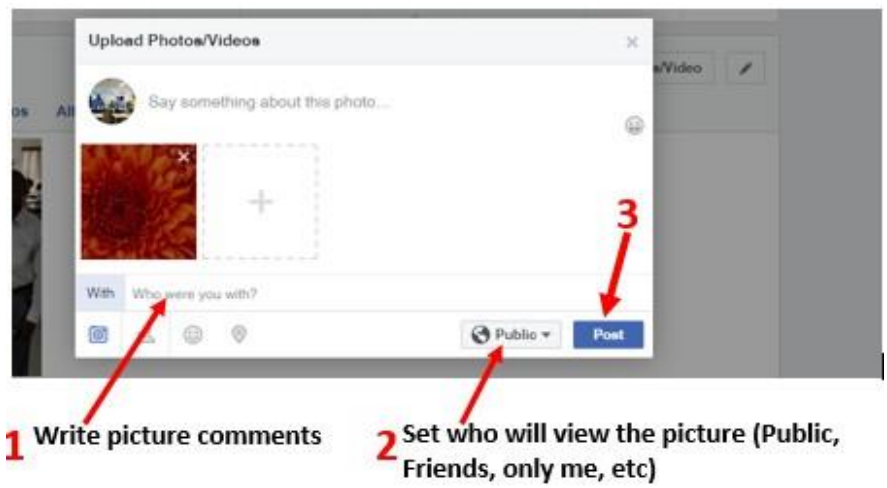


Figure 4. 15. Setting who has rights to view a posted picture

- Comment the picture, set who has rights to view it and click on Post like illustrated in the image above

The uploaded image can then be viewed by anyone (if right to view the image has been set to Public) and they can like, share and comment this image.

d. Chatting

Facebook provides the option to converse with friends by using the chat option whose window is available in the far down right zone of a Facebook page.

The content of the chat is text but can be also attachments in form of text files, images, GIF files, videos or a laptop camera taken picture/video

APPLICATION ACTIVITY 4.3

1. List and explain the steps to create a Facebook account
2. Create a Facebook account and give it your names. Upload your picture on the account's profile
3. Search and request for friends by focusing on your classmates
4. Chat with your friend and send them some documents related to your different subjects' lessons

4.4 Twitter

ACTIVITY 4.4

Observe the picture below:

a. The above picture represents which popular social media
b. Discuss the use of the social media stated in the above question

Twitter is a free microblogging service that allows registered members to broadcast short posts called tweets. Twitter members can broadcast tweets and follow other users' tweets by using multiple platforms and devices.

a. **Creating an account**

- For creating a twitter account first go enter in the browser's address bar twitter.com
- In the first page that will appear click on **Sign up.** This same page is used for sign in when the user has already a twitter account

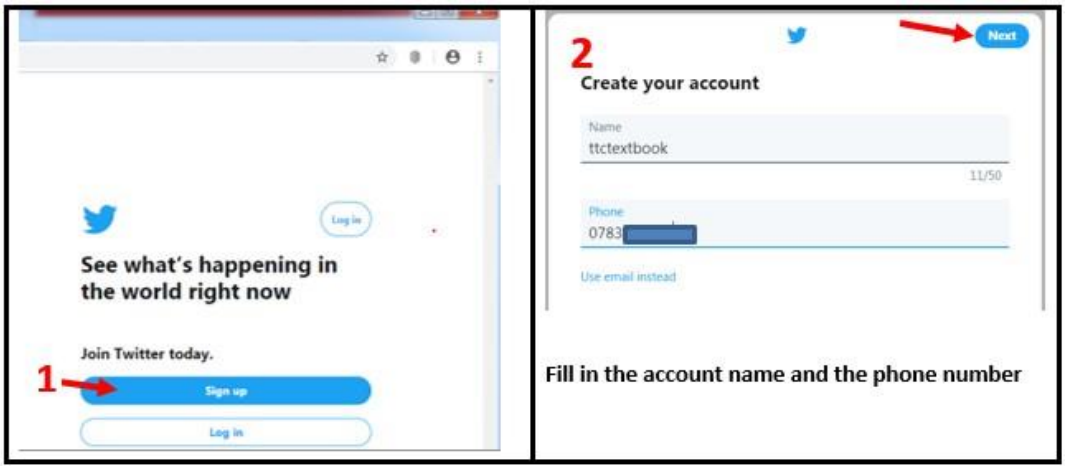


Figure 4. 16. First Twitter page for sign up and sign in (1) and form to fill to create a twitter account

- In the next screen that will appear also click on **Next.** Confirm the telephone number so and use the sent code to continue to the next stage

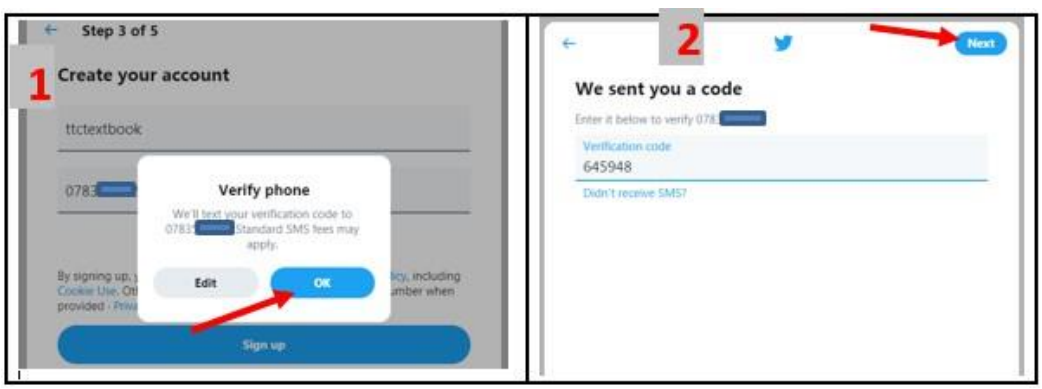


Figure 4. 17. Confirm the telephone number (1) and enter verification code windows

- In the next screen enter the password for your twitter account and click on **Next**. The screen that will thereafter appear will allow you to edit the twitter account profile picture by clicking on the human head-and-body silhouette but this can be skipped to be done later.

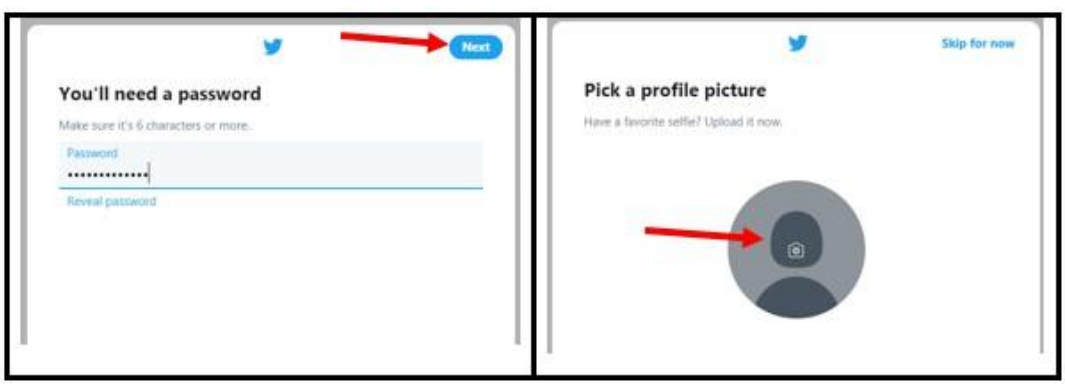


Figure 4. 18. Windows to set the password (1) and to set the account's profile picture (2)

In the next screens that will appear follow the prompts. Those screens will allow describing yourself, setting your interests, suggestions of accounts to follow, turning on notifications

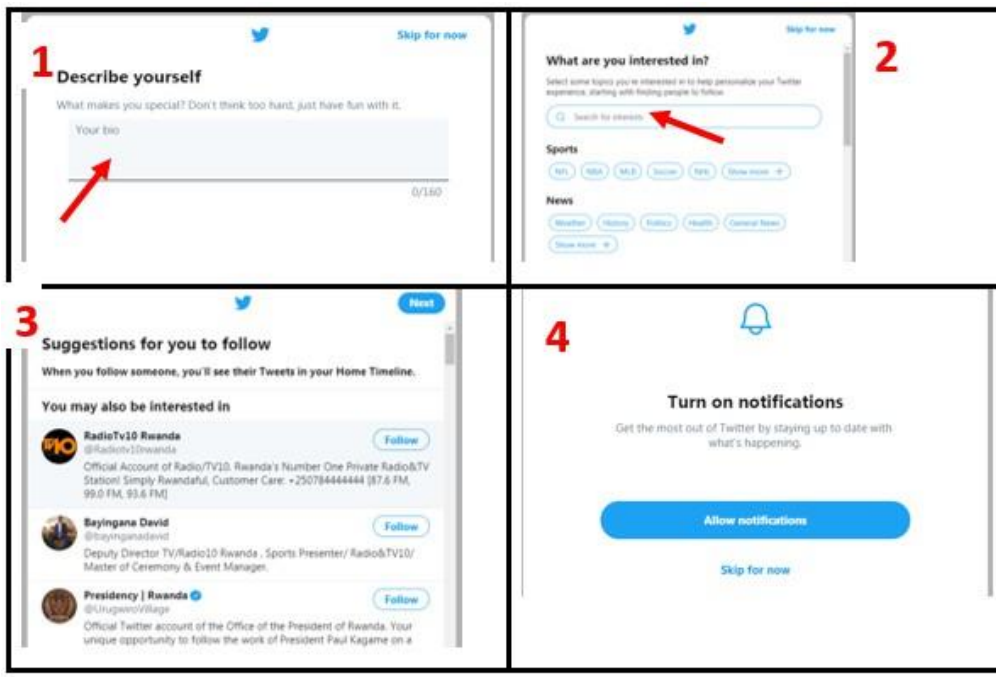


Figure 4. 19. Different windows (1, 2, 3, 4) gone through while creating a twitter account

In the steps given above the account creator may decide to go into additional steps depending on which features to activate. Here most of the options have been skipped or the default provided option was chosen. After going through all the steps the account is created and is ready to be used. However the steps are subject to change and screens may not look like the ones provided here depending on changes brought in by Twitter.

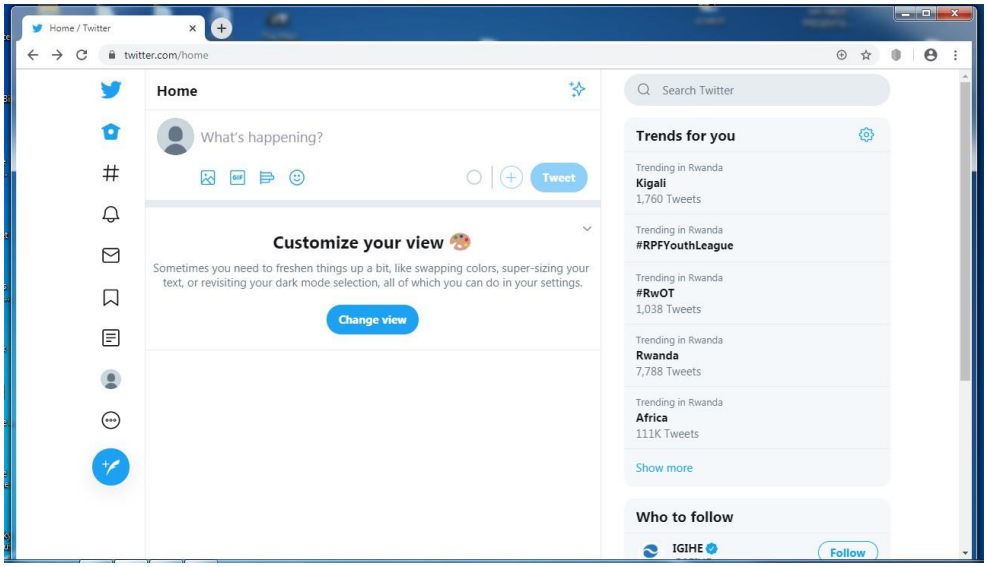


Figure 4. 20. Twitter account ready for use for the first time

b. **Following a twitter account**

All social media provide better experience when one is acquainted with other user in the same social media network. For a twitter user to have better experience he/she has to follow other accounts.

Following an account permits one to receive immediately prompts when the followed account posts a tweet in form of text, image or video; updates the profiles immediately after they are posted.

Following a twitter account is done in these steps:

1. Search for the account to follow using the twitter search box
2. Next to the searched account click on **Follow.** The Followtab will immediately change into **Following**

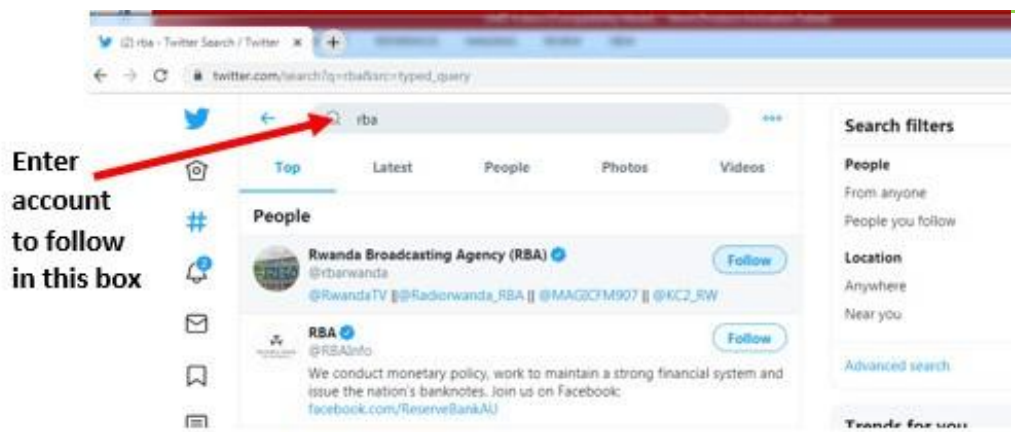


Figure 4. 21. Window to use to search for twitter accounts

c. **Tweeting**

Also known as tweeting is posting making a post on the social media Twitter. The post can be just text, images and videos.

To post a tweet go through this process:

1. In the Twitter Home page click on the twitter icon
2. In the text area that will appear write the tweet text. If images and videos are to be used in the tweet click on the corresponding icons below the text area
3. Once the tweet is ready click on Tweet. The tweet is now posted and can be viewed by the account followers and anyone who searches for it

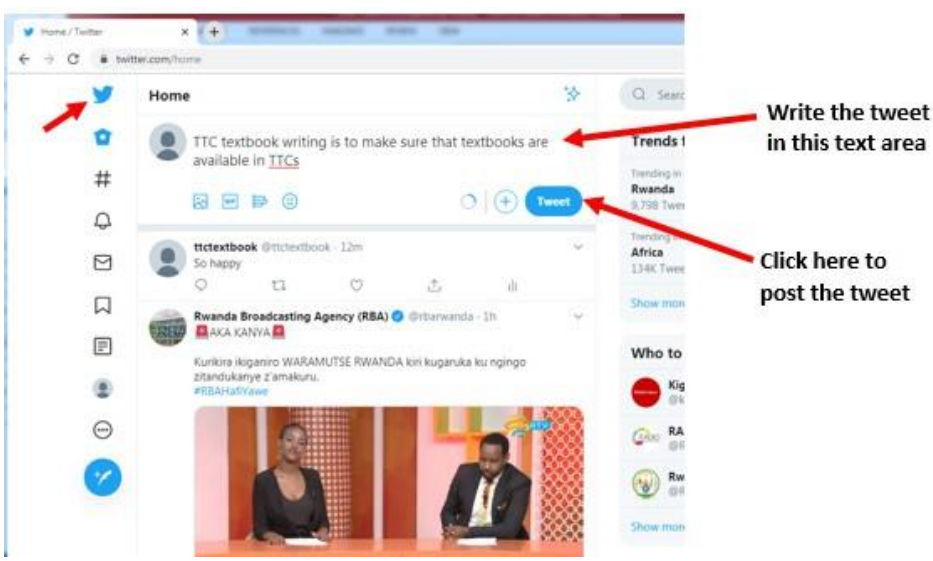


Figure 4. 22. Screen used to post a tweet

Note:

- Twitter provides the option to delete the created tweet by clicking on the drop down icon next to the tweet and clicking on **Delete**
- As one tweet is only of 280 character while tweeting choose properly the words to use. For this reason tweets contain more shortened words
- Twitter users can create hashtags which are keywords preceded by the hash sign and are easily searchable on twitter

SN	ICON	USE
1		Used to have the text area used for tweeting or for viewing tweets from other accounts
2		This is the Home icon. As twitter gets opened immediately the home page appears
3		Used to search for tweets containing a certain keyword
4		When clicked on all notification that the account received are displayed
5		Used to write new messages to send privately to twitter accounts. These messages can be sent to an account that
6		Displays messages that have been bookmarked
7		Displays the list of accounts created
8		Provides the option to edit the twitter account profile
9		When clicked on it provides many options among which is one to log out the account
10		Used to have a window in which to write a new tweet and post it

Table 4. 1. Twitter icons and their use

d. **Twitter menu icons**

In the previous sections some of the available twitter options have been elaborated. Those options can however be easily accessed by using the icons located at the left side of a twitter account page. The table below represents those icons and their roles

APPLICATION ACTIVITY 4.4

1. What is Twitter and why should you use it?
2. Create your twitter account and do the following:
    a. Make it have your picture as a profile picture
    b. Search for accounts to follow mainly your classmates
    c. Post some tweets about your school and lessons

4.5 Instagram

ACTIVITY 4.5

Instagram is one of the Social media platform used by many people:

a. Discuss the use of Instagram
b. Do a research and differentiate Instagram from other social media namely Facebook and Twitter
c. Analyze the Instagram icon and discuss how it relates Instagram use

Instagram is a free social networking service built around sharing photos and videos. It launched in October 2010 on iOS (iPhone Operating Systems) first, and became available on Android in April 2012 and can be accessed via computer internet browsers.

Similar to Facebook or Twitter, everyone who creates an Instagram account has a profile and a news feed. When a photo or video is posted on Instagram it will be displayed on the account's profile and accounts that follow you will see it in their own feed. Likewise posts from other accounts can be viewed if you chose to follow them.

Just like other social networks, an account can interact with others on Instagram by following them, being followed by them, commenting, liking, tagging.

a. Creating an Account on Instagram

Like other social media one cannot use Instagram without having an account created and for that go through these steps:

1. Enter in the browser's address bar the URL of the application (www.instagram.com)

2. In the form that appear to the right of the new page fill in the requireddetails and click on **Sign up**

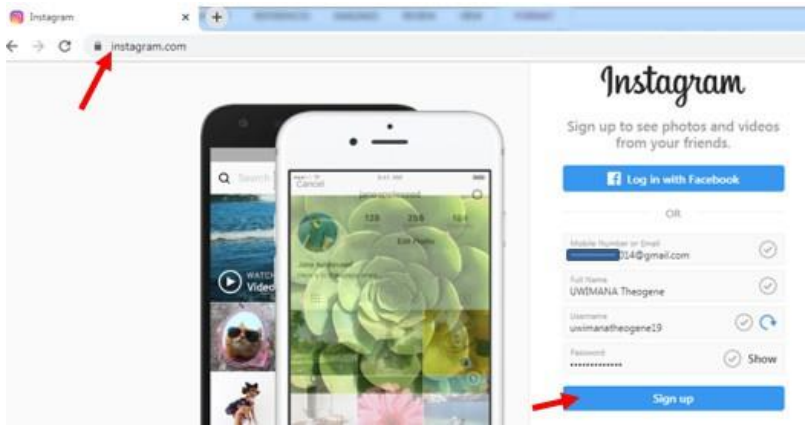


Figure 4. 23. Instagram Create account form

3. in the next screen click on Turn on (to turn on notification) or Not so as to be directed to the Instagram first page

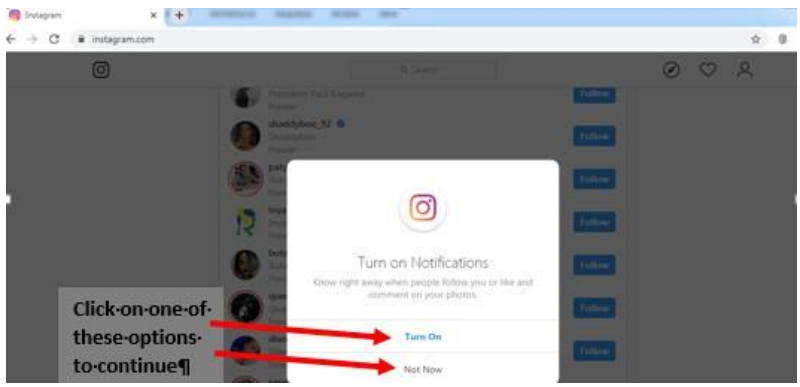


Figure 4. 24. Window to turn on notifications and have access to other accounts

b. **Instagram main icons**

Instagram has got icons which help carry out the basic functions. Those icons are shown in the image below:

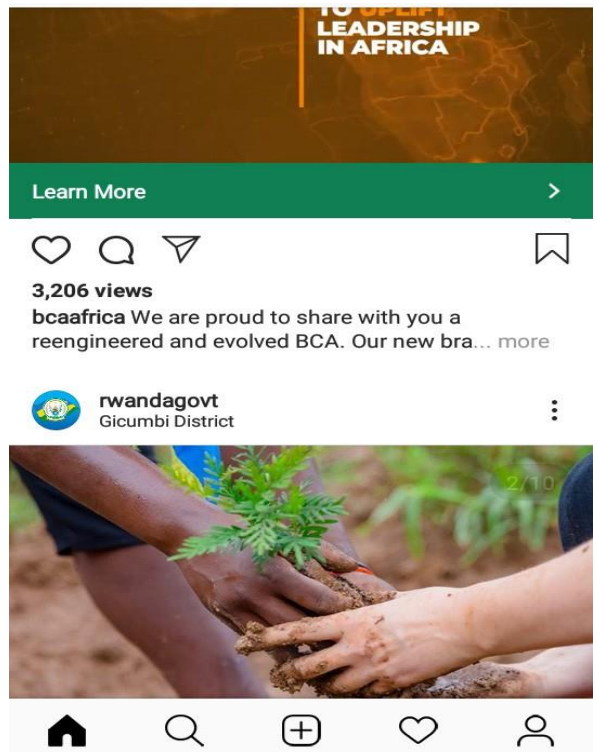


Figure 4.25. Instagram page with its icons

The role of each icon is explained in the table below:

ICON	USE
	The home icon used to move to the Instagram first page
	Icon used to search for accounts, tags and places
	When clicked on it allows to create a post which can be a picture or video (this icon is not available with web Instagram accessible by using web browsers)
	When it is under a video or picture it is for liking it but when at the bottom side of Instagram it shows all likes in your posts, posts by friends and followers
	Used to view and edit an account's profile
	Used for bookmarking some posts
	This is used when an account user wants to message directly
	Used to add a comment on a post

	Used to view the Instagram TV (IGTV)

Table 4.2: Instagram main icons and their use

APPLICATION ACTIVITY 4.5

1. Create an Instagram account under your name
2. Follow some of your class mates
3. Create posts and comment posts from other accounts

4.6. WhatsApp

ACTIVITY 4.6

Umurerwa, a grade 2 student, has heard of a phone application that she can use to chat, send a photo and video call. She decided to use her father's phone to find this app.

Observe the screen of Umurerwa's father

Answer the below questions:

1. Among these applications, which application Umurerwa should use?
2. Explain why you have chosen that application

WhatsApp is a popular messaging app with end-to-end encrypted instant messaging that can be used on various platforms, including Android, iPhone and Windows smartphones, and Mac or Windows PCs.

For WhatsApp to be installed on PCs an auxiliary application is needed in order to create a virtual environment resembling a Mobile Operating System in which WhatsApp will be installed. Such auxiliary applications are **NoxPlayer** and **Blue Stack**.

A. Installing WhatsApp

Installing WhatsApp first requires downloading it through the phone application for downloading applications. For android that application is Play Store. Download WhatsApp by searching for it in Play Store and install it by going through the prompts

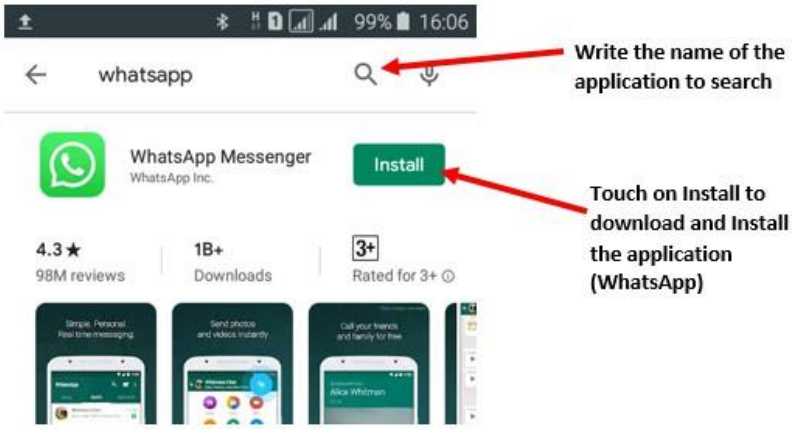
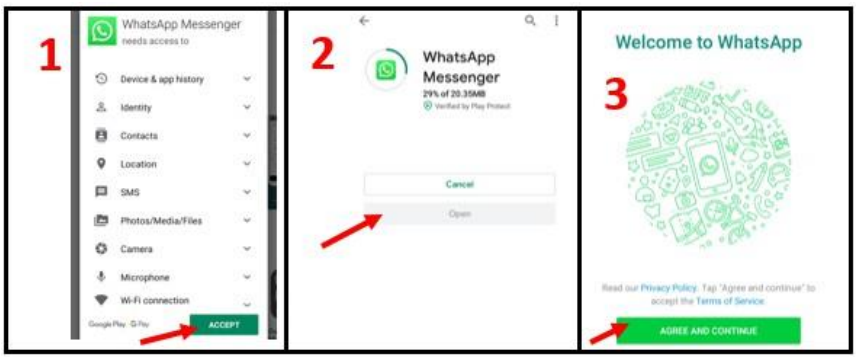


Figure 4. 26. Android phone window for downloading and installing applications (WhatsApp)

In the next screen that will appear touch on Accept and let the application download. When there is not enough space for downloading the application, it will be necessary to delete some files to liberate some space.

Downloading and installing WhatsApp will go through these steps shown in the screenshots below:



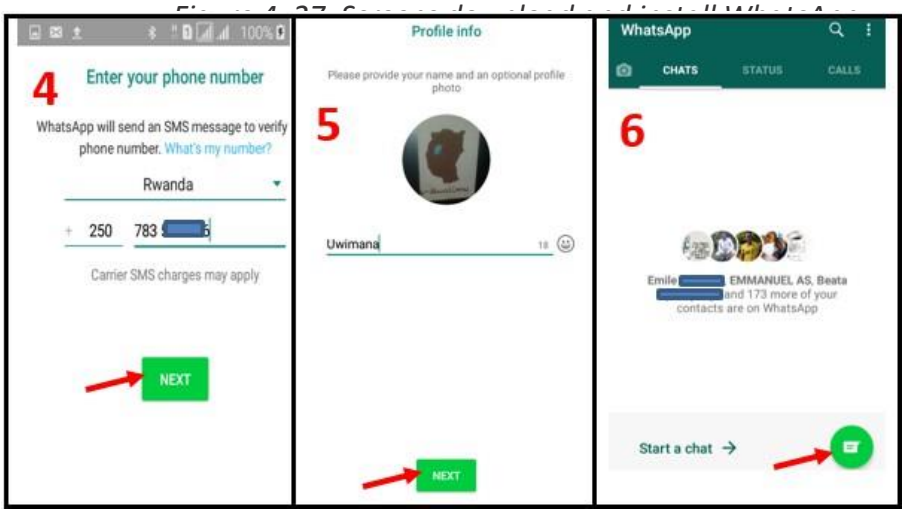


Figure 4. 28. Setting WhatsApp installation

Interpretation of the screens:

a. **Screen One:** The choosing of the application to download and install has already been done now the person has to agree that WhatsApp will have rights to have access to some of the resources in the telephone.

b. **Screen Two:** WhatsApp is now being downloaded and is at 26%. Once downloading is over the application will install itself and when finished the user will touch on **Open** to do further configurations.

c. **Screen Three:** Once the **Open** option is touched in the next screen touch on **Agree and Continue** to agree to the terms of service.

d. **Screen Four:** In this screen fill in the phone number to use on WhatsApp and touch on Next. A WhatsApp code message will be sent to your telephone. Enter it in the next screen and continue

e. **Screen Five:** Configure WhatsApp by uploading an image that will be used as a profile picture to your account and set the account name.

f. **Screen Six:** WhatsApp is now installed. Start chatting by touching on the icon shown by an arrow.

B. Adding a Status in WhatsApp for Android

Similar to apps like Snapchat and Instagram, WhatsApp Status is a place for snapping pictures of whatever you're doing and then uploading them to your profile where they're available for your contacts to see for 24 hours. To get started with Status:

- Tap the Status bar on the home screen.
- Tap the camera icon at the bottom-right.
- Take a picture or video.

- Add any filters, stickers, text, or whatever else you'd like.
- Tap the green circle at the bottom-right to add the post to your Status.

APPLICATION ACTIVITY 4.6

1. Discuss the improvement WhatsApp has brought in the communication area in Rwanda
2. Compare options provided by WhatsApp and Instagram

4.7. E-Banking and E-Payment

ACTIVITY 4.7

Read the scenario below:

During the weekend, Kamana was sent home for school fees issues but on Monday, 7:30 AM he must attend the exam after the payment of the school fees. Umwalimu Sacco Cooperative where Kamana's parents keep their money did not open as it was on Sunday.

Answer the questions below:
1. What Kamana should do to not miss the exam?
2. Give examples of services that can be paid electronically in Rwanda

4.7.1 Online Services

An online service refers to any information and services provided over the Internet. These services not only allow subscribers to communicate with each other, but they also provide unlimited access to information. Online services may include E Banking, E payment, etc

4.7.2 E-Banking and E-Payment

It is an electronic transfer of money from bank account, usually checking account without the use of the paper check. E-cash is a form of an Electronic payment system where a certain amount of money is stored on client's device and made accessible for online transaction.

a. E Banking

Electronic banking is a form of banking in which funds are transferred through an exchange of electronic signals rather than through an exchange of cash, checks, or other types of paper documents

It is also a method of banking in which the customer conducts transactions electronically via the Internet.

Transfer of funds occur between financial institutions such as banks and credit unions. They also occur between financial institutions and commercial institutions such as stores. Whenever someone withdraws cash from an Automated Teller Machine (ATM) or pays for services using a debit card, the funds are transferred via electronic banking.

E-banking is a safe, fast, easy and efficient electronic service that enables an access to a bank account and to carry out online banking services, 24 hours a day, and 7 days a week.

With this service you save your time by carrying out banking transactions at

any place and at any time, from home or office provided there is internet access.

E-banking enables the following:

- Accurate statement of all means available in your bank account
- Statement of current account, credits, overdrafts and your deposits
- Execution of national and international transfers in various currencies
- Execution of all types of utility bill payments (electricity, water supply, telephone bills, and many others)
- Carrying out customs payments
- Electronic confirmation for all transactions executed by E-banking
- Management of your credit cards

Disadvantages

The disadvantages presented by E-banking are linked to the fact that it is a new technology which is not usable by anyone especially in countries where ICT literacy is still a problem.

Other disadvantages are also linked to weaknesses in the system that may be exploited by hackers who may steel money using weaknesses found in the system

b. E payment

An e-payment system is a way of making transactions or paying for goods and services through an electronic medium, without the use of checks or cash. It's also called an electronic payment system or online payment system. E-payment includes the use of Debit/credit card, Mobile Money

Services done by mobile money

Services provided by Mobile Money include money transactions whereby money can be sent from one telephone user to another who can then withdraw the money as cash or keep it and use to pay for different goods and services.

Example

In Rwanda mobile money services are provided by TIGO Cash, MTN Mobile Money and Airtel Money. They include money transfer and withdrawal from a mobile money account and from even a bank account, payment of different bills like water and electricity.

APPLICATION ACTIVITY 4.7

1. Give 3 differences between credit card payment and mobile money payment
2. By conducting a research on the Internet, analyze the Rwandan context in terms of electronic payment. Give the benefits to Rwandans if the country adopts electronic payment in all transactions.

4.8. Irembo Local Online Services

ACTIVITY 4.8

By searching the Internet, list the services available for Irembo.rw and analyze them if they meet the expectations of the local population.

Irembo is an initiative by the Government of Rwanda aiming at improving its service delivery to the citizens and businesses. Irembo is the one-stop portal for e-Government services. Irembo as a platform has the role of the provision of Government services online with ease, efficiency and reliability.

How to create account from irembo

- Type www.irembo.gov.rw in the address bar of your browser

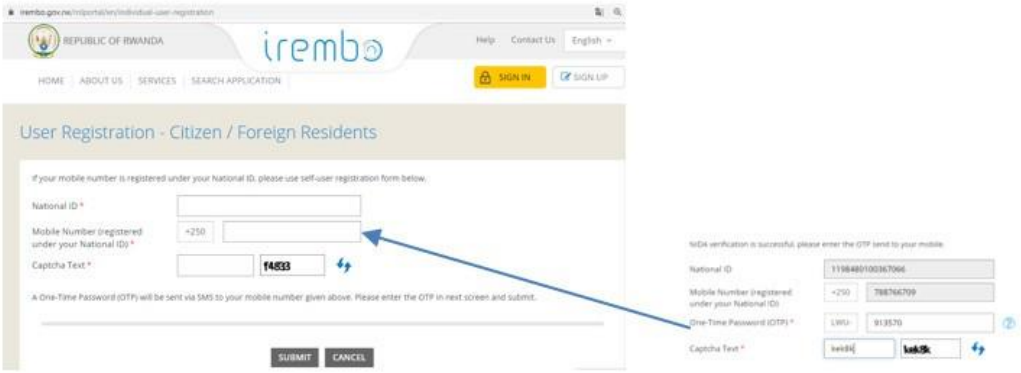


Figure 4. 29. User Registration Form

Fill in dialogue box black space

a. Password place
b. Confirm Password
c. Email
d. Captcha Text

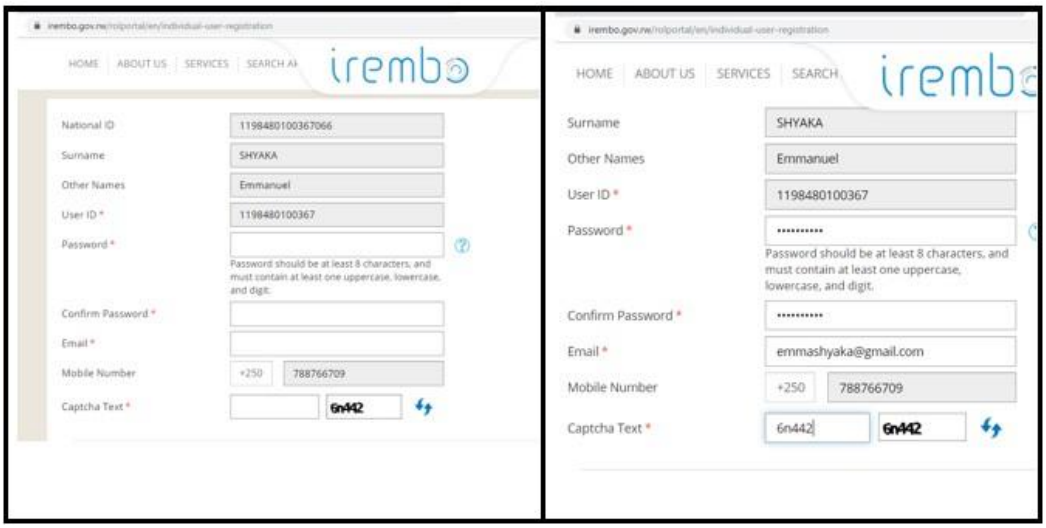


Figure 4. 30. Forms used to create an Irembo account

These services are subject to changes as some services can be added but the ultimate goals is to have all services offered through this platform.

a. Requesting for Irembo service

Requesting for services on Irembo requires first to have a username which is

the identity card number without the last three digits and a password

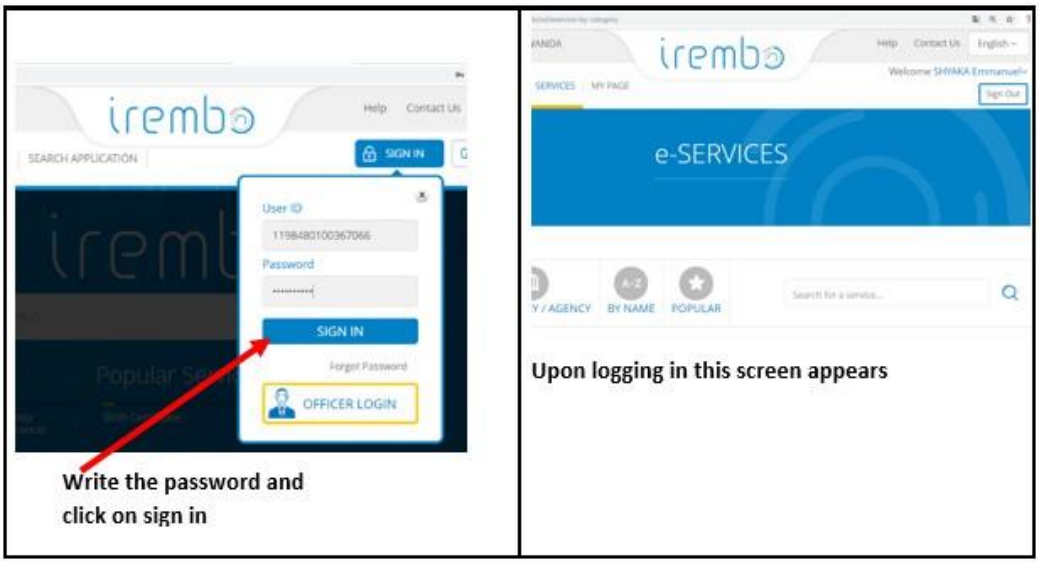


Figure 4. 31. Signing into an Irembo account

b. Current Irembo services

Currently, Irembo services are into these categories:

1. Immigration and emigration
2. Land
3. Local government
4. National ID
5. Notarization and Gazette services
6. Police
7. Rwandans living abroad
8. Media
9. Education
10. Health
11. Ubudehe and mutuelle
12. Institutions of national meseum of Rwanda
13. Transportation
14. Tourism

Requesting for a criminal records clearance

1. Open irembo website
2. Enter your ID and Password
3. Payment using VISA, MasterCard , MTN Mobile money(*182#), airtel (*182#), Tigo(*310#) Mobicash or BK
4. After paying you send sms/email confirming that you have requested a service and service paid
5. Feedback of certificate must be sent to you after 3 days

Advantages of using irembo

1. Helps citizens to save a time
2. Save transport
3. People can request a service when he or she is at home
4. Reducing corruption malpractices

5. It creates jobs
6. It simplifies access to the Government services
7. Avoiding friendship

APPLICATION ACTIVITY 4.8

1. List and explain 5 advantages of using IREMBO Service
2. Explain at least 3 problems that Irembo services have come to solve

END UNIT ASSESSMENT

1. Give the difference between WhatsApp , Instagram and Twitter ?
2. Using a clear example, explain 3 common features of social media
3. Give examples of services that can be paid electronically in Rwanda
4. Give 3 differences between credit card payment and mobile money.

UNIT 5: DATABASE basics

5.0 Introductory Activity

Observe the following diagram showing the collection of files GS Nyamabuye.

Answer to the questions below:

1. Describe the possible ways that can be used to organize these files?
2. Where do think these files can be kept ?
3. Is it easy to retrieve and update some information?
4. What are challenges do you expect in these responsibilities
5. Suggest possible answers to address these challenges.

5.1: Introduction to Database

Activity 5.1

Interview someone from the administration office at your school who is dealing with students' information on a daily basis. In your interview, include the following questions:

a. How do you collect data on students?
b. What data do you need from each student?
c. Where are you keeping that data?
d. How do you call the set of all information related to the students?
e. Have you full information about students
f. With whom else do you share that student's information?

After you have done the interview, write up findings in the form of a report to be presented to the class

5.1.1 Definition of Database

A **database** is an **organized collection of related data**.

It is considered to be **organized** because the data is stored in categories that are accessible in a logical manner. A database is a collection of one or more **relations**, where each relation is a table made of rows and columns.

5.1.2 Definition of Data and Information

- **Data** is commonly referred to as 'raw' data: a collection of text, numbers and symbols, images with **no meaning.**

Data therefore has to be processed, or provided with a context, before it can have meaning.

- **Information** is the result of processing data, usually by computer.

This results in facts, which enables the processed data to be used in context and have meaning. Information is data that **has meaning**.

Note: *An information system is a combination of computer hardware and software that is designed to create, store, process and present information. The heart of all information systems is a database.*

Application Activity 5.1

1. Define the following terms:
   a. Database
   b. Data
   c. Information

2. What is the difference between data and information?

5.2 Database Approach

Activity 5. 2

There are 3 departments that manage teachers' information in Lycee de Kigali, respectively Salaries, Information, Restaurant.

The information for salaries is represented as follows:

	Name	Address	salary	Date of birth
1	MUNEZA	Huye	11000	1/3/1991
2	UMUTESI	Gisagara	11000	7/9/1992
3	MUKANTWARI	Gatsibo	12000	3/2/1990
4	NYINAWUMUNTU	Gasabo	15000	3/1/1992
5	KABALISA	Musanze	13000	3/2/1980

The information for restaurant is represented as follows:

- MUNEZA is from Huye district, Salary is 11000, born on 1/3/1991and his bill is 10000.
- UMUTESI was born on 7/9/1992, in Gisagara district, Salary is 11000 and his bill is 15000
- MUKANTWARI is from Gatsibo district, she was born on 3/2/1990, Salary is 12000, her bill is 12000.
- NYINAWUMUNTU is from Gasabo and born on 3/1/1992 her Salary is 15000 and bill is 11000.
- KABALISA is from Musanze district, born on 3/2/1980, Salary is 13000 and bill is 10000

The information for dispensary is:

- MUNEZA from, Huye , Salary is 11000, born on 1/3/1991, bill is 5000.
- UMUTESI born on 7/9/1992, from Gisagara, Salary is 11000, bill is 1000
- MUKANTWARI from Gatsibo born on 3/2/1990 Salary is 12000, bill is 2000
- NYINAWUMUNTU from Gasabo born on 3/1/1992 Salary is 15000, bill is 1000
- KABALISA from Musanze born on 3/2/1980 Salary is 13000, bill is 1200

Analyze how information is organized in 3 departments and Answer the following question:

1. Write down your critics about this information management in respective departments
2. What do you propose as a solution to minimize the cost of information at Lycee de Kigali?

The most efficient way to store data is with the help of a database. A database is made up of tables that contain columns and rows. Each category is given its's own table.

For example: a company may have a table for customer information and another for sales numbers. You can think of a table somewhat like a spreadsheet. Inside a spreadsheet there

are columns and rows of data. For a database however each row is called a **record** and each cell is called a **field.**

5.2.1: Traditional File Processing Systems (TFP) approach

This is an approach which was used earlier, prior to DBMS. With this approach, users had to write their application programs to store data in form of files on the computer permanent storage device (Hard Disk). A user must have knowledge of programming languages but this is not easy for a common computer user, even an experienced programmer would find it difficult to write a program each time a new database was to be created. Each application program written by a user had to define and manage its own data.

a. Advantages of the Traditional File Processing

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 Database
- **Efficiency:** file processing cost less and can be more speed than Database
- **Customization**: you can customize file processing more easily and efficiently than Database because files are related with the application and it have all the data needed for that application.

b. Disadvantages of Traditional File Processing System

- **Separation and Isolation of Data:** In file-based approach, data are isolated in separate files. Hence it is difficult to access it.

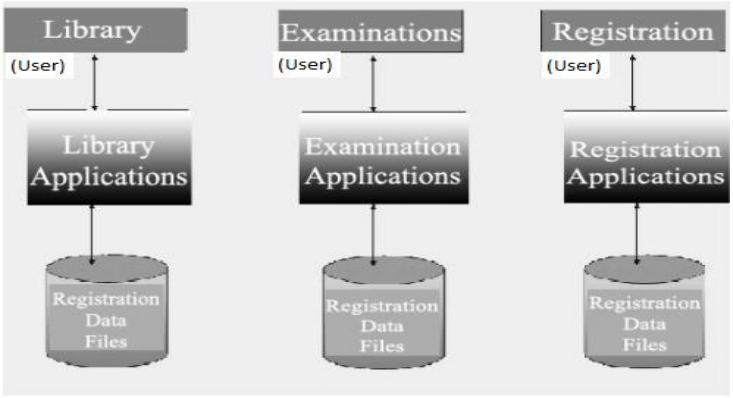


Figure 5.1 TFPS Approach

- **Duplication of Data:** Duplication of data means same data being stored more than once. This can also be termed as data redundancy.
- **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 that the data contained in the database is both accurate and **consistent (**Data inconsistency means different copies of the same data will have different values**)**.

- **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.
- **Security problems**: File based approach is not secured because different files are stored in different locations.

5.2.2 Database Management System (DBMS)

The Database Management system (DBMS) is a referred to as a software system that is used to store, access, manage, organize, maintain, modify and delete data from databases. Some of the most popular software include, **Microsoft Access**, **Oracle, Microsoft SQL Server, MySQL.**

MySQL is, one of the most popular database management systems used by online entrepreneurs.

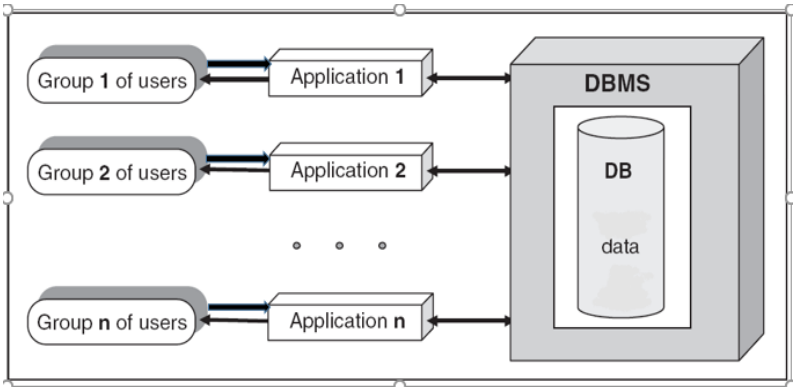


Figure 5.2: DBMS approach

a. The advantages of database management system

There are many advantages of database management system.

- **Reduce data redundancy:** Data redundancy refers to the duplication or repetition of data. The database system is used to eliminate the problems of data redundancy and data inconsistency.
- **Data integration:** Data integrity means that the data contained in the database is both accurate and consistent.
- **Data Independence:** Data independence means that programs are isolated from changes in the way the data are structured and stored.
- **Reduce data inconsistency:** Actually, data redundancy and data inconsistency are inter-related. If data redundancy is controlled, then data inconsistency will also be controlled automatically. Data inconsistency means different copies of the same data will have different values.
- **Data sharing:** Due to the fact that data is centralized, many different users from different locations can share data.

- **Data recovery after a crash (a break down):** DBMS allows to recover data after a crash. The crash may depend on power failure or hardware failure. The recovery manager calls a recover algorithm after a crash.
- **Concurrent transaction control:** A transaction means a collection of operations that perform a single action in a database.
- **Increased Data security and safety:** DBMS allows data to be highly protected against unauthorized access.

Application Activity 5.2

1. Compare Database Management System and Traditional File Processing System
2. Check and list the DBMS software installed in the computers of the school computer lab.

5.3 Area where database can be applied

Learning Activity 5.3

Mr. Mugabo is managing a shop in our village. All daily sold products are recorded manually in the notebook so that he can know how much money he made. Sometimes, he uses to write whether the payment was cashed or not. However, when it is time to make a verification of the whole week's sales so that he can buy new products for the shop, he met serious problems related to calculations, to know how much sold, how much remained, and who has not reimbursed the depts.

1. Discuss how Mr. Mugabo can improve his shop management?

2. What benefits would Mr. Mugabo get if he decided to set up a database?

These days, the evolution of Database management systems has obliged governments, NGOs, and private companies to use databases in their daily basics. They are getting more from their work because they can keep records of everything.

Database management systems make these organizations work faster to search for information and records about any people or products that make them more effective in work. Below are some of the applications and uses of the database management system (DBMS).

- Human resources: to track information about employees
- Banking: to keep customer information, accounts, and loans, and banking transactions.
- Airlines: to keep for reservations and schedule information. Airlines were among the first to use databases in a geographically distributed manner - terminals situated around the world accessed the central database system through phone lines and other data networks.
- Universities: to keep student information, course registrations, and grades.
- Credit card transactions: to keep purchases on credit cards and generation of monthly statements.
- Telecommunication: to keep keeping records of calls made, generating monthly bills, maintaining balances on prepaid calling cards, and storing information about the communication networks.
- Finance: to keep storing information about holdings, sales, and purchases of financial instruments such as stocks and bonds.
- Manufacturing: to keep management of supply chain and for tracking production of items in factories, inventories of items in warehouses / stores, and orders for items. etc.

Application activity 5.3

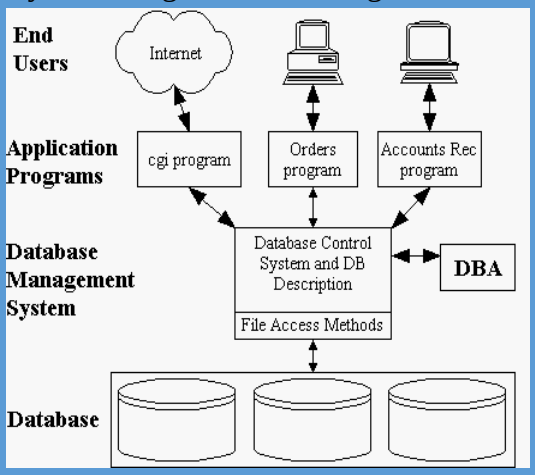
The database is very important in society.

- Research and identify the impact of database in society

5.4 Database Access Levels and Users

Activity 5.4

By observing the below image;



Interpret the figure by writing down what do think is going on.

5.4.1 Database access levels

A major purpose of a database system is to provide users with an abstract view of the data. That is, the system hides certain details of how the data are stored and maintained.

There are three-levels that form the basis of modern database architectures:

a. **The Internal Level**

The Internal level has an internal schema, which describes the physical storage structure of the database. The internal schema uses a physical data model and describes the complete details of data storage and access paths for the database.

b. **The conceptual level**

The conceptual level has a conceptual schema, which describes the structure of the whole database for a community of users.

The conceptual schema hides the details of physical storage structures and concentrates on describing entities, data types, relationships, user operations, and constraints.

Usually, a representational data model is used to describe the conceptual schema when a database system is implemented. This implementation conceptual schema is often based on a conceptual schema design in a high-level data model.

c. **The external or view level:**

The external view level is closest to the users. It is concerned with the way the data is viewed by individual users. A user can either be an application programmer or an end-user. The external level consists of many different external views of database.

At the view level, computer users see a set of application programs that hide details of the data types.

5.4.2 Database users

The purpose of the three-level architecture is to separate the user application and the physical database. The reasons of this separation are that different users need different views of the same data.

1. Users should not have to deal directly with the physical database storage details.
2. The **database administrator** should be able to change the database storage structure or storage device without affecting other user's views.

When considering users of a Database system, there are three broad classes to consider:

1. **The database administrator (DBA)**: Responsible for authorizing access to the database, for coordinating and monitoring its use, acquiring software and hardware resources, controlling its use and monitoring efficiency of operations.
2. **The database designer**: Responsible to define the content, the structure, the constraints, and functions or transactions against the database. They must communicate with the end-users and understand their needs.
3. **The end-user, who accesses:** End-users, they use the data for queries, reports and some of them update the database content.

5.4.3 Data Independence

Data Independence: The ability to modify a scheme definition in one level without affecting a scheme definition in a higher level is called data independence.

There are two kinds:

1. **Logical data independence**

The ability to modify the conceptual scheme without causing application programs to be rewritten.

Immunity of external schemas to changes in the conceptual schema usually done when logical structure of database is altered.

2. **Physical data independence**

The ability to modify the internal scheme without having to change the conceptual or external schemas.

Modifications at this level are usually to improve performance.

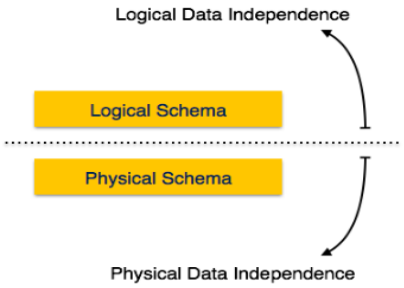
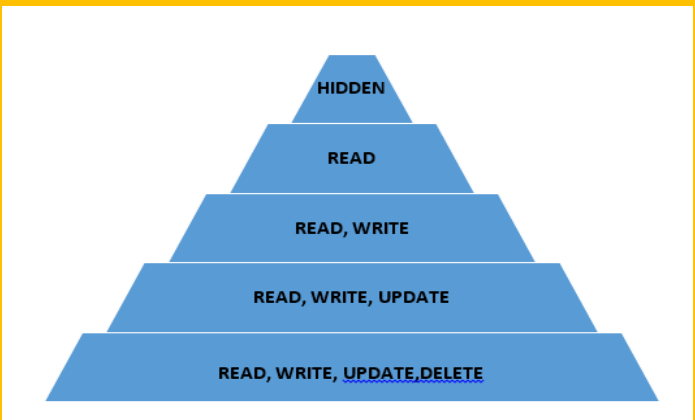


Figure 5.3: Physical and Logical Independence

Application Activity 5. 4

From the bellow figure:

Explain different Access Levels in the context of your school hierarchy such as headmaster, DOS, teachers, students, and visitors.



1. Assign each user from the hierarchy what is supposed to do. Example: Everything happening in your school is hidden from the visitors.
2. Discuss about the difference between logical independence and physical

5.5 Relational Model

Activity 5.1

Search the on the Internet the different database models that exist.

5.5.1 Definition of Relational Database Model

The Relational Database Model represents the database as a collection of relations.
A relation is nothing but a table of values.

- Every row in the table represents a collection of related data values.
- These rows in the table denote a real-world entity or relationship.
- The table name and column names are helpful to interpret the meaning of values in each row. The data are represented as a set of relations. In the relational model, data are stored as tables.

5.5.2 Relational Model Concepts in DBMS

- **Entity** is a real-world object that has certain properties called attributes that define the nature of the entity.

In Relational model an entity is considered as table. Entities are distinguishable, i.e., each entity in a pair of entities has a property that makes one entity different from the other entity.

Entities consist of attributes that define their characteristic features/properties.

For example: if we consider a black piece entity on a chessboard and a white piece on a chessboard, they are distinguishable since the color of the black piece and the white piece are distinguishable.

- **Primary Key** is also called a primary keyword, is a key (column) in a relational database that is unique for each record.
- **Foreign Key** is a set of attributes (columns) in a table that refers to the primary key of another table.
- **Alternate Keys** is a column or group of columns in a table that uniquely identify every row in that table.

A table can have multiple choices for a primary key but only one can be set as the primary key. All the keys which are not primary key are called an Alternate Key.

- **Table:** In the Relational model, the relation is saved in the table format.

A table has two properties rows and columns. Rows represent records and columns represent attributes. Table is a named relational database data set that is organized by rows and columns.

- **Attribute:** Each column in a Table. Attributes are the properties which define a relation.
- **Constraint:** In DBMS is the set of rules that ensures that when an authorized user modifies the database they do not disturb the data consistency.
- **Tuple:** It is nothing but a single row of a table, which contains a single record.
- **Degree:** is the total number of attributes which in the relation is called the degree of the relation.

- **Cardinality:** is the total number of rows present in the table.
- **Column:** The column represents the set of values for a specific attribute.

Application activity 5.1

1. Explain brief the relational database model
2. What is the relationship between entity and attributes?
3. What is the difference between degree and cardinality?

End Unit Assessment

1. List the database user? explain the role of each database user
2. Differentiate the File Processing System and Database Management System approach.
3. Discuss data independence and explain its importance in database environment.
4. Discuss the uses of databases in business environment.