INFORMATION TECHNOLOGY STUDENT'S TEXTBOOK GRADE 9

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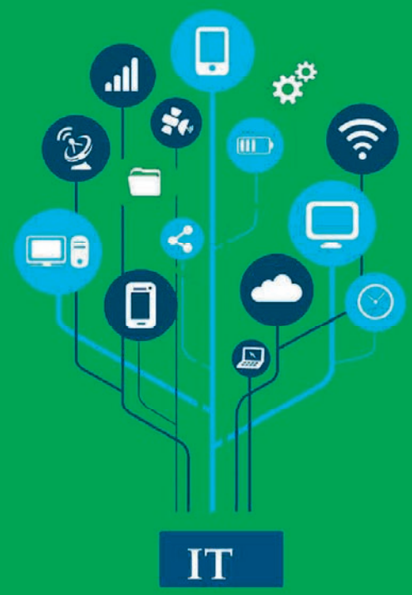
Federal Democratic Republic of Ethiopia Ministry of Education

INFORMATION TECHNOLOGY

Grade 9

STUDENT'S TEXTBOOK



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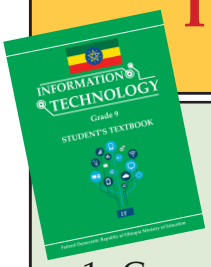

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INFORMATION TECHNOLOGY

Grade 9

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UNIT 5 : INFORMATION AND COMPUTER SECURITY

UNIT 6 : FUNDAMENTALS OF PROGRAMMING

UNIT 1 ORGANIZATION OF FILES

UNIT OUTCOMES

At the end of this unit, learners will be able to:

- Explain file, folder and drive.
- Manipulate file and folder.
- Explore drive on computer system.

UNIT OVERVIEW

This unit introduces you to files and file organization in computer systems. A computer file can be both system generated and created or transferred from other sources in to a computer. You will learn how to manipulate files (creating, copying, renaming, deleting and searching).

A file folder is a mechanism to keep your computer files in an organized manner. This unit will deal with folder manipulation mechanisms that operating systems provide.

1.1 Basics of Files and Folders

Brainstorming

1. Have you ever visited your family's "edir" or "ekub" association's membership information? Do they use paper to keep membership information?
2. What do you think are the limitations of using the above manual filing system (shelf or filing cabinet-based filing system)? Do you think computers are used to store such information?

1.1.1 Files

A file is a collection of data stored in one unit, identified by a filename. It can be a Word, Spreadsheet, PowerPoint Presentation document that you had learnt in Grade 8. Files are represented by an icon in a computer. Thus, icons are small graphical representation of a file. Because there are different file formats, icons are usually used to help identify the type of file or program associated with. In Figure 1.1 below, you can see different types of files on the desktop.

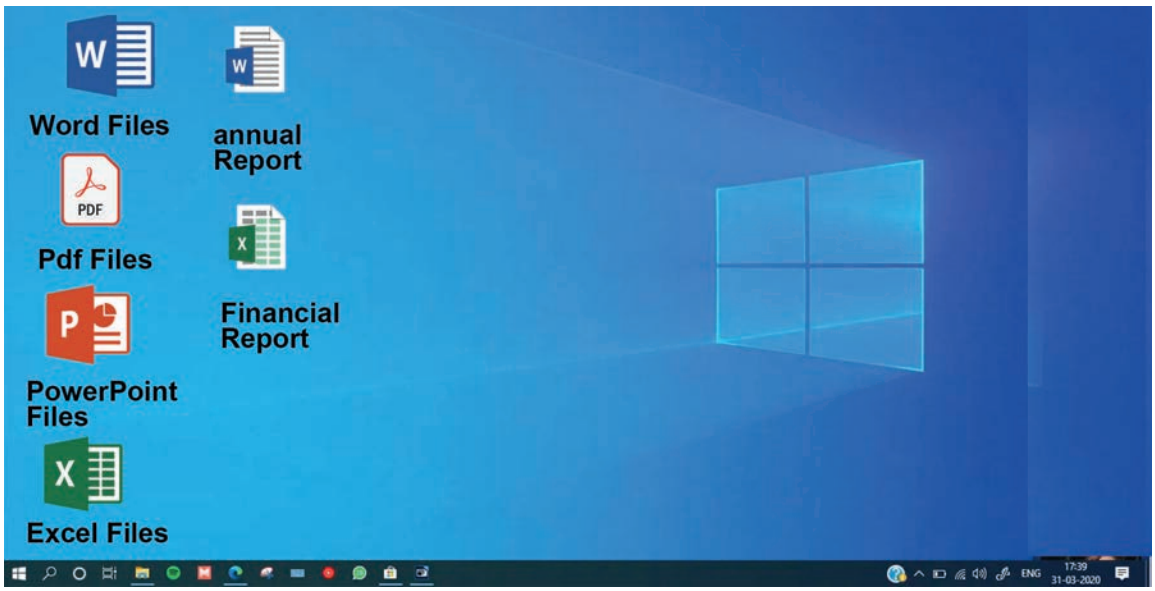


Figure 1.1 Common File Icons in Window 10

KEY CONCEPTS

- A file stores a data which can be a document, a picture, text, video, audio, etc.
- A file has different icons in a computer.

1.1.2 Folders

A folder, also called a directory, is a container which is used to store related files together. A folder can also contain another folder inside. A folder contained in another folder is called a ***subfolder***. A good analogy is the *manila folders (dossier)* seen in an office to store papers or reports.

The difference between a file and a folder is that a file is a collection or group of interrelated data and information whereas a folder is a container used to store different files and subfolders. We can have different types of Files such as text, video, document and image and each has different extensions to identify their types but folders do not have extensions.

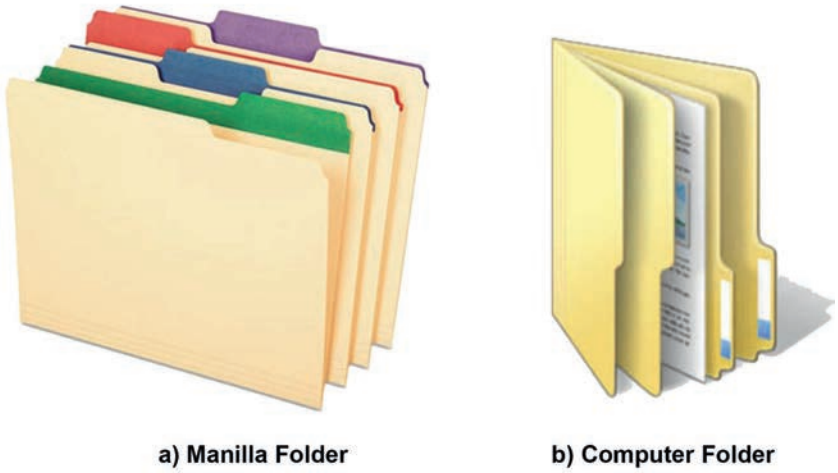


Figure 1.2 Manila and computer folders

Activity 1.1

This activity is designed to help you discuss the importance and advantages of computer folders. Form a group of two to five students in a class and discuss the following questions.

1. Present the way you put things in your home such as your cloths, exercise books and text books. Compare and contrast a messy home and a tidy home. Which one is easy to locate things?
2. In analogous to this, compare and contrast cluttered files shown in Figure 1.3 (a) and organized files in folder shown in Figure 1.3 (b).
3. How do you organize different files such as document, image, video and audio files in your desktop computer?

Figure 1.3 (a) Cluttered file (b) Organized file by folders

Importance of Folders

Folders help to keep related files organized together as shown in Figure 1.3 b above. This helps to locate files easily. If you had no folders on your computer, your documents, programs and operating system files would all be located in the same place. Folders allow you to have more than one file with the same file name. For instance, you can have a file called My-letter.doc in your My Documents folder and another file called My-letter.doc in a different folder called 'Letter collection'. If all your files were in a single place, every file would need a unique file name.

KEY CONCEPTS

- A folder, which is also called a directory, is a container of files.
- A folder helps us to organize related files together.

1.2 Managing Files and Folders

Brainstorming

1. How are documents created, named/renamed, copied, moved and deleted in paper-based file systems?
2. How is a folder/dossier created, named/renamed, copied, moved and deleted in manual filing system? Do you think there is a way to do such things in computers' files and folders?

In ***Windows operating system,*** the primary way of interacting with files and folders is through the ***File Explorer*** application. There are also other operating systems, but in this textbook we use Windows operating system.

1.2.1 Using File Explorer

A file explorer (which was called Window explorer in applications before Window 10 version) has the following main parts (See Figure 1.4 and Table 1.1).

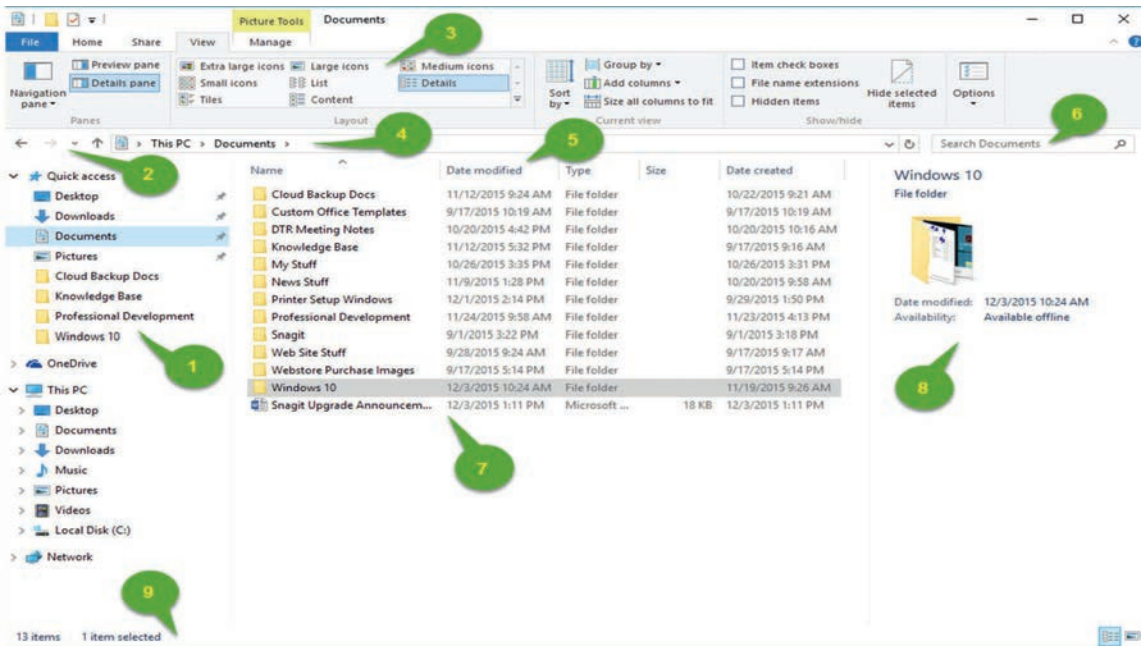


Figure 1.4 File Explorer window

Table 1.1 File Explorer Parts and Their Descriptions

Element Numbers	File Explorer Elements	Description and Usage
1	Navigation pane	Navigation pane allows you to view and access your computer's file and folder structure. On Navigation pane, there is a Quick Access area. It allows you to navigate quickly and easily to the folders that you use regularly or frequently. To add or pin a folder to the Quick access area, right-click on the folder name and then select Pin to Quick access from the drop-down menu.
2	Forward and Back buttons	Enables you to go to folders you have previously opened. If you go to a different folder, you can choose the Back button to return to the last folder you accessed.
3	Ribbon	Enables you to perform layout, formatting and sharing tasks. It also enables you to change your files' and folders' displays. Tasks available to you might differ depending on what folder you select (e.g. Documents versus Pictures). To display the Ribbon, click on one of the menu items at the top of File Explorer or click on Expand the Ribbon button (down-pointing arrow) located at the top right-hand side of File Explorer.
4	Address bar	Enables you to go to a different folder in the same Explorer window. (For more information, see Navigating the Address Bar in section 1.2.6.)
5	Column headings	Titles of each of the columns displayed in the file and folder list. You can choose which columns you want to display by adding a column heading or removing a column heading, as well as changing the order in which those columns are displayed. Click on a column heading to sort your files and folders by that column (e.g. date modified).

6	Search box	Allows you to search for subfolders, documents, images, programs, web pages and bookmarks in the current folder.
7	File and folder listing	Shows you the files and folders in the current folder (the folder you selected in the Navigation pane).
8	Preview/Details pane	Enables you to quickly preview an item, such as a photo, without having to open that item. To open the Preview pane (which is not open by default), click on the View menu at the top of File Explorer, then click on the Preview pane button located at the left-hand side of the Ribbon in the Navigation pane area.
9	Status bar	Displays information about a selected folder and its contents such as the total number of items in the folder, the number of items selected and the total file size. Contains buttons that enable you to quickly switch between thumbnail and detail views for the items displayed in the current folder.

Opening File Explorer

To open File Explorer, click on the File Explorer icon located in the taskbar.

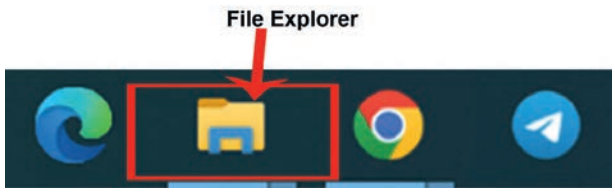


Figure 1.5 Opening File Explorer from task bar

Alternatively, you can open File Explorer by clicking on the Start button and then clicking on File Explorer.

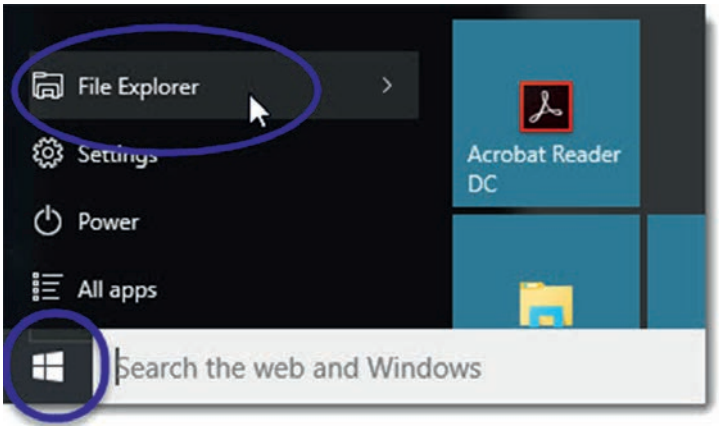


Figure 1.6 Opening File Explorer from Start menu

NOTE

You can use *Win key* ( ) + *E* keyboard shortcut to open file explorer.

1.2.2 Creating New File

A file is created using a computer software program. For example, to create a plain text file you can use a text editor such as Notepad or Notepad++. You can use word processing software such as WordPad, Microsoft Word and LibreOffice Writer to create a text document file. An image file can be created using image editing software such as Microsoft Paint, Paint 3D, Gimp and Adobe Photoshop.

Practical Exercise 1.1

Creating a document file

1. Work in a group to create a document file entitled Ethiopian Cultural Foods using Word processing software.

   Try to remember how to create documents using Microsoft (MS) word or any other word processing application software from your previous grade (Grade 8).

2. Open Word processing software on your computer.

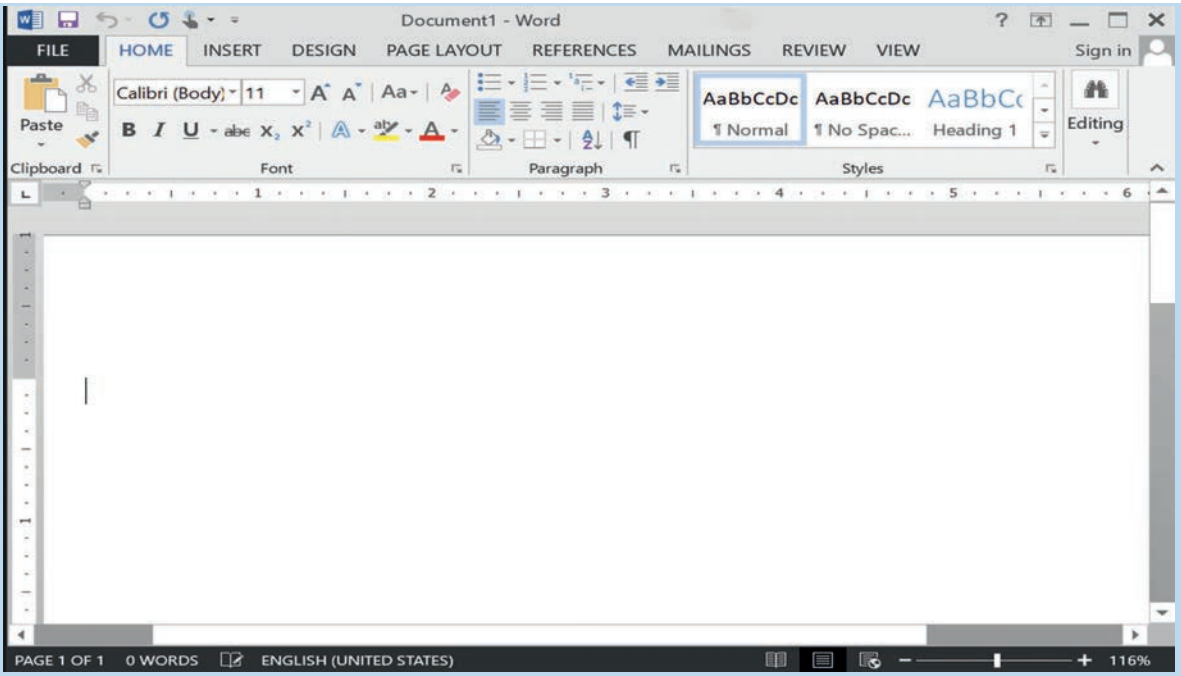


Figure 1.7 Newly created document

3. Type the passage

To insert text in your document, place the cursor at the position where you want to enter the text and start typing a paragraph about the Ethiopian cultural foods by exploring different sources. You can see Figure 1.8 as an example document.

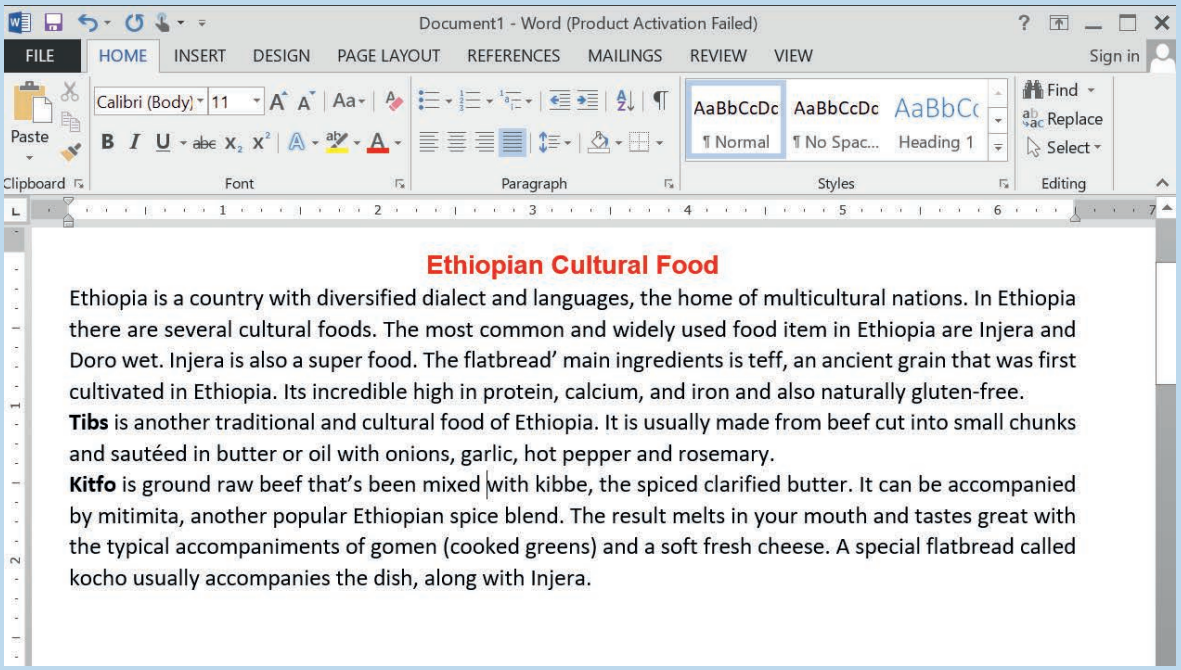


Figure 1.8 Article on Ethiopian Cultural Food

4. Saving the document

Save allows you to update a previously saved file with new content, whereas Save As allows you to save a new file or an existing file to a new location with the same or different name.

How to create a text file

The easiest way to create a text file in Windows is to open up the Notepad application software program on your computer. The Notepad is a text editor included with Microsoft Windows.

A text file is considered as a plaintext file and Notepad is capable of creating and editing plaintext files. Notepad saves any text file with .txt file extension, which means no special formatting or fonts.

The Windows Notepad program can be opened using the methods below.

1. Click Start.
2. In the Run or Search box, type Notepad and press Enter.

Viewing, editing, and creating images

There are many software programs you can use to display, view, edit and create images, logos or arts on your computer. Microsoft Paint is a default image editing application software in window Operating system. We can use it to simply edit our image file.

Practical Exercise 1.2

Using Microsoft Paint to create an image

Create an image using Paint application following the steps below.

- Click on Start ➜ Open Paint Application ➜ Create your own image ➜ Save your image

Creating presentation file

Presentation files are created for electronic presentations consisting of a series of separate pages or slides. To create presentation files, there are different application software such as Microsoft PowerPoint and LibreOffice.

Practical Exercise 1.3

Preparing a presentation file for a project

Work in a group to create presentation file using Microsoft PowerPoint (say Ethiopian Wild Life) using your previous grade (grade 8) knowledge of using Microsoft PowerPoint. Use the following steps to open it.

1. Open Microsoft PowerPoint application.
2. In the left pane, select New.
3. Select a New Blank Presentation.
4. Start adding contents in the slide about Ethiopian wild Life.

1.2.3 Creating a New Folder

Creating a new folder can help you store related files in an organized manner. The following steps can be followed to create a new folder.

1. Navigate to the location where new folders are created.
2. In File Explorer, click on the Home menu item.
3. From the Home tab, click on the New folder button (See Figure 1.9).

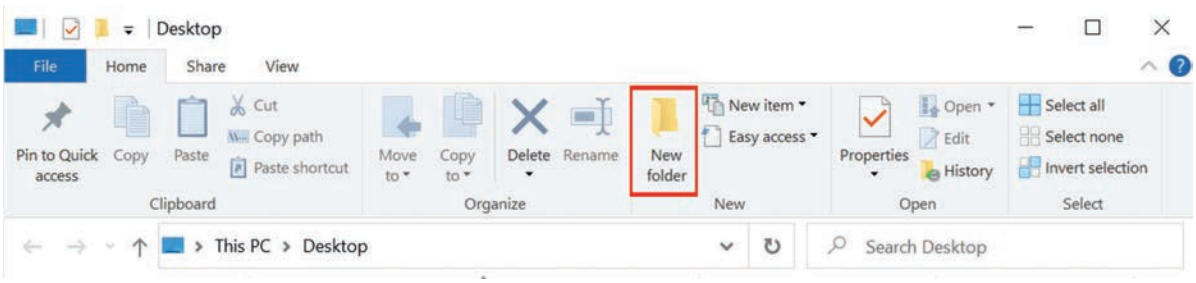


Figure 1.9 New folder button on file explorer

4. Enter the name of your new folder.
5. After you enter the folder name, click anywhere outside the text area to complete creation of the folder name.

1.2.4 Copying a File

Copying a file is used to put the file in a duplicated manner. To copy computer documents, pictures or other files from one place to another, follow the following instructions.

The following steps show how to copy a file or multiple files in Microsoft Windows from one folder to another.

1. Go to the files or folders you want to copy.
2. Highlight the file or files you want to copy by clicking them once with the mouse. If you need to highlight more than one file, you can hold down the Ctrl or Shift keys on your keyboard or drag a box around the files you want to copy.
3. Once highlighted, right-click one of the highlighted files and select copy. You may also press the Ctrl + C shortcut key or in File Explorer, click Home at the top of the window and click Copy.
4. Open the destination folder, right-click an empty space in the folder, and choose paste. Alternatively, in the File Explorer menu bar at the top, click Home and then click Paste. (See Figure 1.10).

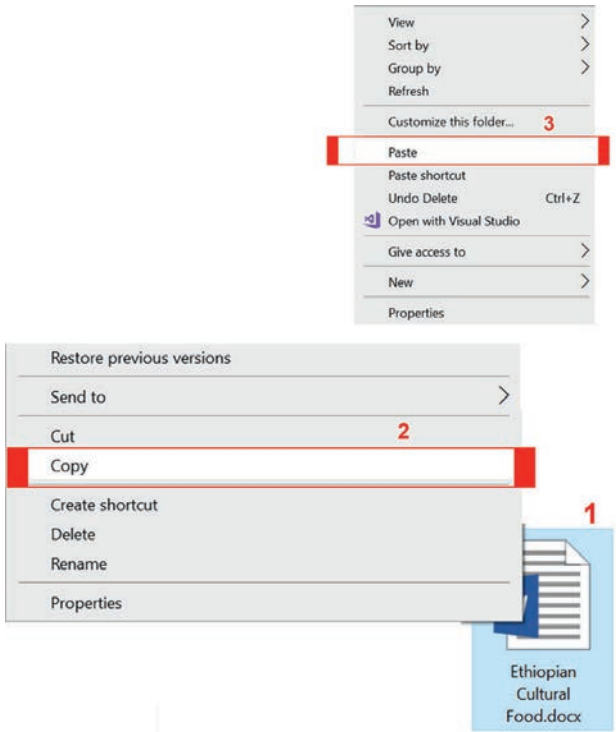


Figure 1.10 Copying a file using right click option

When copying files, you are going to get more than one copy of the file on your computer. If you want only one copy of the files, move them instead. A file name must be unique; otherwise, a number will be appended to the end of a file name. It may also have "- Copy" appended to the end of the file name, instead of a number. Appending a number to the end of the copied file's name assures the copied file is unique. For example, if the original file name is StudentMarkList.pdf and a copy is created in the same directory or folder, the copied file name could be StudentMarkList (1).pdf or StudentMarkList - Copy.pdf.

1.2.5 Renaming File and Folder

You must have right or permissions to a file, a folder or a directory to rename it. In some cases, you may need administrator privileges in the operating system to rename.

In Window, to rename files such as text, photo, document, audio and video files and folders, you can use one of the following methods.

Method one

1. Highlight the file or the folder.
2. Right click the file with your mouse and select Rename from the menu that appears.

Method two

1. Highlight the file or the folder.
2. Press the F2 key on the keyboard.

Method three

1. Highlight the file or the folder.
2. Click File at the top of the window and select Rename from the list of available options.

Method four

1. Highlight the file or the folder you want to rename by single-clicking the file.
2. Once highlighted, wait a few seconds and click the file name again. A box should appear surrounding the file or folder name, and you can rename the file.

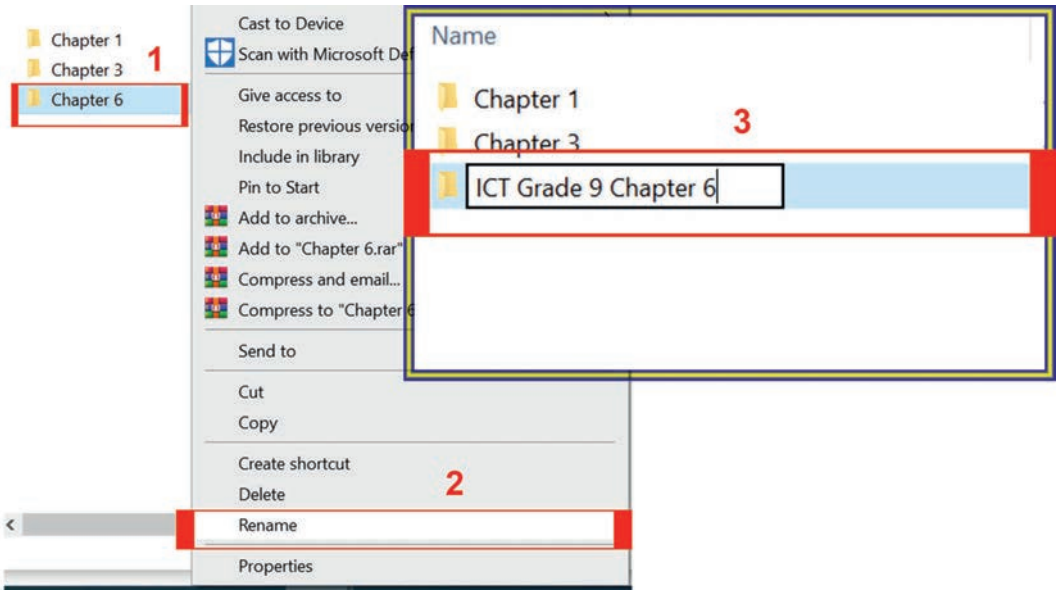


Figure 1.11 Renaming using right click Rename option

If you do not wait long enough and click the file or folder too fast, it can open the file or folder rather than allowing you to rename it.

If we want to rename multiple files of folders at once, we should keep the following steps.

1. Open Explorer.
2. In Explorer, select all the files you want to rename.
3. Once the files are selected, press F2 to edit the file name and type the new name for the files. For example, typing "test" renames the files to test, test (1), test (2), test (3), etc. If you have file extensions shown, make sure that you also typed the name of the file extension you are renaming.

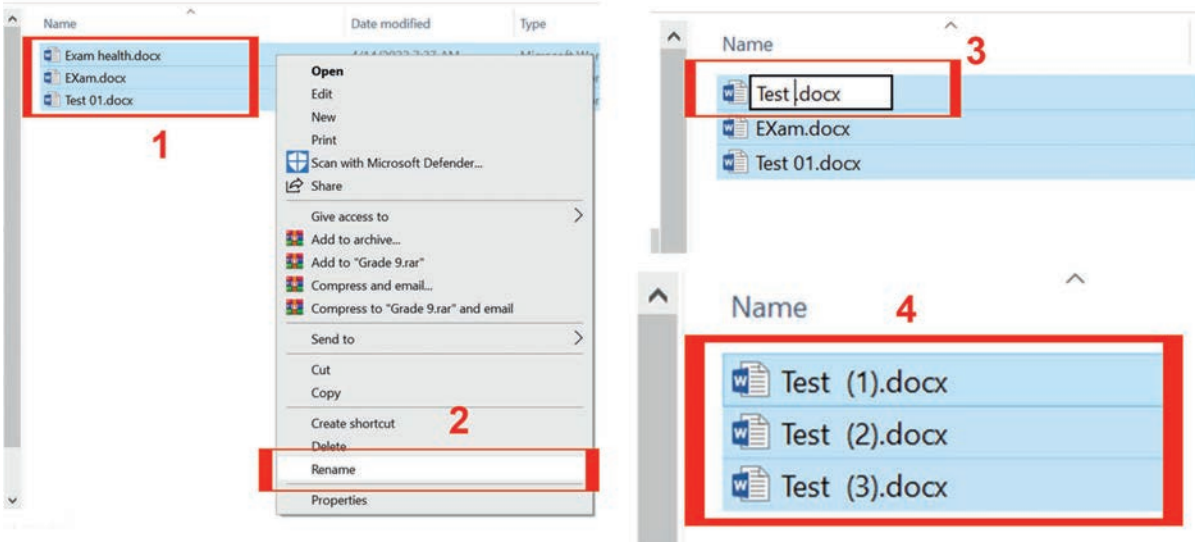


Figure 1.12 Renaming multiple files

1.2.6 Accessing Files and Folders

There are a number of ways you can navigate to your files and folders in File Explorer. The methods below will help you to do so.

- Using the Address bar (located at the top of File Explorer). The Address bar shows the full path of your current location.
- Forward and Backward buttons
- From the Folders/Navigation pane
- Using the Search function (which searches file names and file and folder contents in the current folder to find items containing your search term)

Using the address bar

The address bar, which is located at the top of File Explorer as shown in Figure 1.13 below, displays the path of the currently selected folder or active folder.

File Explorer drop-down menus are available for each subfolder in the address bar. Therefore, we can easily go backward or forward in the folder path by clicking on the right-pointing arrow next to the folder and selecting a subfolder from the drop-down menu.

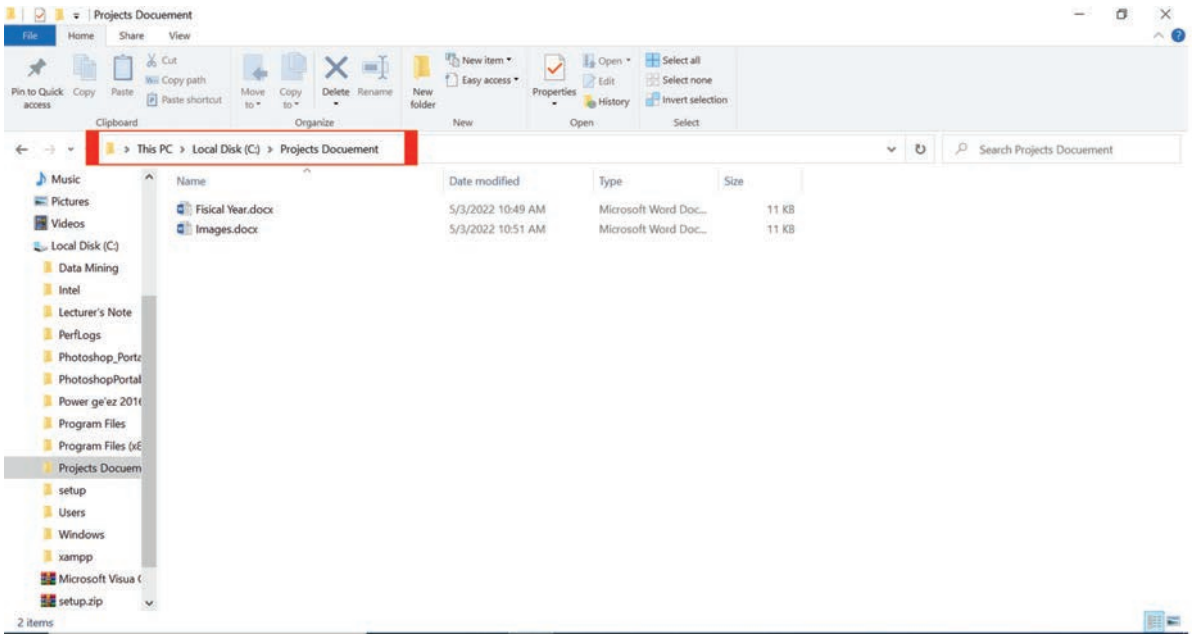


Figure 1.13 File Explorer address bar

Viewing previously visited folders in the address bar

To view folders you have seen previously, you can do any of the following.

Option 1: Click on the forward (➔) or back buttons (➔) as shown in Figure 1.14.

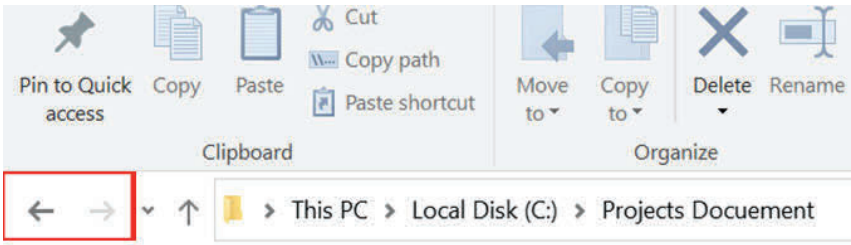


Figure 1.14 Forward and back buttons to view previously visited folders in address bar

Option 2: Click on a folder name in the address bar as shown in Figure 1.15 below.

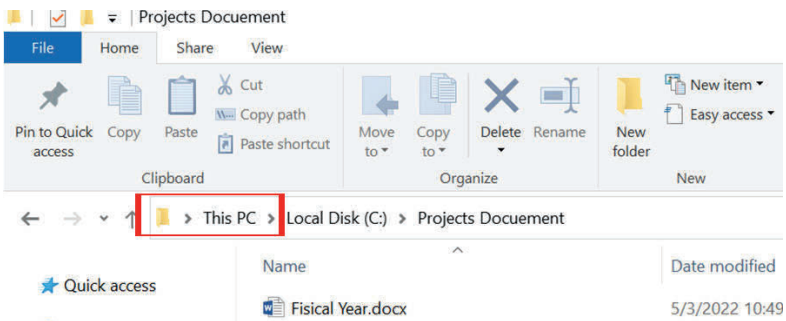


Figure 1.15 Clicking on folder name to view previously visited folders in address bar

Viewing the contents of a folder in the address bar

To view the contents of a folder in the address bar, click on the right-pointing arrow (>) next to the folder whose subfolders you want to view. The arrow changes to a downward-pointing arrow (*V*) and a drop-down list of the subfolders will be displayed (See Figure 1.16).

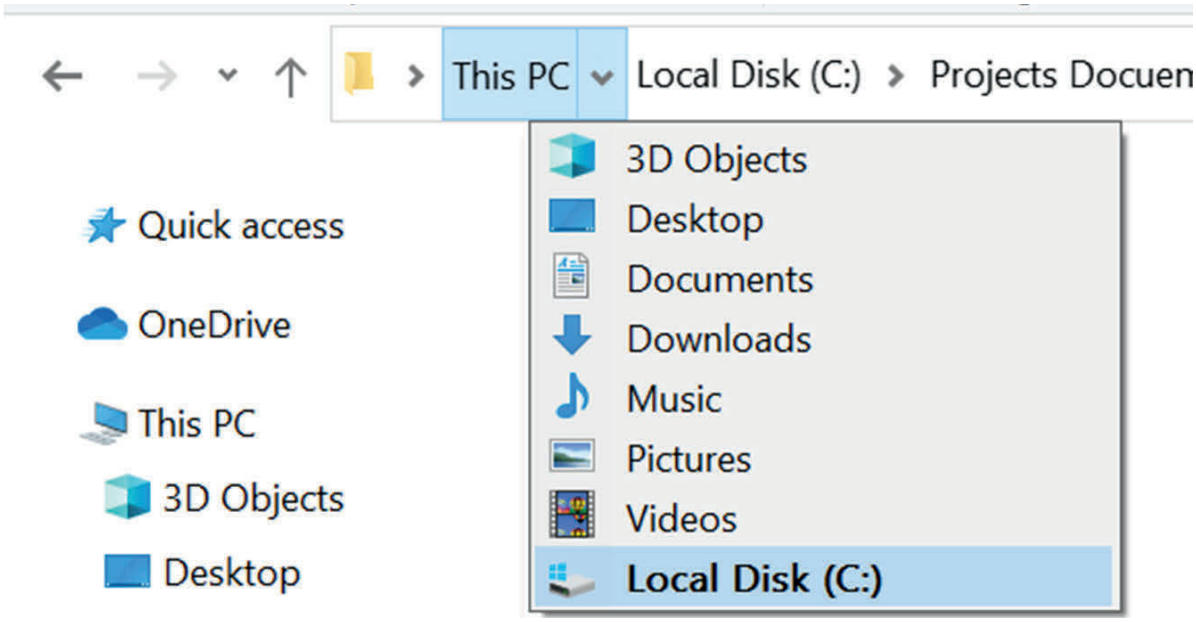


Figure 1.16 Viewing the contents of a folder in address bar

1.2.7 Displaying Subfolders Using Navigation/Folder Pane

The Folders pane or the Navigation pane is found along the left edge of every folder and displays a directory tree of all the folders on your computer (See Figure 1.4 and Table 1.1). You can select one or more folders in the Folders pane to display their contents in the File List pane. The Folder/Navigation pane contains several main sections: Quick Access, OneDrive, This PC and Network (See Figure 1.4).

If you used previous versions of Windows 10, you know that a folder name would have a plus sign next to it if that folder contains documents or subfolders.

With Windows 10, if a folder contains subfolders, that folder's name will have a small right-pointing triangle next to it (>).

- No triangle next to a folder name (Windows 10) means the folder has no subfolders.

- Right-pointing triangle next to a folder name () means the folder has subfolders.
- Down-pointing triangle next to a folder name () means the subfolders are currently displayed for that folder.

To view a folder's subfolders, click on the right-pointing triangle (>) next to the folder. The right-pointing triangle will turn into a down-pointing triangle and the subfolders will be displayed as shown in Figure. 1.17 below.

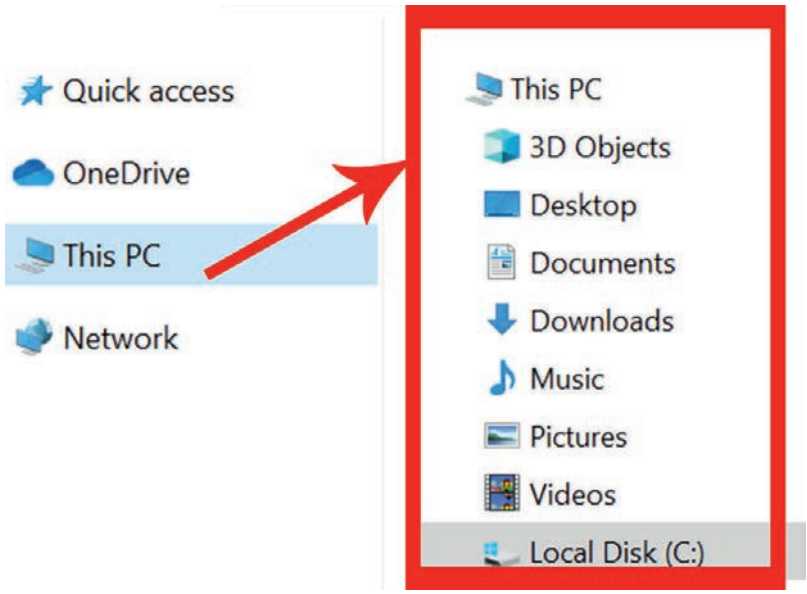


Figure 1.17 Displaying subfolders

In the figure above, "This PC" contains subfolders. To display the subfolders, just click on the folder name; to hide a folder's subfolders, click on the down-pointing triangle of that folder so that the subfolders will no longer be displayed.

1.2.8 Moving Files and Folders on Computer

There are several methods available to move computer files and folders (directories) from one source or level to another.

When moving files or folders, only one copy of the files is moved. If more than one copy of the files are needed, copy the files and instead of move them. See how to copy files in section 1.2.4 above.

In Windows, you can move files using several methods. These are:

- Cut and paste

- Drag-and-drop
- Use the "Move to Folder" command

Below are the steps used in different methods (options) to move files in Windows. Choose the option that works best for you.

You can also select multiple files and move multiple files at once using any of the steps below.

Option 1: Cut and paste

To move files using cut and paste method:

1. Select the file you want to move.
2. Right-click the highlighted file
3. Then select Cut.
4. Browse to the folder you want to move the file to.
5. Right-click in the folder, and select Paste.

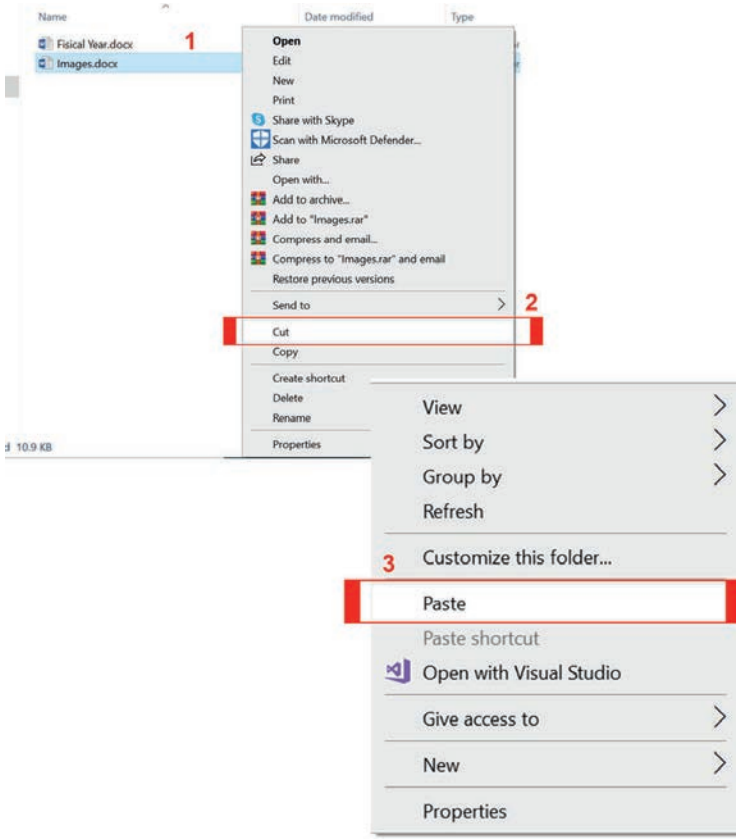


Figure 1.18 Moving a file in Windows

Alternatively, you can click Home from file explorer, select Cut to cut the files, browse to where you want to move the files, then select Home and Paste in the file menu.

You can also use shortcut keys to cut and paste files. Select the files you want to cut, then press the shortcut key Ctrl+X to cut the files. Cutting the files is like cutting text in a document, i.e. it moves the files to a temporary clipboard until you paste them somewhere. Navigate to the destination folder and press the shortcut key Ctrl+V to paste the files. The files are now in your destination folder.

Option 2: Drag-and-drop

To move the files and folders using drag and drop, follow these steps:

1. Highlight the files you want to move.
2. Press and hold your right mouse button and drag-and-drop the files to where you want to move them.
3. When you release the mouse button, a menu appears.
4. Select the Move here option to move the files.

For drag-and-drop to work, you will need to be able to see the window of where you are moving the files.

Option 3: Use "Move to Folder"

To move the files and folders using Move to Folder command, follow these steps:

1. Select the file by clicking the file name.
2. Click the Home menu found on the top-left of the window and select the Move to Folder option.
3. In the new window, browse to the folder you would like to move the file; then click the Move button to move the file to that folder.

If you are using Windows 7 and below versions, once the files are selected, the Move to option is shown under the File tab.

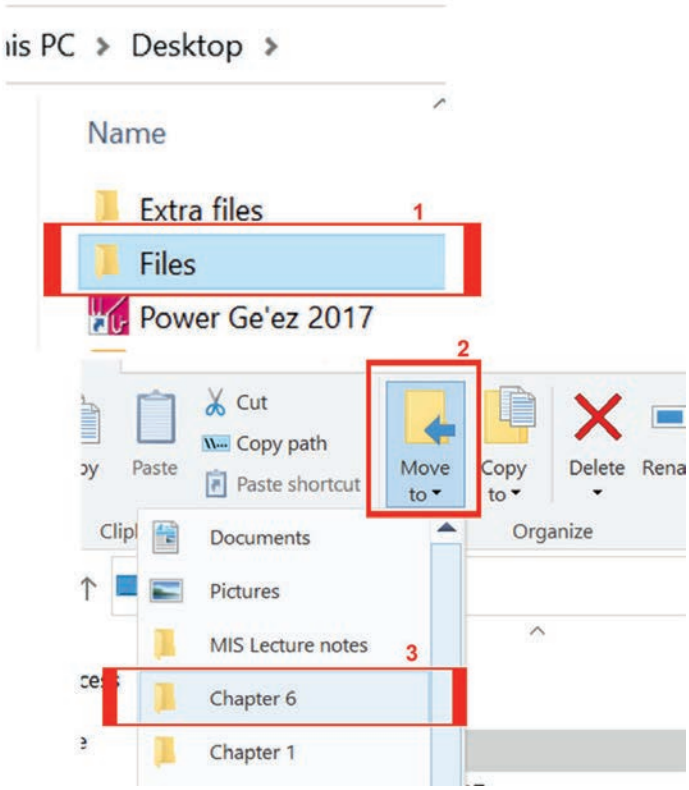


Figure 1.19 Using Move to Folder command to move files

1.2.9 Deleting File and Folder

Now and then, it is a good idea to clean up your drives and delete duplicated files such as photos, documents, temporary files and videos, and other unneeded or unwanted files and folders. The steps to delete a computer file, a directory or a folder vary based on the method you want to use and your operating system. Below are more common methods used for deleting a file or a folder in Microsoft Windows.

Users not familiar with Windows should realize that if they delete a folder or directory, all files and folders in that folder or directory are deleted. Deleted files or folders can be restored from Recycle Bin if not permanently deleted using shift + Delete key.

Use the following Steps to delete file or folders using Delete key method

1. Locate the item you want to delete.
2. Highlight the file or the folder by left-clicking with your mouse once.

3. Press the Delete key.

NOTE

You can delete multiple files or folders by holding down the Ctrl key and clicking each file or folder before pressing Delete. You can hold down the Shift key while pressing the Delete key (shift + Delete) to delete the files permanently. In this case, restoring from Recycle Bin is not possible since the file will not go to the Recycle Bin when deleted. It will be deleted permanently.

Use the following steps to delete a file or a folder by right-clicking method.

1. Open This PC or File Explorer. We recommend you to make sure that the directory or folder is empty before proceeding; otherwise, you intend to delete everything in it.
2. Locate the file or the folder you want to delete and right-click it.
3. Choose the Delete option from the pop-up menu.

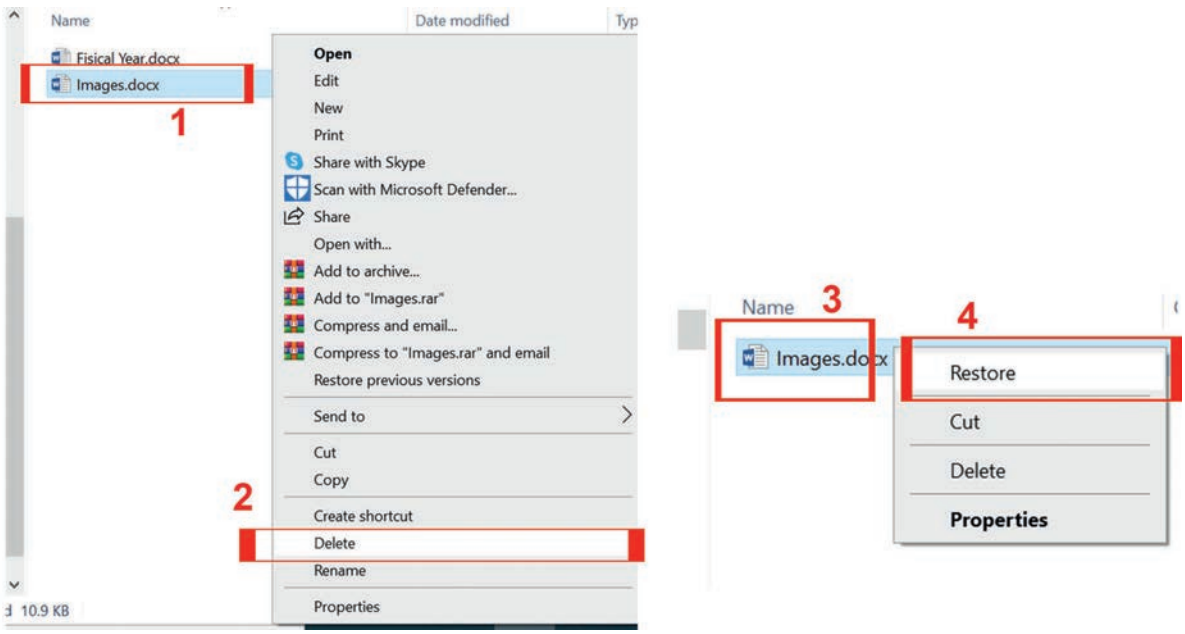


Figure 1.20 Delete file using right click option

Caution!

The local disk contains files and folders that are important for your computer to run correctly. Unless you know what you are deleting, please do not delete any file from this section.

Use the following steps to delete a file or a folder using Delete command from the Home menu.

1. Open This PC or File Explorer.
2. Locate and select the file or folder you want to delete.
3. Click Home in the top menu bar, and select Delete.

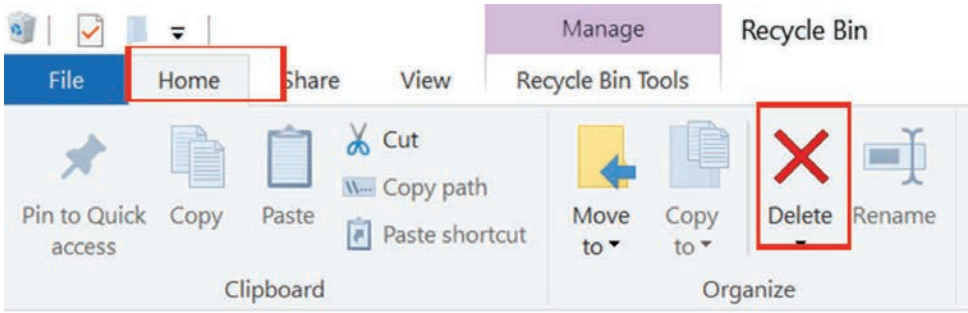


Figure 1.21 Delete from the Home menu

Practical Exercise 1.4

Find an icon of a file that you saved on your desktop before or identify any file that is not important anymore to keep and delete it using one of the methods that you have learnt.

Caution: be aware of the danger of deleting system files.

Note about a special folder called ***Recycle Bin*** where deleted files are kept in. You need to delete the file from the Recycle Bin for a permanent removal.

1.2.10 Searching a File on a Computer

All major operating systems running on computers can find files on the hard drive or other drives connected to the computer.

Microsoft Windows has a search feature that helps you find any file such as document, spreadsheet, picture or video on your computer. To find a file, it is not required to know its full name. Some of the methods used to search files are discussed below.

Option 1: Using Start button

1. Press the Windows key; then type part or the entire file name you want to find.

2. In the search results, click the file name you want to open.

Option 2: Using File Explorer

1. Open File Explorer.
2. In the left navigation pane, click Computer or This PC.
3. Near the top-right of File Explorer, click in the Search field and enter part or the entire file name you want to find.

NOTE

To find a file on a specific drive, click the drive under Computer or This PC in the left navigation pane. Then enter the file name you want to search for in the Search field.

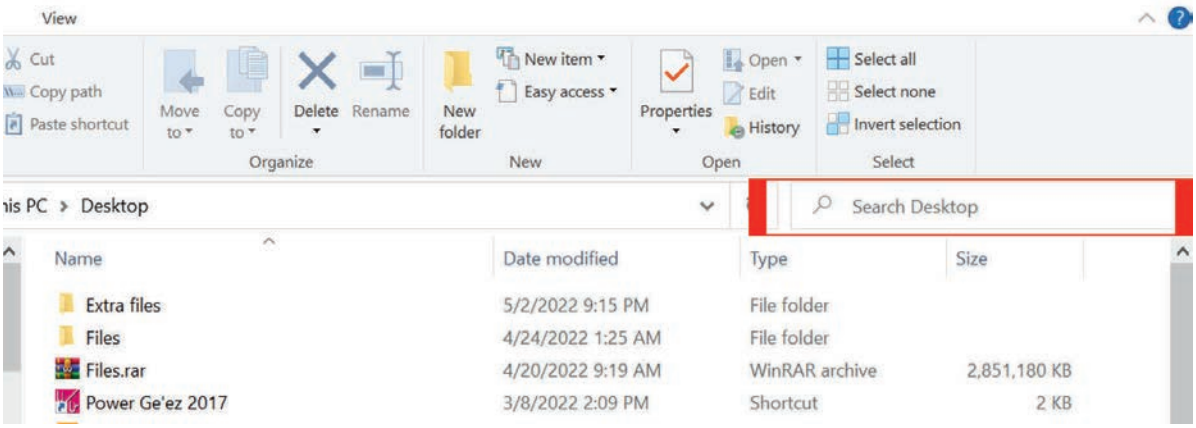


Figure 1.22 Search for a file in File Explorer

Practical Exercise 1.5

Work in a group of two or three to do the following file and folder management activities.

1. **Creating a folder**

   Create two folders called Test1 and Test2 in Documents folder.

2. **Creating files**

   Create a text file and write the text "I love Ethiopian cultures" and save it as "testfile1.txt" in the Test1 folder created as answer to question number 1 above. Open the Test 1 and Test2 folders. Which of the two folders created above are empty?

Create ***testfile2.txt*** in folder **Test2** with the name of your school as a text following the above procedures.

3. **Copying a file**

   Copy testfile1.txt to **Test2** folder using one of the methods you learned in section 1.2.8 above. What do you observe now in the two folders? Which folder contains two files?

4. **Moving a file**

   Move ***testfile2.txt*** from **Test2** folder to **Test1** folder. Which method do you use? Is there any difference between copying and moving files? What are the keyboard shortcuts that you use for copying and moving files?

5. **Renaming a file**

   Rename ***testfile2.txt*** file in **Test1** folder as ***testfile3.txt***. See section 1.2.5 to revise how you can do this.

6. **Deleting duplicated file**

Notice that we have a file named ***testfile1.txt*** both in **Test1** and **Test2** folders. Thus, the file is a duplicate. What is the problem of keeping duplicate files in your computer? Remove ***testfile1.txt*** from **Test2** folder. Open the ***Recycle Bin*** and search for the ***testfile1.txt*** file. Why is it found in the Recycle Bin?

KEY CONCEPTS

- File Explorer enables you to create, view, rename, delete and search files and folders in computer.
- File Explorer is also called Window Explorer in earlier versions of Windows 10.
- You can use window key + E to open File Explorer.

1.3 Computer Drives

A drive is a computer hardware component used to store and retrieve data, files, programs, operating system, etc. All drives store files and programs used by a computer. For example, when you write a letter in a word processor, the program is loaded from the hard drive. When you save the document, it is saved to the

hard drive or other disk or drive. In window operating system, a drive is often referred to by its letter like C:, D: or F:. However, Linux operating system uses tree structure starting from root represented by forward slash (/). For example, /home in Linux is a directory used to store users files. A computer drive can be a hard disk drive, CD/DVD drive, removable disk (USB) flash drive, etc. These are called secondary storage devices which you have learnt in Grade 8.

A hard disk drive (hard disk or fixed disk) is usually designated as the "C: drive". The hard disk drive is the main data and program storage hardware device that can provide quick access to large amounts of data and program in a computer. A CD/DVD drive, which is also called optical disc drive, allows you to use CD and DVD to listen to music, watch movie or store any files. It is usually designated as the "D: or G: drive". A USB drive, which is also referred to as a flash drive or memory stick, is a small, portable device that plugs into the USB port on your computer. USB drives are commonly used for storage, data backup and transferring files between devices.

The following figure shows examples of common computer drives.

Figure 1.23 Computer drives

NOTE

Some users may be confused with "drive" and "driver." These are separate terms. The word drive typically refers to a mechanical hard drive or solid-state hard drive used to store the operating system, data

and programs. A driver is software code that enables one or more hardware devices to communicate with the computer's operating system. Without drivers, a computer could not send and receive data correctly to hardware devices such as printer and flash drive.

Accessing all drives available on a computer

In Windows 10, it is possible to view all mounted or attached drives in File Explorer. To achieve this, follow the following steps carefully.

1. Open File Explorer by pressing Windows key + E.
2. In the left pane, select This PC.
3. All drives are shown on the right. Figure 1.24 shows a typical view of This PC with three mounted drives.

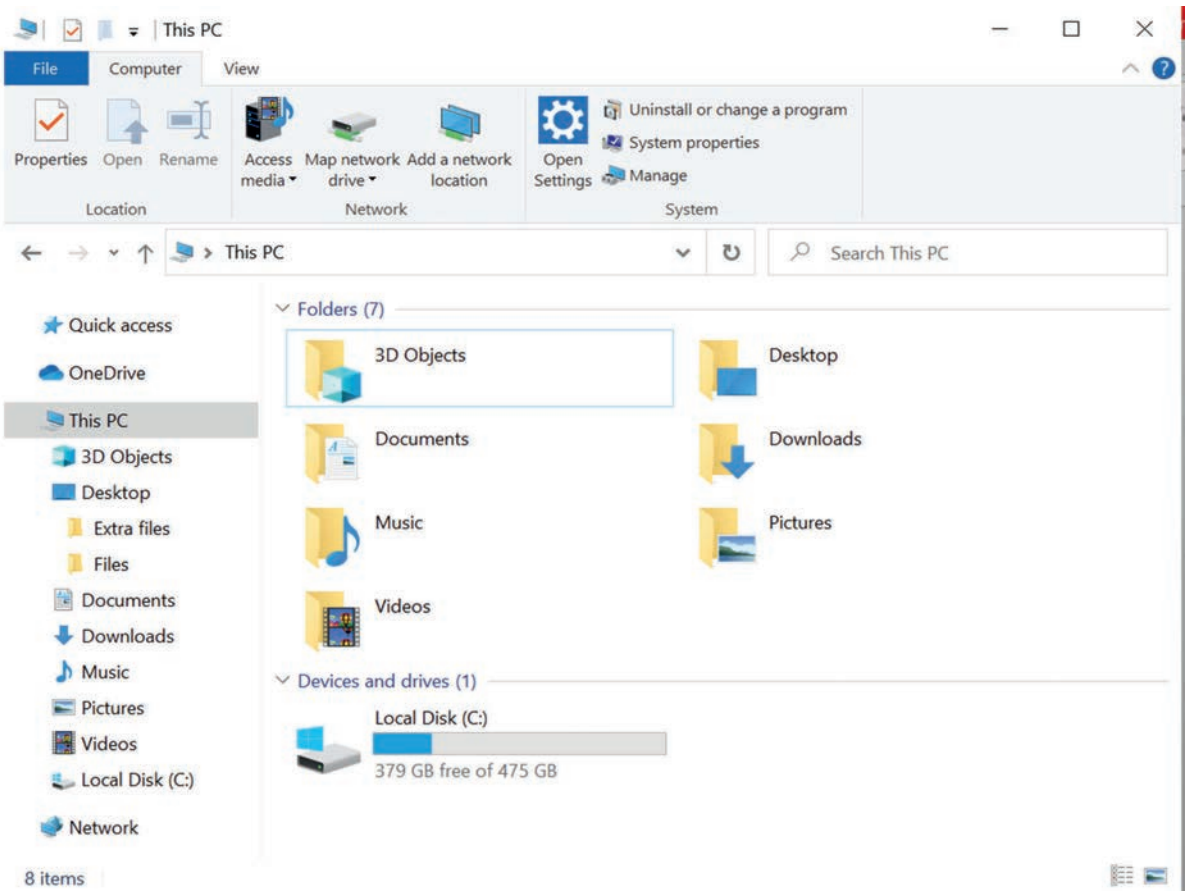


Figure 1.24 This PC in Windows 10

Practical Exercise 1.6

Work in a group of two or three to practice accessing removable drive and copying files from it following the instructions given below.

Plug a removable drive and copy any file into a folder created in your Documents folder.

Note for safe removal of a flash drive.

When you have done using a flash drive, do not remove it from the USB port just yet! You will need to make sure that it is disconnected properly to avoid damaging files on the drive. Follow is the steps below to safely remove your flash drive.

1. Right-click the flash drive; then select Disconnect (or Eject) disconnecting the flash drive.
2. You can now safely remove the flash drive from the USB port.

If you want to rename a flash drive, follow these steps

1. Right-click the flash drive; then select Rename.

In Windows, most of your programs are stored in the Program Files folder, and your documents are frequently saved in the My Documents folder.

MINI PROJECT: MANAGING FILES, FOLDER AND DRIVES

Read and understand each of the following cases carefully and answer the questions that follow them.

Case 1

Suppose you have just started to work in school as record officer. Your computer uses Windows 10. Your first task is to organize the hard drive on your computer. Record officer create and save several types of files about the students, including words, spreadsheets and pictures. Your supervisor has asked you to present a plan for organizing the student files on the computer. Currently, all of the files are saved in the root directory or folder of the computer.

1. Write a plan for naming and organizing the students' files of the school. Include the following in your plan.

a. Create a visual tool using pen and pencil that explains your plan.
b. Create a list of folders and describe how you will identify each folder and the files that are to be placed in each folder. For example, you might organize files by students' year or section.
c. Create your own naming standard for folders and files. For example, the name can contain student grade; then underscore the section, i.e. Grade_Section.

2. Create all the necessary folders and then files according to the above plan.
3. Show the new filing system to your teacher. Describe how you will use File Explorer to view the new folder structure and the organized files for students' registration files.

Case 2

Suppose you use computer to store all information about the subjects you are currently learning. For example, you may have notes, reference books, assignments and files or folders for each subject.

1. Write a plan for naming and organizing the subjects you have been learning in grade 9. Include the points discussed above in case 1 in your plan.
2. Create all the necessary folders and then files according to the above plan.
3. Show the filing system you have created to your teacher.

KEY CONCEPTS

- Drive is a hardware component of a computer which stores files and folders.
- Drive can be fixed and removable.
- Fixed drives are found within a computer while removable drives are portable and plugged externally.
- This PC section of Window Explorer navigation part contains all drives mounted on the computer.

1.4 Unit Summary

Learning files and folders is important. Organizations, small or large, have file management systems either in a computerized or manual system. Organization

maintains different files such as human resource data, day-to-day activity data, payroll files, customers' files, organizational documentation files, plan and schedule. Students must know how to manage files and folders in a computer system so that they can easily locate it, search it, organize similar file together in a folder, delete unwanted file to make a room for important files, and do similar activities on files and folders. The following are key points of files and folders organizations.

- A file is a collection of similar data stored in a computer system.
- A file in computer is analogous to real world file which is used to store some data, for example, student's data, teacher's data, etc.
- In computer, file can be document, picture, audio, video, application, etc.
- Each file in a computer has unique icons.
- A folder is like manila folder, it is a container of a file and other folder.
- Folder helps you organize similar files together so that you can locate files in a computer easily.
- File explorer is the best application in order to manage files and folders in window. Managing files and folders includes creating, deleting, renaming, sorting, viewing and similar activities on files and folders.
- Navigation Pane is part of the File Explorer which is used to view your computer files and folders in tree structure hierarchically. It consists of quick access sections: OneDrive, This PC and Network.
- Quick access section is used to navigate to folders quickly. It consists of Desktop, Download, Documents, Pictures and frequently accessed folders. If you click Desktop, you will get all files found in your desktop. Browsers such as Internet Explorer, Microsoft Edge and Chrome will put all files downloaded from internet by default in Download folder. So, you can access your Download file from Quick access section in navigation pane. Documents contains word documents, letters, memos, etc. and Picture contains photos you have shot or saved from the Internet.
- To open File Explorer application, you can use:
    - The shortcut on task bar or on the desktop.

- Start typing 'File explorer' after clicking Start button.
- Window key + E keyboard shortcut.

- To navigate to your files and folders using File Explorer in a computer system, you can use either of the following methods.
  - Using the Address bar (located at the top of File Explorer)
  - Forward and Backward buttons of File Explorer
  - From the Folders/Navigation pane
  - Using the Search function which is located at the right side of File Explorer
  - Clicking the right-pointing triangle next to the file on navigation pane, to view the subfolders and/or content of each folder
- To move files, you can use either of the following methods.
  - Cut and paste
  - Drag-and-drop
  - Use the "Move to Folder" command
- You can use F2 shortcut key to rename file or folder after selecting it.
- A drive is a computer component used to store the data and it can be:
  - Static (built in) drive: including internal hard disk, SSD and the like.
  - Removable drive: including Flash Disk, Removable Hard Disk, CD, etc.
- To view all mounted or attached drives in window, File Explorer application is used.

1.5 Unit Review Exercise

Part I: Write whether the following statements are true or false.

1. 'Copy and paste' can also be referred to as moving a file.
2. A file is an entity in a computer system that contains other files inside.
3. Renaming a file removes its content.

4. Dragging a file creates multiple copies of files.
5. Deleting a file will completely remove files from the disk.
6. We cannot access or open files and folders using address (path) because files and folders do not have address in computer.
7. Windows does not allow handling multiple files.

Part II: Choose the correct answer among the alternatives provided.

1. To expand a branch of the folder tree, you would _____.
   A. click on the folder name in the folder tree
   B. click on the icon Arrow right (>) of the branch
   C. click on the icon Arrow – down (V) of the branch
   D. None of the above.
2. To remove a file or a folder, you would _____
   A. drag it out of the window
   B. select it and press the Delete key
   C. select it and press Ctrl + Delete keys
   D. right click on the file or the folder and select Cut
3. What do you do to select an of icon a file?
   A. Left click
   B. Right click
   C. Double click
   D. Scroll
4. Which one of the following is true about file explorer?
   A. It was called window explorer previously.
   B. It is used to view files and folders.
   C. It is used to view available drives.
   D. All of the above.

5. What do you do to get a menu when clicking on a folder or file icon?

   A. Left click

   B. Right click

   C. Double click

   D. Scroll

6. Which type of icon can take you to another place quickly?

   A. File

   B. Folder

   C. Application

   D. Shortcut

7. What do you do to open a folder?

   A. Left click

   B. Right click

   C. Double click

   D. Scroll

8. What do you do to rename a folder?

   A. Left click

   B. Right click

   C. Press F2 key

   D. Scroll

9. What is drive used for?

   A. To open files from your teacher

   B. To use applications not on your computer

   C. To save things on the computer

   D. To save their work for students

10. What would you do to see the content of the file using Navigation pane?

    A. Right click

    B. Left click

    C. Double click

    D. Drag

11. _____is used to open a file or a folder.

    A. Right click

    B. Left click

    C. Double click

    D. Drag

12. Which one of the following short cut keys is used to save any file?

    A. Ctrl + N

    B. Ctrl + S

    C. Alt + Z

    D. Ctrl + A

Part III: Fill in the blanks.

1. Information is stored in a storage device with a specific name called _____.
2. Duplication of files from one drive to other is called _____.
3. The cut and paste option is also called _____.
4. _____ means locating a file among a set of files.
5. To delete a file, you have to click the right button of the mouse on the file name and select the _____ option.
6. _____ is used to manage files and folders in window.

Part IV: Match the following items in column A with column B.

A	B
1. Collection of data	A. File Explorer
2. Used to organize similar files	B. Used to draw pictures
3. Used to manage files and folders	C. Navigation panes
4. View your computer's file and folder structure	D.Used to process text files
5. Formerly called favorites	E. File
6. Allows you to see all networked PCs	F. Quick Access
7. Paint Application	G. Network
8. Moving files	H. Folder
9. Fixed drive	I. CD
	J. Internal hard disk
	K. This PC
	L. Copy and Paste
	M. Cut and Paste
	N. Internet Explorer

Part IV: Provide clear and precise responses to the following questions.

1. What is the difference between a file and a folder?
2. Where are files stored?
3. Write the steps to create a folder?
4. Why do files need to be kept in the proper place in a computer?
5. Write the major steps to rename a folder?
6. Write the major steps to delete a folder?

UNIT

2 COMPUTER NETWORK

UNIT OUTCOMES

At the end of this unit, learners will be able to:

- Define what a computer network is.
- Identify the building blocks of a computer network.
- Compare and contrast the basic types of networks (LAN, MAN, WAN) and client server vs. peer to peer.
- Describe the topologies of network.
- Discuss the advantages and disadvantages of network.
- Draw simple network diagrams using network device symbols.

UNIT OVERVIEW

This unit focuses on computer network, mainly on Internet and Internet services emergence. You learned about Internet and its services in grades 7 and 8. Do you remember the different services that you can get from the Internet such as web surfing for searching information, file sharing, chatting, messaging, and social media networks? There are also serious risks associated with unsafe and improper utilization of Internet.

This unit discusses fundamental concepts of computer network. The unit is divided into four sections. The first section defines what a network is and is followed by listing and describing different components of a computer network, both the software and hardware parts. The last two sections present types of network and advantages and potential threats of connecting computers or other electronic devices into a network.

2.1 Definition of Network

Brainstorming

1. Have you shared a file or received a message using mobile phone? How do you think that your file or message move around to reach its destination?
2. Identify different organizations in your local areas that utilize computer networks for their service provisions.

A netwok is a connection of two or more computers that are linked together in order to share resources(such as printers, files and disks) or allow electronic communications. Using Bluetooth application in your mobile phone to share files is an example of a network.Sometimes, the Internet is called the largest global network. Figure 2.1 shows an example of a network with multiple computers and other network devices, which are all, connected. The figure shows that the laptop, the tablet, the mobile phone and the television are connected to the central network device. The central network device is, in turn, connected with a global network through an internet service provider (ISP) company such as Ethio-telecom. You will learn more about these in the next sections.

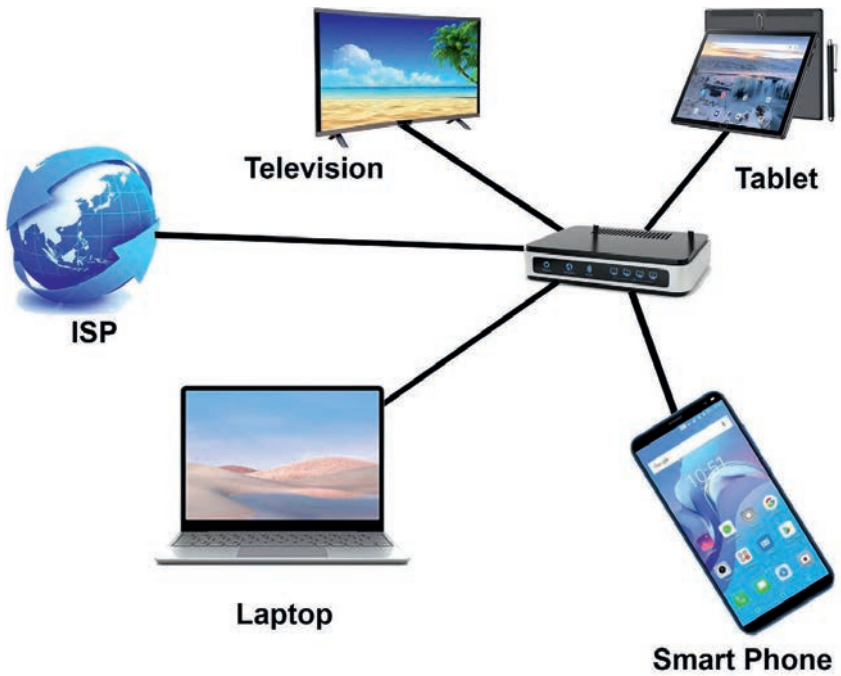


Figure 2.1 Home network

Activity 2.1

Form a group of three to five students and discuss the following questions.

1. What is a computer network?
2. What are the applications of network in our day-to-day lives?

2.2 Fundamental Elements of Network

Networks are comprised of four basic elements: hardware, network software, protocols and connection medium. All data networks are comprised of these four elements, and cannot function without them. The backbone of any network is the hardware that runs it. As you can see from the top two rows in Figure 2.2 below, network hardware includes end devices and intermediary devices.

Network software is also a foundational element for any network. This type of software helps to manage connected end devices and services the network provides. Protocols are set of rules to facilitate electronic communication across connected device. You will learn more about protocols in Grade 10. Transmission medium which can be wired or wireless, caries message between end devices.

Each element of networks is described one by one in section 2.2.1 to 2.2.4 below. Figure 2.2 shown in the next page presents examples of the hardware elements in the three categories.

2.2.1 End Devices

Brainstorming

Consider different electronic devices at home, e.g. digital camera, laptop, mobile, television, etc. Which of the devices do you see connected with cable or other formats?

End devices, which are also called ***hosts***, are devices used to send or receive data over the network. The sending device is called a ***sender*** and the receiving one is a ***receiver.*** Some examples of end devices are:

- Computers(such as desktops, laptops, file servers and web servers etc.)
- Network printers
- Security cameras
- Mobile handheld devices.

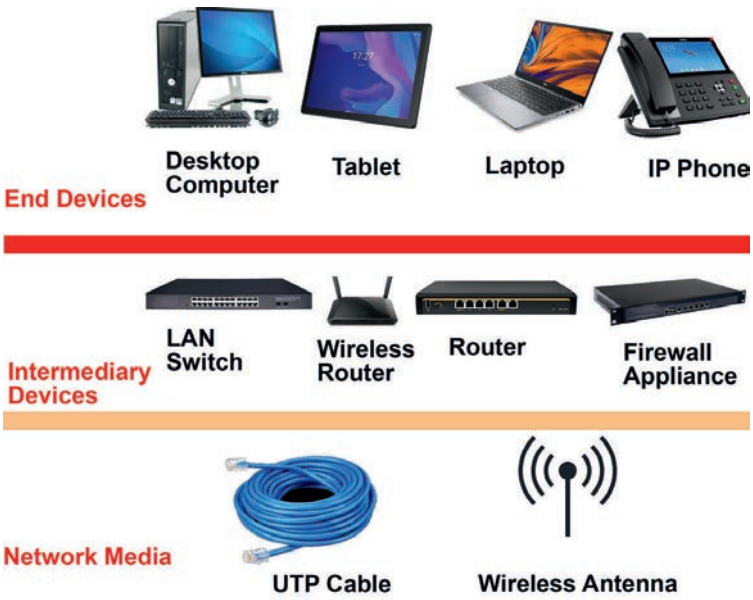


Figure 2.2 End devices, intermediary devices and media

2.2.2 Intermediary devices

Intermediary devices interconnect end devices. These devices interconnect and work behind the scenes to ensure data flow across the network and the devices. Intermediary devices connect the individual hosts to the network and also can connect multiple individual networks to form an internetwork. Intermediary device includes network cards, routers or network switches, wireless access point (WAP) and repeaters. Without these hardware devices, end devices have no means of accessing a network.

a. Network Interface Card (NIC)

Network Interface Card (NIC) is a computer hardware component that connects a computer to a computer network. As it is shown in Figure 2.3, Network Interface

Card (NIC) comes in a card form to be plugged into the computer system or can be an integrated one as part of the systems board that you often see in laptops. NIC has a slot to plug-in a cable connection with a network.

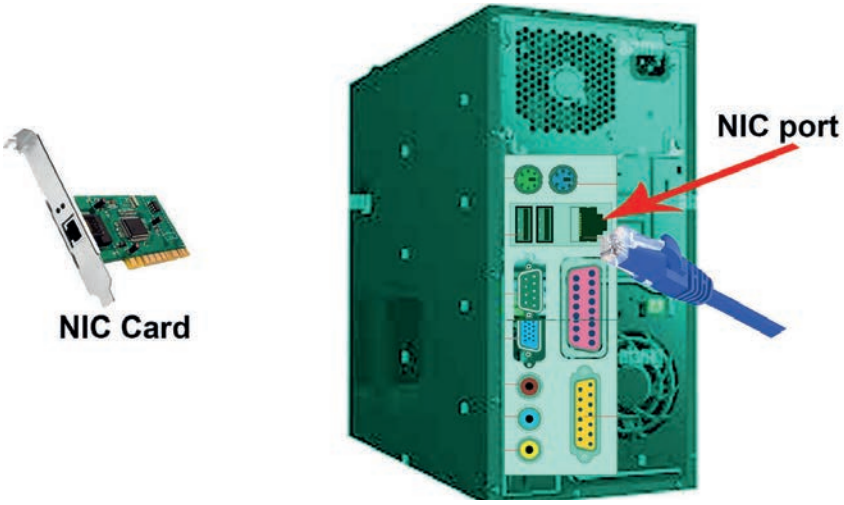


Figure 2.3: a) Network interface card b) Cable to be plugged in to a desktop computer NIC

b. Repeater

Communication media or cables that you are going to learn in section 2.2.4 have limitation. This includes the electronic signal they carry will become weak after traveling a long distance. Repeater enables a network segment to extend the coverage to reach beyond its inherent distance limitation by refreshing or generating the weak network signal. Figure 2.4 depicts that a weak signal (depicted on top of the Figure) is regenerated by a repeater in the middle to restore the signal to its original signal (bottom).

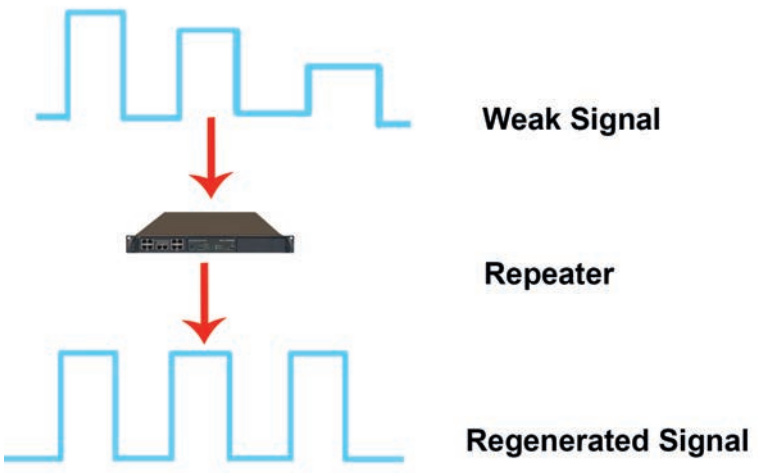


Figure 2.4 Repeater

c. Switch

A switch, as shown in Figure 2.5 (a), is a device that interconnects various devices such as computers, printers and servers in a small business network, as shown in Figure 2.5 b below. Switch is more intelligent device than hub as it can segment a computer network into smaller parts. In addition, switch forwards packets to specific destination after learning the network topology. To perform this, switch uses a table which contains computer ***physical address*** and ***switch port number*** on which a computer connected on. A hub is unintelligent device which broadcasts all received packets to all computers connected to it except the sender.

Figure 2.5 a) 24 port switch b) Switch on a network

d. Router

Consider yourself as a taxi driver in a given town which has a lot or streets (roads) interconnected. Think about the driver when he or she selects a particular street from many different options available to reach to his or her destination. What factors does he or she consider? The distance? The traffic jam or number of cars in a certain road segment? Which road segment would take him or her where? What else, he or she might think of?

A router is such an intelligent device which operates in determination of pathways for electronic messages in networks. A router, as its name suggests, works with routing or finding a route through a network. That is, it is a router of a network. The main objective of router is to connect dissimilar and different networks simultaneously as shown in below Figure 2.6. As shown in the figure, there are two network segments, each connected to a switch. The two switches are connected to each other through the router. Assume two different cases.

Case 1: A computer sends a message for another computer within one network; that is, both the sending and the receiving computers are connected to the same switch.

Case 2: A computer in one network segment sending a message to another network connected to a different switch.

The router usually works for case 2 type scenario and it selects best route to reach to the destination network. To do this, a router uses a mechanism called *routing table*, which contains destination network field and interface number of routers.

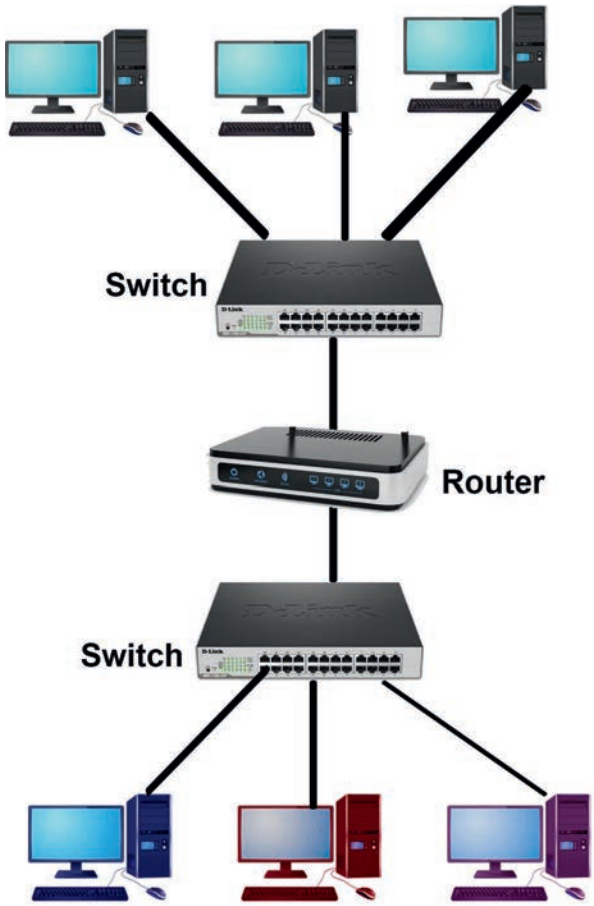


Figure 2.6 Router connecting two networks

e. Wireless Access Points

Brainstorming

Discuss in a group of three to five students about different methods that you could use to connect handheld mobile phones to the Internet.

A wireless access point (WAP) is an intermediary device in a network that connects various types of wireless communication devices with wireless networks. The connectivity is made possible through Bluetooth and Wi-Fi technologies. It acts as an intermediary between wireless and wired devices that are part of a network (See Figure 2.10 in Section 2.3).

2.2.3 Communication Protocol

Brainstorming

1. Do people have a convention, protocol or set of rules when they communicate, for example when they talk on phone or write a letter, email, etc.? Have you learned about formal and informal letter writing in your English or local language subjects? How do you write sender's and receiver's addresses in the letter? Are these not protocols? What others common protocol do you remember?
2. What will happen if an individual does not follow a protocol?

In networking, a protocol is a set of rules that governs data communications. In order for different network hardware to interact with the network, they should follow the same rules called protocols. It is software that instructs network devices on how to connect to the network and how to interact with one another. Internet Protocol (IP) is one of the important communication protocols and used for addressing network devices and forwarding data from one network to another. You will learn IP and its classes in detail in grade 10.

2.2.4 Connection Media

Brainstorming

Why are the telecommunication cables stretched across the streets and roads? What about the big mobile antenna towers that stood on the hills and in the towns?

Without physical connections(wired or wireless), a network cannot function. The connection media are the media which are used to carry the message from sender to receiver. We have two types of communication medium: wired and wireless.

i. **Wired medium:** It is also called *guided medium.* It is a cable that connects end devices. Copper and fiber optic cables are examples of wired medium. The most common copper cable used in networks today is unshielded twisted-pair cable (UTP), which uses electric signal to transmit message for a maximum distance of 100 meters. Fiber optic cable uses light to transmit signal at faster speed and longer distance than copper cable.

ii. **Wireless Medium:** It is also referred to as *unguided media* or *unbounded transmission* media. It is used to communicate information through the air, water or vacuum, e.g. radio Waves, micro waves, infrared waves and satellite communications.

Figure 2.7 below presents some examples of wired and wireless communication media along with their connectors. You will cover the communication media in detail in grade 10.

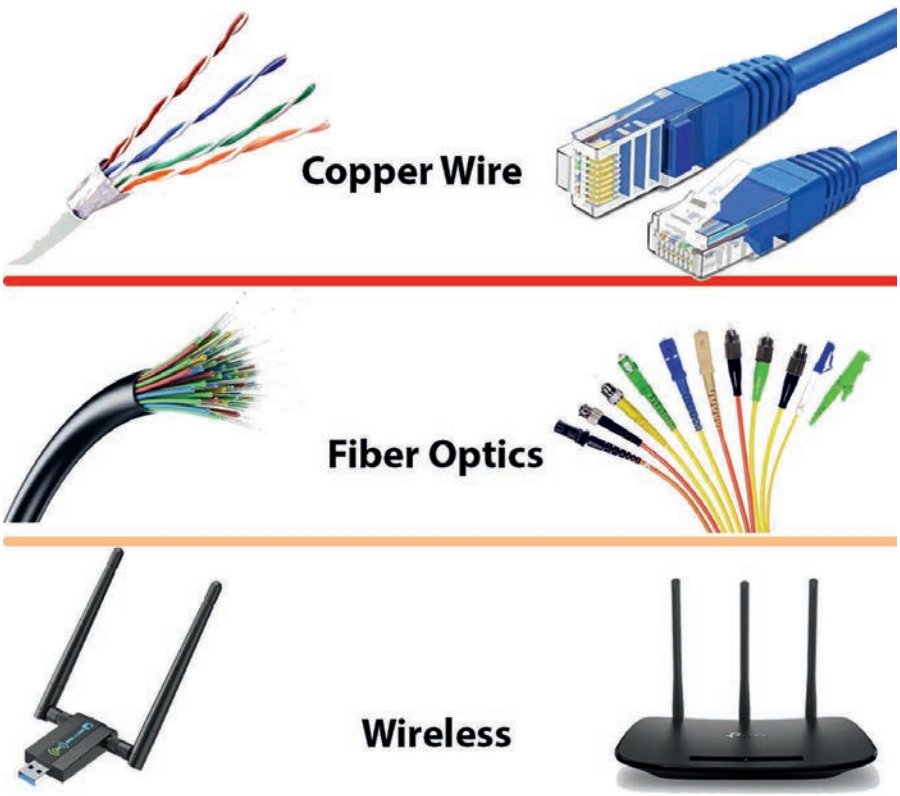


Figure 2.7 Types of communication medium

Activity 2.2

Form a group of three to five students and work on the following activities.

1. Visit your school network or computer laboratory and identify fundamental elements of network available.
2. Ask the network administrator or the laboratory manager about some network protocols used/implemented in the design of the school network?
3. Find an unshielded twisted-pair (UTP) cable analyse its connectors, the number of wires inside the plastic shield, colour of each wire and order of the colours.
4. Ask the responsible person about which interconnecting devices are used to set-up the network at your school and roles or functionalities of the devices in the school's network.
5. Compile an activity report and reflect it in your class.

Practical Exercise 2.1

Form a group of two to three students and work on the following activities.

1. Search the internet for Cisco and Huawei network device symbols that are covered in the classroom.
2. Use these symbols and draw simple network diagram that consists of the fundamental elements of network
3. Draw a network diagram specified in Figure 2.6 using a Cisco packet tracer, Graphical Network Simulator 3 (GNS3) or on paper using the right symbols.

KEY CONCEPTS

- Network is connection of two or more devices for sharing resource which can be data, hardware, software, etc.
- A given network comprised of the following four basic components.

- End devices are senders and receivers and able to send and receive messages.
- Intermediary devices are used to interconnect end devices together in the same and different networks.
- Protocols are common rules followed by communicating parties to govern communication in a network.
- Transmission medium is a physical path between sender and receiver, used to carry message.

✍ There are two types of transmission medium: wired and wireless medium.

✍ Switch is used to create a local area network whereas Router is used to interconnect different local area networks.

2.3 Types of Networks

Brainstorming

Consider networks at your home, if any, or at your school. Consider also the network that belongs to such a big company, like Ethiopian Airlines, that has branch offices throughout Ethiopia and abroad. Are the network technologies and number of end devices connected the same among these networks? Discuss how they are the same or different.

There are different types of network classified based on the following four categories:

- Network media
- Size of the network or geographical coverage of the network
- Topology
- Resource security and access

The type of network based on this categorization is depicted in Figure 2.8 below. Each type of the network depicted in Figure 2.8 is discussed in subsection 2.3.1 to 2.3.4.

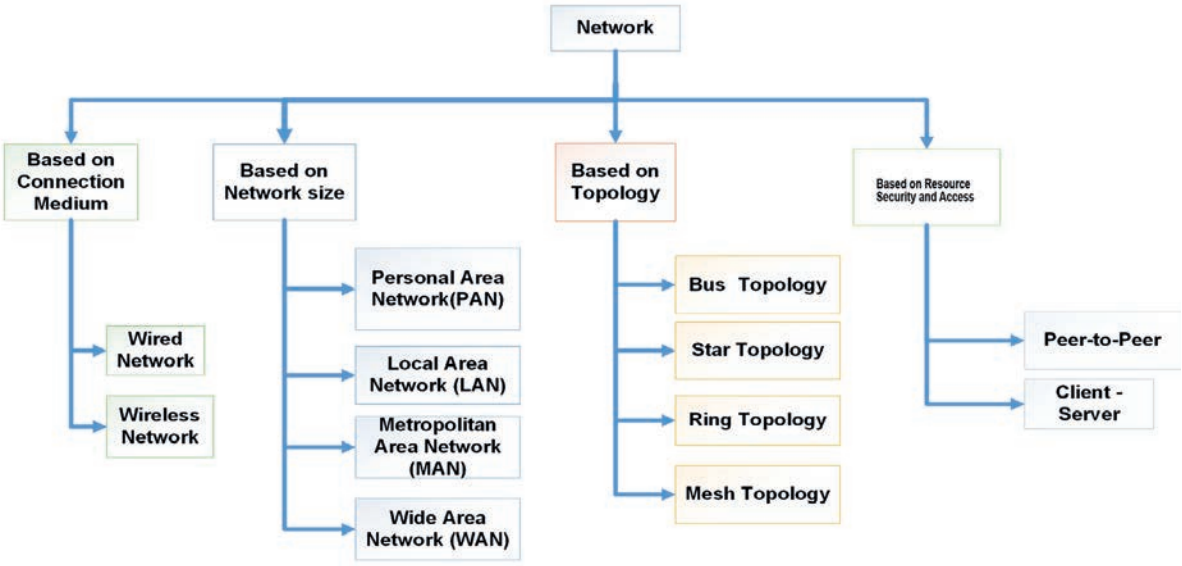


Figure 2.8 Types of networks based on different perspectives

2.3.1 Types of Network Based on Connection Medium

Based on connection medium, computer networks are classified into wired and wireless networks.

Wired Network

Wired networks, also called Ethernet networks, are the most common type of local area network (LAN) technology. A wired network is simply a collection of two or more computers, printers, and other devices linked by Ethernet cables. This is shown in Figure 2.9, as an example, where each line connects the end devices and servers to the global network (the globe) cables.

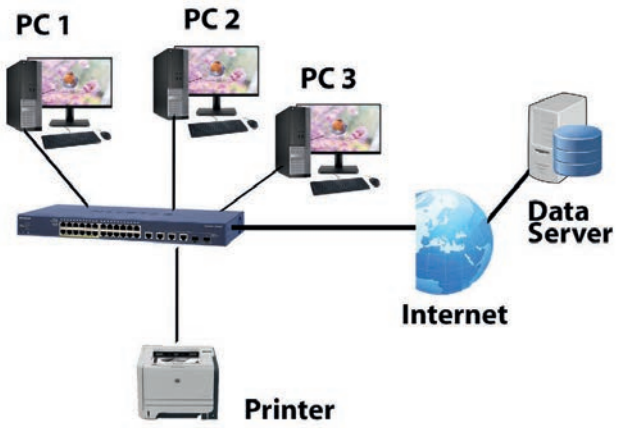


Figure 2.9 Wired network

Wireless Network

If you compare Figure 2.10 below, which is a wireless network, with Figure 2.9 above, you will see a wireless access point connecting with a wireless or a wired computer and a model, which connects the network with the Internet (or cloud). Wireless networks have no physical connection with the wired network; instead they get connected through the wireless access point (WAP). A wireless network, which uses high-frequency radio waves rather than wires to communicate between nodes, is another option for home or business networking.

Individuals and organizations can use this option to expand their existing wired network or to go completely wireless. Wireless network allows for devices to be shared without networking cable which increases mobility.

Figure 2.10 Wireless network

The backbone of wireless network is always a wired network.

Activity 2.3

Ask your parents or adults you have close contacts with about the following and discuss them in your classroom.

1. Ask your parent or any person about different networks which exist in your city, town or village.
2. Based on the description you got from your activities in question number 1 above, discuss the types of the network that at least one of the organizations has in terms of connection medium, wired, wireless or a mixed one?
3. Discuss also what types of end and intermediary devices the network could potentially have in the organization, with a reason for your device type selections.

2.3.2 Types of Networks Based on Size

Computer networks can be characterized by their sizes. The size of a network can be expressed in terms of the geographic area the network occupies and the number of computers connected to the network. Networks can cover anything from a handful of devices within a single room to millions of devices spread across the entire globe.

In Figure. 2.11 and Table 2.1, we classify networks by their rough physical size. The smallest in size is the personal area networks (PAN), networks that are meant for one person. Beyond PAN, with varying coverage range are categorized into local, metropolitan and wide area networks, each with increasing scale.

Some of the network types based on size are:

- Personal area network or PAN
- Local area network or LAN
- Metropolitan area network or MAN
- Wide area network or WAN

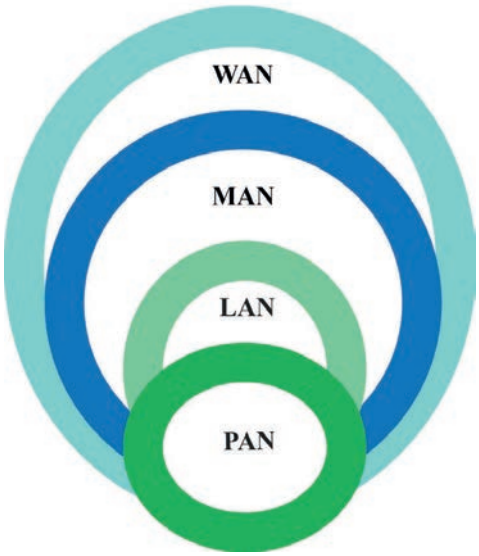


Figure 2.11 PAN, LAN, MAN and WAN

Table 2.1 PAN, LAN, MAN and WAN Descriptions

Network Distance		
1 m	Square Mater	Personal Area Network
10 m	Room	Local Area Network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan Area Network
100 km	Country	Wide Area Network
1000 km	Continent	
10,000 km	Planet	

Personal Area Network (PAN)

A personal area network (PAN) is a computer network organized around an individual person within a single building. A common example is a wireless network that connects a computer with its peripherals. Almost every computer has an attached monitor, keyboard, mouse and printer. If there is no wireless network, this connection must be done with cables.

A network created by **Bluetooth** is PAN. Bluetooth is a short-range wireless network used to connect computer's peripheral components without wires as shown in Figure 2.12. In the figure, a laptop, a mobile phone and a television or tables are connected to one another without a cable. The idea is that if your devices have Bluetooth, then you need no cables. You just put them down, turn them on and they work together.

Figure 2.12 Bluetooth PAN configuration

This type of network provides a great flexibility. For example, it allows you to:

- Send a document to the printer in the office while you are sitting on the couch with your laptop.
- Upload a photo from your cell phone to your desktop computer.
- Watch movies from an online streaming service to your TV.

Local Area Network

Local Area Network (LAN) is generally an organizational or a privately owned network within a single office, building or campus covering a distance of a few kilometers. The main reason for designing a LAN is to share resources such as storage spaces, printers, programs and data. It also enables the exchange of information.

The smallest LAN may use only two computers while larger LANs can accommodate thousands of computers. A LAN typically relies mostly on wired connections for increased speed and security, but wireless connections can also

be part of a LAN. If a LAN is entirely wireless, it is referred to as a wireless local area network (WLAN). Figure 2.3 depicts a LAN that combines cabled and wireless networks into a single network.

Figure 2.13 Wired and wireless and local area networks

Metropolitan Area Network

A Metropolitan Area Network (MAN) is a network that is designed to cover an entire city. Suppose a bank wants to connect three of its branches in a given city. In such a case, the bank will utilize the service of existing telephone network of the city (for example the Ethio-telecom network) to interconnect its offices, through which MAN is created. Figure 2.14 shows a MAN that interconnects a hospital, a school/collage and a factory local area networks.

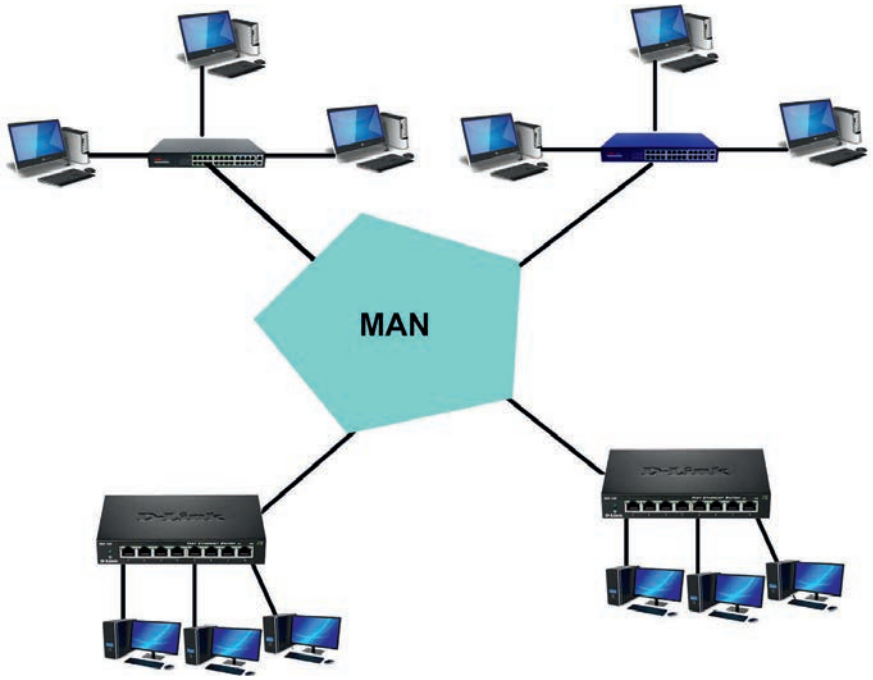


Figure 2.14 Metropolitan area network

Wide Area Network

A wide area network (WAN) occupies a very large area such as an entire country or the entire world. A WAN can contain multiple smaller networks such as LANs or MANs. The Internet is the best-known example of a public WAN. A diagram depicting MAN is shown in Figure 2.15 below. It indicates that computers residing in different parts of the world are connected to each through a MAN.

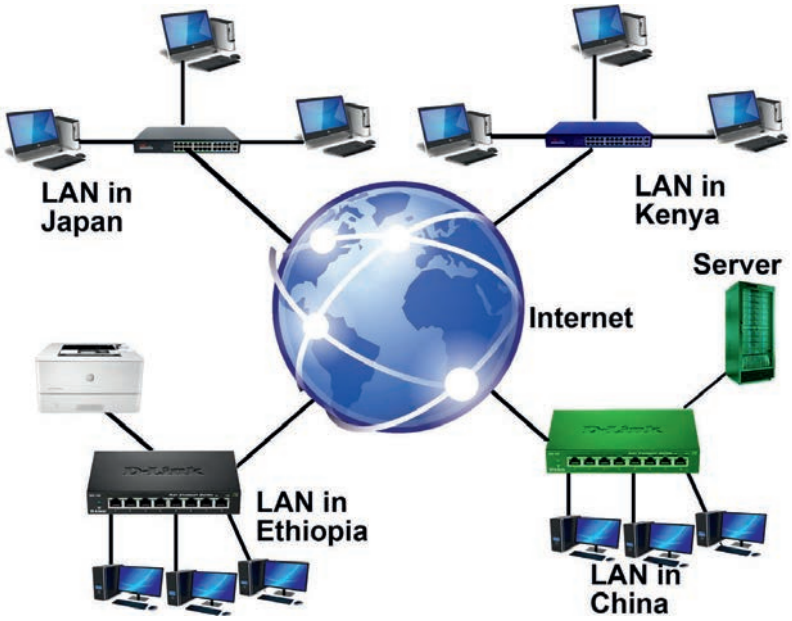


Figure 2.15 Wide area network

Activity 2.4

Do the following as an extension to Activity 2.3 above.

Based on the description you got from your activities in question number 1 of Activity 2.3, discuss the type of the network that at least one of the organizations has in terms of connection medium as well as size of the network.

2.3.3 Types of Network Based on Topologies

Network topology defines how various computers or electronic devices represented as nodes are connected to one another in the network. It refers to the physical arrangement of devices in a network. Typical network configurations include bus topology, mesh topology, star topology, and ring topology (See Figure 2.16).

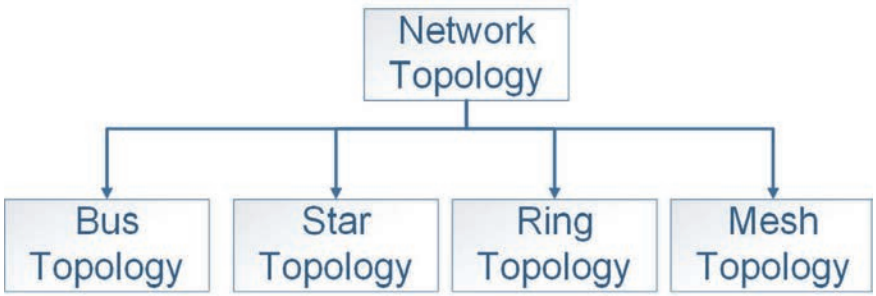


Figure 2.16 Network topologies

a. Bus Topology

In bus topology, there is a long cable called *bus* which acts as a backbone for all the nodes as shown in Figure 2.17. A bus topology network connects each computer or electronic devised to a backbone cable (or bus) just like a water pipe interconnections

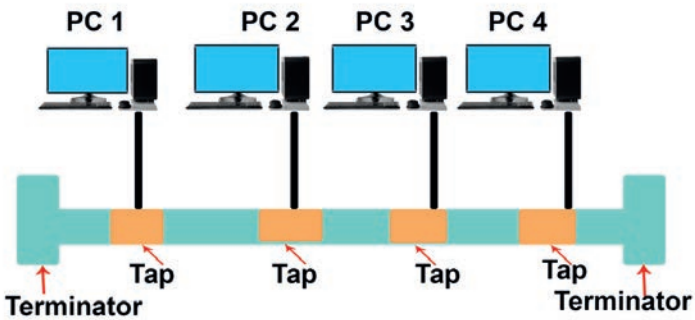


Figure 2.17 Bus topology

A bus is easy to install and uses less cables than other topologies. However, fault isolation becomes very difficult in bus topology. It is also relatively difficult to add new nodes to a bus, thus making it more inflexible. This is because addition of a node changes the number of taps and the average distance between them, which are generally optimized for a bus length. Another demerit is that, even if a portion of the bus breaks down, the whole bus cannot function.

b. Mesh Topology

In mesh topology (also called complete topology), each node is connected to every other node by direct links. Figure 2.18 illustrates this.

Mesh topology does not have traffic congestion problems due to dedicated links. This topology has the advantage in terms of data security. It is also robust; that means, if one link is down, the rest of the network can still continue. Fault identification is also easy in this case. The main demerit of this network scheme is cable length and consequent cost and complexity. This is clearly impractical for medium to large networks.

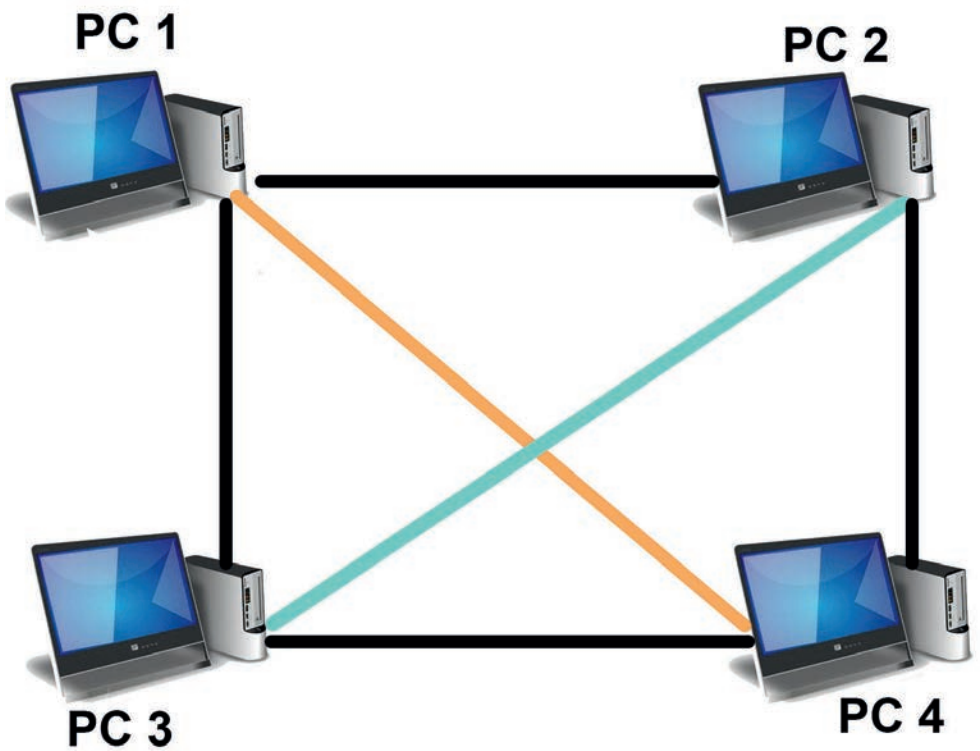


Figure 2.18 Mesh topology

c. Star Topology

In a star topology, each device has a dedicated point-to-point link only to a central controller, usually called a switch. The devices are not directly linked to one another. Unlike a mesh topology, a star topology does not allow direct traffic between devices. If a node wants to send some data to another node, it sends it to this switch. The switch, in turn, sends it to the appropriate node as Figure 2.19 depicts.

Star topology is cheaper than mesh topology. It is also relatively easier to install, maintain and reconfigure. It is also robust. However, if the switch goes down, the entire network becomes defunct. This is a major demerit of this scheme.

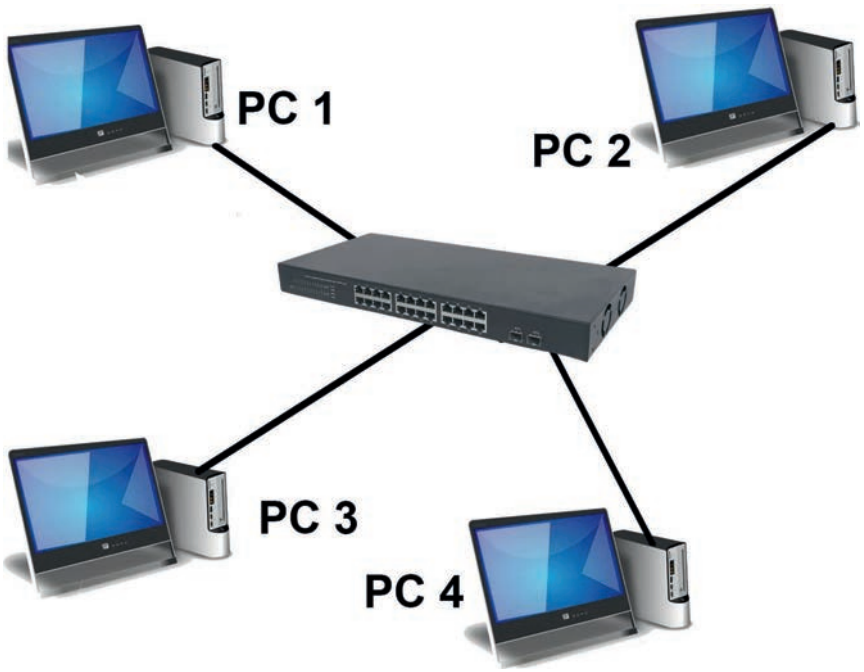


Figure 2.19 Star topology

d. Ring Topology

In ring topology, each node is directly connected to only its two adjacent neighbors. If a node wants to send something to a distant node on a ring, it has to go through many intermediate nodes, which act like repeaters, reproducing the incoming bit stream with full signals on the outgoing line. Figure 2.20 depicts this topology.

Figure 2.20 Ring topology

A ring is easy to reconfigure and install. In a ring, a signal normally circulates all the time. A node not receiving any signal for a long time indicates a fault. Therefore, fault isolation is relatively easy in a ring. However, if a node in a simple ring fails, the whole ring cannot function. Another demerit is that traffic flows only in one direction. This topology is not used if the number of nodes to be connected is very high. Advantages and disadvantages of all network topologies are summarized in below Table 2.2.

Table 2.2 Advantages and disadvantages of all network topologies

Topology	Advantages	Disadvantages
Bus	- Cheap - Easy to install	- Difficult to reconfigure - Break in bus disables entire net work
Star	- Cheap - Easy to install - Easy to reconfigure - Fault tolerant	- More expensive than bus
Ring	- Efficient - Easy to install	- Reconfiguration is difficult - Very expensive
Mesh	- Simplest - Most fault tolerant	- Extremely difficult for reconfiguration - Extremely expensive - Very complex

Activity 2.5

Do the following as an extension to Activities 2.3 and Activity 2.4.
Based on the description you got in Activity 2.3 question number 1, discuss the type of the network that at least one of the organizations has in terms of connection medium, size and network topology.

2.3.4 Types of Network Based on Resource Security and Access

Peer-to-Peer Network

In a Peer-to-Peer network, each machine (computer) is known as *peer* and can participate in the sharing of files or resources. No server is required in this network, so there is no additional cost for a dedicated machine, but there is also no a real security.

A peer-to-peer network is also called ***workgroup*** and there is no hierarchy among the computers. This mean that all computers are peers (equals) and the connection is created for resource sharing and communication purposes only. The number of computers in peer-to-peer network usually does not exceed 10; if the number is beyond this, the network becomes very difficult for administration.

Advantages of peer-to-peer network

- Server is not required.
- All computers are equal in the network.
- No additional cost is needed for dedicated-machine.

Disadvantages of peer-to-peer network

- Provides share level security, i.e. it applies a trust-based security.
- Can work in small environments only.

Client-server Network

A client-server network involves multiple clients or workstations, connecting to at least one central server. Most resources are installed on the server. When clients need access to these resources, they access them from the server. Servers often have private user directories as well as multiple public directories.

In client-server networks the clients are allowed to function as workstations without sharing any resources. It is easier to upgrade software applications and files because they are held on one single computer. System-wide services can be provided through the server software. Security is enhanced on a client server network because the security is handled by the server. The following table summarizes the difference between peer-to-peer and client network.

Table 2.3 Comparison of client-server and peer-to-Peer networks

S.No	Client-server Network	Peer-to-peer Network
1	Clients and server are differentiated; specific server and clients are present.	Clients and server are not differentiated.
2	Focuses on information sharing.	Focuses on connectivity.
3	Centralized server is used to store the data.	Each peer has its own data.
4	Server responds the service which is requested by client.	Each and every node can do both request and respond for the services.
5	Costlier than peer-to-peer network.	Less costly than client-server network.
6	More stable than peer-to-peer network.	Less stable if number of peer is increased.

A client is a computer which requests resources and services while a server is a computer which provides services and resources according to client requests. Informally, clients often tend to be desktop PC's or workstations, while servers are more powerful machines.

KEY CONCEPTS

- There are different types of network based on type of medium, topology and size of the network, and resource security and access.
- Wired network uses cable while wireless uses radio waves to form a network.

- The number of devices connected in the network and the geographical coverage of the network is called the size of the network.
- Based on size of the network, network can be categorized as personal area network (PAN), local area network (LAN), metropolitan area network (MAN) and wide area network (WAN).
- Network topology is the physical arrangement of devices on a network and can be bus, star, ring and mesh topologies.
- Based on security and access, network can be either client-server or peer-to-peer network.

Activity 2.6

Ask your parents or adults you have close contact about the following and discuss them in classroom.

1. Discuss whether peer-to-peer or client-server network is more appropriate for:
   a. A small home network.
   b. A school laboratory network.
2. Discuss advantages and disadvantages you considered for the selection of the network type in question 1 above.

2.4 Advantages and Disadvantages of Network

Brainstorming

Consider networks at your home, if any, or at your school. Discuss the potential benefits as well are risks that emerge from connecting to a network.

2.4.1 Advantages of network

There are more advantages to a network than disadvantages. In fact, many companies today would not exist without accessing some form of network. Below are the advantages of a network.

- **Sharing data and information** - One of the biggest advantages of a network is sharing data and information between each of the devices on the network. In addition, networks allow accessing the data which is stored on central computer called database server. For example, we use network for sharing documents, images, photos, songs and videos.
- **Communication** - A network gives all users the ability to quickly communicate with each other either using chatting or instant messaging services such as Skype, WhatsApp and Viber to send files and messages among the users, video conferencing, e-mail, TV and radio.

Communication at a distant is called telecommunication; 'tele' in Greece is to mean remote.

- **Sharing hardware** – Expensive hardware devices connected to a network can be shared among all users.
  - Storage devices such as Hard Disk that are shared on a storage server, which is also called ***NAS (Network attached storage)***, can store and access vast amounts of information.
  - A printer which is attached and shared on a server (printer server) allows all network users to print from one printer according to their privilege configured on the server by a network administrator.
  - Fax machines, Scanners, more powerful computers, such as super computers that can perform complex tasks within short period of time than a single computer will take to complete.
- **Share software** – Different application software and Internet-based services can be shared over the network for all licensed users for the software. For instance, we can share software such as computer games and work Internet-based services such as e-learning. E-learning or learning management system in its broadest sense is designed to support

teaching and learning as well as student-to-student and student-to-teacher instructions.

- **Transferring money** - Being connected to a secure network allows a person or business to digitally transfer money between banks and users. For example, a network could allow a company not only to manage employees' payroll but also to transfer their pay to the employee's bank account.

2.4.2 Disadvantages of network

Although there are many advantages to a network (mentioned above), there are some disadvantages. Below are some disadvantages of a network.

- **Virus and malware -** Networks make sharing information between network users easy. Unfortunately, this also means that viruses and other malwares have an easier time spreading between computers on a network.
- **Vulnerabilities -** When computer are connected on the network, it will be accessible remotely, with these potential new methods of accessing the computer; it can introduce new security issues or vulnerabilities to the computer, users and the data on the network which affect the organization and the country at large.
- **Complex -** Networks are complex, and setting up and managing a network for a business or corporation requires someone with a lot of experience or certification.
- **Cost -** Setting up, managing and administering a network hardware and software incurs cost to the organization building a network.
- **Social media effect on youth and adults -** particularly youths, including students, waste their time on use of social media and unsafe Internet resources. There are also many cyber security threats such as cyberbullying, disinformation/misinformation and identity theft that you should be aware of and learn to develop safe use of the Internet.

Practical Exercise 2.2

Make a group of three to five students and do the following.

1. From Ethio-telecom website (https://www.ethiotelecom.et/), assess the common network services it provides as an internet service providers (ISP).
2. Search for reliable information such as the one from Ethiopian Information Network Security Agency (INSA) https://www.insa.gov.et) about different cyber security attacks that you may encounter as a student – such as misinformation/disinformation, cyberbullying, sex trafficking, hate crime and financial scams. Discuss in group how you can protect yourselves from such attacks.
3. Explore the functionalities and symbols used for representing network devices, preferably in an open source network mapping tools such as Dia (http://dia-installer.de/).

KEY CONCEPTS

- Computer network can be used to exchange data and information, and to share resources such as hardware (e.g. storage spaces) and software.
- A virus can travel over the network and can affect our file on the computer.

2.5 Unit Summary

In this unit, the students are supposed to learn the basic concepts, types, advantages and disadvantages of network. You shall develop essential skills through the classroom learning, participation in activities and laboratory-based work in the unit.

Computer networks help us have such services as emails, online newspapers, blogs, chats and other network services offered on the Internet. Therefore, understanding network will help students to become actors and beneficiaries of the networked society and share resources and have a faster communication.

The following are the main points covered in the unit.

- A computer network is interconnection of two or more computers or any devices that able to connect over the network.

- To make a communication and interconnection between devices on a computer network, networking hardware, also known as network equipment or computer networking devices, which are electronic devices, are required. These are end devices, intermediate devices, connection medium and protocol.
- End devices are the sender and the receiver which can be any devices capable of composing, sending and receiving a message.
- Intermediate devices are interconnecting devices that found between end devices, as their name indicates. Intermediary device includes network cards, routers or network switches, modems and Ethernet repeaters.
- Network interface card (NIC) is used to plug a UTP cable to the computer. It has wireless variety which allows a computer to connect to the network wirelessly.
- Repeaters, as the name indicates, repeat and boost the signal. It accepts weak signal on one port, illuminates the noise that makes signal week, regenerates signals and resends the boosted, cleared signal over the other port. It has an analog version, which is also called **Amplifier**. Amplifier amplifies not only the signal but also the noise and sends it again.
- Switch is more intelligent device than repeater because after learning the network, it forwards packet to the destined port or a device connected to the port only.
- A router is a device that connects different types of network and more intelligence than switch.
- Router uses routing tables.
- Router selects best path through networks.
- Protocol is a common set of rules to manage communication (packet transmission) through a network.
- Connection media used in networks are wired (guided) and wireless (unguided) media.
- UTP is the most common wired medium used in local area networks.

- Wireless media can be radio waves, microwaves and infra-red waves.
- Based on size, network can be classified as personalized area network (PAN), local area network (LAN), metropolitan area network (MAN) and wide area network (WAN).
- PAN is the smallest area network which can be made using Bluetooth network.
- LAN is larger than PAN and smaller than MAN in number of computers and geographical coverage. LAN can be a small office, one campus or school, network.
- MAN convers area of a city and can contain multiple LANs.
- WAN covers very large area such as the globe.
- Network topologies include bus, star, ring and mesh topologies.
- A bus topology is a cheap network where computers are connected to a common backbone cable.
- In a mesh topology, every computer in a network is connected to each other independently. Mesh topology needs more cable and more ports on the computer.
- In star topology, all computers are connected separately to a central device, which can be a switch. A failure of the central device results in a failure of the entire network.
- Ring topology looks like finger ring that connects devices in such a way that each device is connected to other two adjacent devices. Failure of one node in ring topology network will affect the whole network.
- Peer-to-peer and client-server networks are based on resource access and sharing.
- In peer-to-peer network, resources are distributed among peers and each peer can be a server and client at the same time.
- In client server, resources to be shared over the network are administered centrally and there is a dedicated server which provides resources called **servers** and there is also a dedicated **client** which requests a resource from the server.

- Network is advantageous in increasing communication speed, sharing data, sharing hardware, sharing software and getting entertainment.
- Network also disadvantageous in security concerns and incurring cost for setting up and administration of network, hardware, software and the like.

2.6 Unit Review Exercise

Part I: Write whether the following statements are true or false.

1. Each individual client computer is responsible for the security of the resource in the client and server networks.
2. Software cannot be shared over the network.
3. A MAN is usually within the boundary of a private building.
4. In ring topology, each node is directly connected to many other adjacent neighbors.
5. WAN has fewer nodes than LAN.

Part II: Choose the correct answer among the alternatives provided.

1. Which one of the following is different from others?

   A. Star

   B. Ring

   C. Bus

   D. Peer-to-peer

2. The term WAN stands for _____.

   A. Wide Area Net

   B. Wide Access Network

   C. Wide Area Network

   D. Wide Access Net

3. If a given two networks use separate and different protocols, which one of the following devices can be used to link them?

   A. Repeater

   B. Router

C. Switch

D. None of the above.

4. Bluetooth is an example of _____.

A. Personal area network

B. Local area network

C. Metropolitan area network

D. Wide area network

5. A ____ typically connects personal computers within a very limited geographical area, usually within a single building.

A. LAN

B. WAN

C. MAN

D. TAN

6. Physical or logical arrangement of network is called _____.

A. topology

B. routing

C. networking

D. None of the above.

7. Which of the following topologies requires a central controller such as switch?

A. Star

B. Mesh

C. Ring

D. Bus

8. _____ topology requires more cables than others?

A. Star

B. Mesh

C. Ring

D. Bus

9. The network system that spans states, countries or the whole world is _____.

   A. LAN

   B. WAN

   C. MAN

   D. None of the above.

10. Network system within a building or campus is_____

   A. LAN

   B. WAN

   C. MAN

   D. None of the above.

11. A network that spans across a glob is _____.

   A. World area network

   B. Local area network

   C. Personalized area network

   D. None of the above.

12. In _____ topology, if a node fails, the whole network cannot function entirely.

   A. ring

   B. bus

   C. mesh

   D. star

13. Which one of the following interconnecting devices accepts a weak signal, boosts it to its original strength and forwards to the next segment of a network?

   A. Switch

   B. Router

   C. Repeater

   D. Client

14. _____is used to connect one or more LANs together.

    A. Server
    B. Router
    C. Repeater
    D. Client

15. _____type of network is created when two or more mobile devices are connected by a Bluetooth.

    A. LAN
    B. MAN
    C. Internet
    D. PAN

Part III: Fill in the in the blanks.

1. Network is a group of two or more computer systems sharing _____.
2. In client-server model users are called _____.
3. Based on size of the network, network is classified into _____,_____, _____ and _____.
4. _____ is a common rule between communicating parties.
5. The best example of wide area network is _____.

Part IV: Match the following items in column A with column B.

A	B
1. Interconnection of two or more computers or other devices	A. Fiber Optic Cable B. Used to draw pictures
2. Set of rules to guide communications	C. Client
3. E-Learning	D. Originator of messages
4. Sender computer	E. Server
5. A dedicated link that every computer has to the rest of the nodes	F.Disadvantage of network G. Network
6. Uses switch as central device	H. Mesh topology

7. Increased vulnerability	I. Application of a network
8. Hosts and gives networked resources	J. UTP cable
9. Microwave	K. Protocols
10. Uses light system to transmit signal	L. Star topology
	M. Wireless medium

Part V: Provide clear and precise responses to the following questions.

1. What is a network?
2. State the criteria used to categorize networks.
3. What are wired and wireless media?
4. What is a network topology?
5. List at least three applications of a network.

UNIT

3 APPLICATION SOFTWARE

UNIT OUTCOMES

At the end of this unit, learners will be able to:

- Indent a paragraph.
- Align text by using icons on the menu bar and selecting paragraph from formatting menu.
- Apply bullets and numbers in text.
- Insert and delete page break and page number in a document.
- Add and delete headers and footers in a document
- Manipulate data in spread sheet.
- Create a presentation in PowerPoint

UNIT OVERVIEW

From your earlier grades (grade 7 and 8) lessons of computer system unit, you know that computer is a system that comprises hardware and software components. You also discussed input devices, output devices, computer memory and central processing units under hardware components of a computer. In addition to this, you also covered how to use application and system software such as operating system, utility software and driver software.

In this unit, you will enhance your skills of using application software such as word processor, spreadsheet and presentation software. You will also practice different Microsoft Office Suite applications or any other free application software such as LibreOffice.

3.1 Using Application Software

Brainstorming

1. What makes application software different from system software?
2. Which application software had you used in your grade 8 ICT subject?
3. Do you get word editors, spreadsheet and presentation application on smartphones or tablets?

The software used by general public users in their daily tasks most often is application software. Some examples of application software are:

- Word processing software
- Presentation software
- Spreadsheet software

Application software may consist of a single program, such as Microsoft Notepad, for writing and editing simple text. It may also consist of a collection of programs called a software package, which work together to accomplish a task. Application software may also include a larger collection of programs (a software suite), related but independent programs, which have a common user interface such as Microsoft Office Suite.

3.2 Word Processing

Brainstorming

1. What word processing application software had you used in your grade 8 IT subject?
2. What different mobile apps have you used recently?

Word Processing refers to the act of using a computer to create, edit, save and print documents including, but not limited to, textual reports, letters, memos, newsletters and brochures. In order to perform word processing, specialized

software (known as a Word Processor) is needed. One example of a Word Processor is Microsoft Word; other word processing applications are also widely used. Other examples of word processing applications include Microsoft Word Processor, WordPerfect and other free and open-source word processers such as OpenOffice Writer, LibreOffice and Google Drive Document.

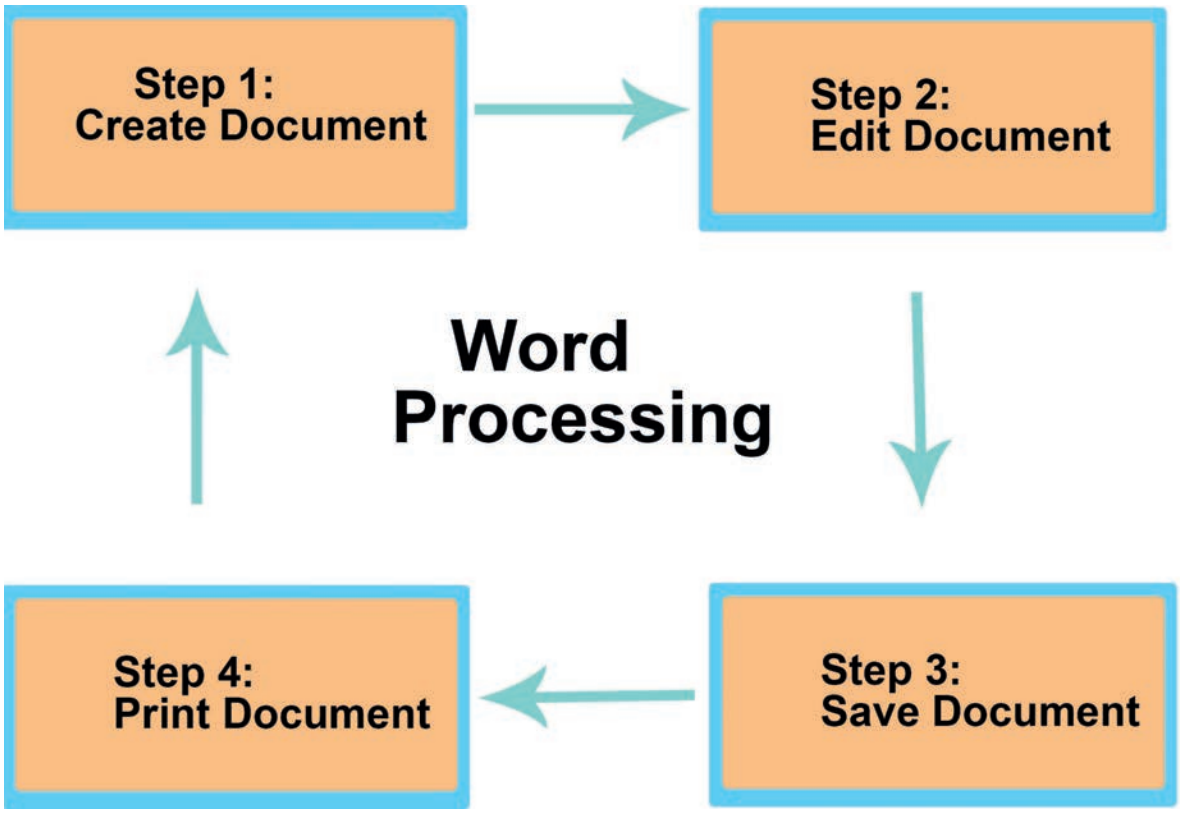


Figure 3.1 Word processing

Some of the functions of word processing software include:

- Creating, editing, saving and printing documents.
- Copying, pasting, moving and deleting text within a document.
- Formatting text such as font type, bolding, underlining or italicizing.
- Creating and editing tables.
- Inserting elements such as illustrations and photographs from other software.

- Correcting spelling and grammar.
- Providing different templates for repetitive tasks.

Tip

Text editors such as **Notepad,** which only work on plain text with no formatting, should not be confused with word processing software. Text editors are used to work with files in plain text format such as source code of computer programs and configuration files of an operating system.

3.2.1 Starting Microsoft Office Word Program in Windows

To start Microsoft Office 2016 or later program in Windows 10 or later, you can follow either of the following methods.

Method 1

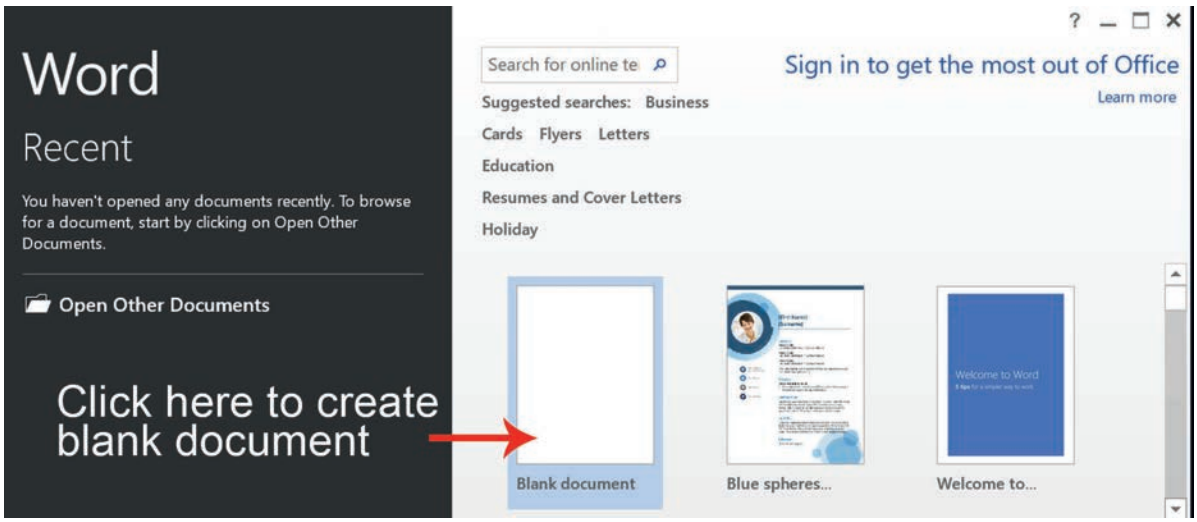


Figure 3.2 Click on Blank document

Click the Start button on the Windows taskbar ➜ A pop-up menu appears ➜ Click the tile that represents Microsoft Word 2016 or later version ➜ Click on a Blank document and blank document will appear (See Figure 3.2).

Method 2

Click the start button on the window taskbar ➜ Type Word (See Figure 3.3 ➜ Click to Word icon to open new blank document.

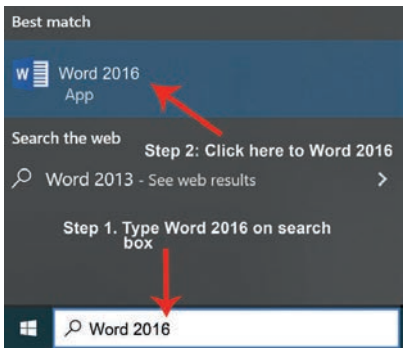


Figure 3.3 Open Word 2016 by searching

3.2.2 A tour of the Word user interface

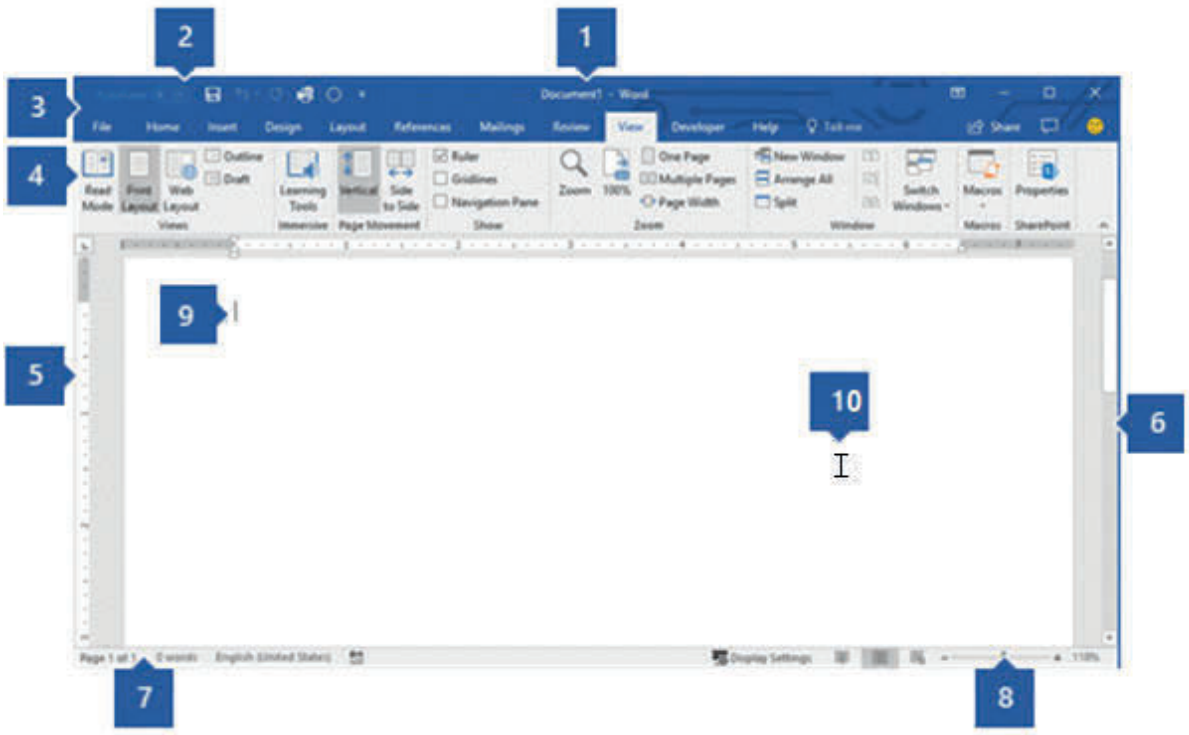


Figure 3.4 New word document and its interface element

The following table describes the common interface elements of Microsoft Word 2016.

Table 3.1 Word 2016 interface elements descriptions

No	Interface Part Name	Description
1	Title Bar	Displays the file name of the document that is being edited and the name of the software you are using. It also includes the standard Minimize, Restore and Close buttons.
2	Quick Access Toolbar	Commands that are frequently used such as Save, Undo and Redo are located here at the end of the Quick Access. Toolbar is a pull-down menu where you can add other commonly used or commonly needed commands.
3	File Tab	Click this button to find commands that act on the document itself rather than the content of the document such as New, Open, Save as, Print and Close.
4	Ribbon	Commands needed for your work are located here. The appearance of the Ribbon will change depending on the size of your monitor. Word will compress the ribbon by changing the arrangement of the controls to accommodate smaller monitors.
5	Edit Window	Shows the contents of the document you are editing.
6	Scroll Bar	Lets you change the display position of the document you are editing.
7	Status Bar	Displays information about the document you are editing.
8	Zoom Slide Control	Lets you change the zoom settings of the document you are editing.
9	Insertion Point/Cursor	It is the blinking line in your document that indicates where text is inserted when you type. There are several ways to move an insertion point.
10	I-beam Pointer	The I-beam [I] shows where your mouse pointer is.

3.2.3 Paragraph Formatting

Brainstorming

When we write a letter or a passage in our English or local language, how do we organize our ideas? Discuss the relationships between words, phrases, sentences, paragraphs and passages.

A paragraph is a collection of words, numbers or any combination of them. It is organized in a section that describes a particular idea or point.

Formatting a paragraph can be a little combination of different commands. These include:

- Indention
- Alignments
- Bulleting and Numbering
- Line and Paragraph Spacing.

To format a paragraph, you can use different commands such as different text alignments, bullets, numbering, multi-level list, paragraph indents, sorting text, line spacing, shading and different borders. To format a paragraph, follow the steps shown in Figure 3.5 below.

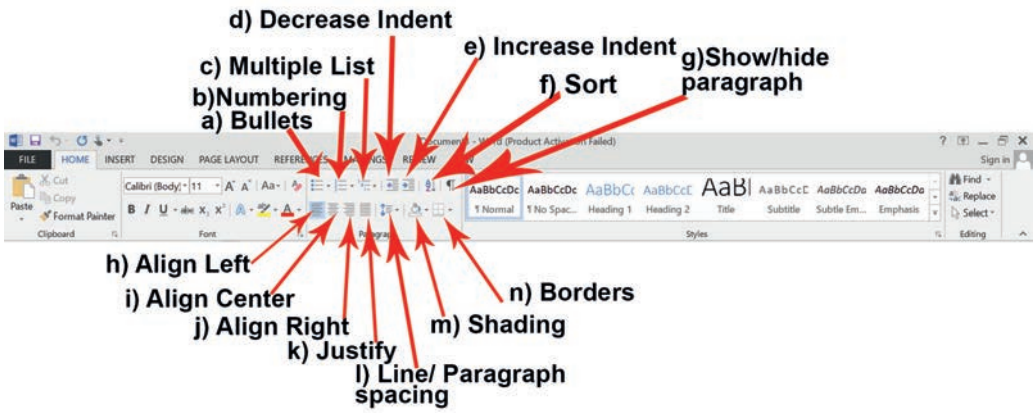


Figure 3.5 Paragraph formatting commands

Commands of paragraph formatting group in MS-Word are explained in detail in Table 3.2 below.

Table 3.2 Paragraph formatting group commands and their descriptions

Letter		Button	Functions	Keyboard shortcut key
A	**Bullets**		To start text/Line/ Paragraph with a bulleted list, you can choose different bullet styles by clicking the drop-down arrow of the Bulleted List.	
B	**Numbering**		To start text/line/Paragraph with a Numbered list, you can choose diffeent Number styles by clicking the drop down-arrow of the Numbered List.	
C	**Multilevel List**		To start text/line/Paragraph with amultilevel list, you can choose multi- level list styles by clicking the drop-down arrow.	
D	**Left Align-ment**		Aligns text to the Left of the page to format a para-graph.	Ctrl + L
E	**Center Align-ment**		Aligns text to the center of the page(for paragraph for-matting).	Ctrl + E
F	**Right Align-ment**		Aligns text to the right of the page.	Ctrl + R
G	**Justification**		Aligns text to both the right and the left margins of the page by adding the extra space between words for the clean look in a word document.	Ctrl + J
H	**Decrease Indent**		Decrease indent means decreasing the gap between the left margin and left of the paragraph in the document (for paragraph formatting).	

I	**Increase Indent**		Increase indent means increasing the gap between the left margin and left of the paragraph in the document (for formatting the paragraph).	
J	**Sort**		In this, you can arrange the selected text in ascending or descending order.	
K	**Show or Hide Paragraph Marks**		Paragraph Marks are useful and show the marks when you apply section or page breaks.	Ctrl + *
L	**Line and paragraph Spacing**		Increases or decreases the space between the lines or paragraphs in the document.	
M	**Shading**		Coloring the background of a line from the left margin to the right margin.	
N	**Border**		You can apply different borders to the selected text in the word document.	

a. Setting Indents

Indentation means how far you want to move the paragraph away from the left or the right margin. Look through your grade textbooks to see different types of indentation used. In Microsoft Word, there are four methods to do paragraph indentation:

- The Tab Key method
- The Ruler method
- The Indent Command method
- The Paragraph Dialog Box method

The Tab Key Method

If you want to indent existing paragraphs, the quickest method is the Tab key. To indent a single paragraph using Tab key method, follow the steps below.

1. Open Microsoft Word application and write two paragraphs which describe Grand Ethiopians Renaissance Dam, as shown below.

The Grand Ethiopian Renaissance Dam (GERD)

The Grand Ethiopian Renaissance Dam (GERD), formerly known as the Millennium Dam, is under construction on Blue Nile River in the Benishangul-Gumuz region of Ethiopia, which is located about 40km east of Sudan. The project is owned by Ethiopian Electric Power Corporation (EEPC).

The dam will be capable of handling a flood of 19,370 cubic meters per second, reducing alluvium in Sudan by 100 million cubic meters and facilitating irrigation of around 500,000ha of new agricultural lands. It will also reduce approximately 40km of flooding in Sudan, upon its completion.

2. Insert your cursor at the start of the paragraph.
3. Press the Tab key on your keyboard.

What changes have you observed in the first paragraph? Is it indented?

The Ruler Method

If you want to indent all existing paragraphs, the quickest method is the ruler method. Follow the steps below to use it.

1. If your ruler is already visible, skip to step 4.
2. Select the View tab in the ribbon.

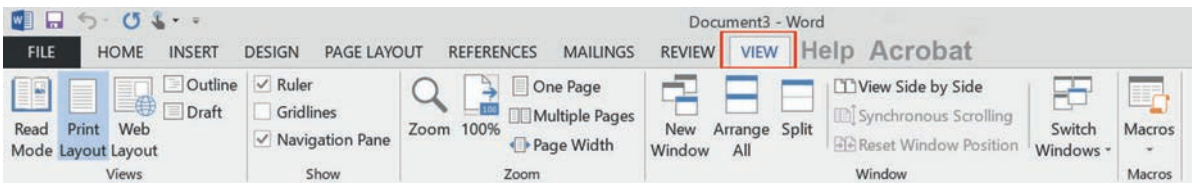


Figure 3.6 Word view tab

3. Select Ruler in the Show group.

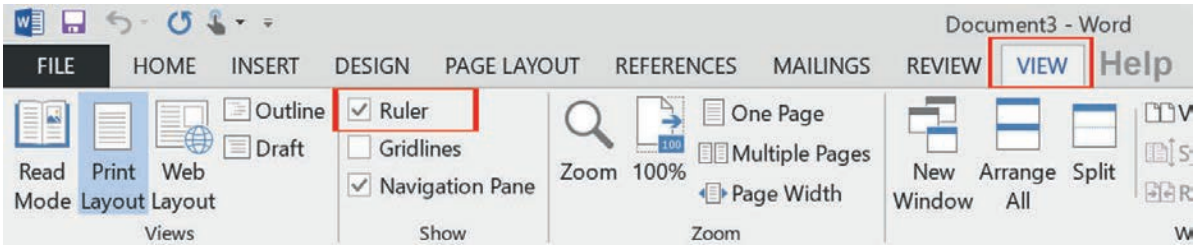


Figure 3.7 Ruler option

Word provides indent markers that allow you to indent paragraphs to the location you want. The indent markers are located to the left of the horizontal ruler, and they provide several indenting options shown and described in Figure 3.8 and Table 3.3 below.

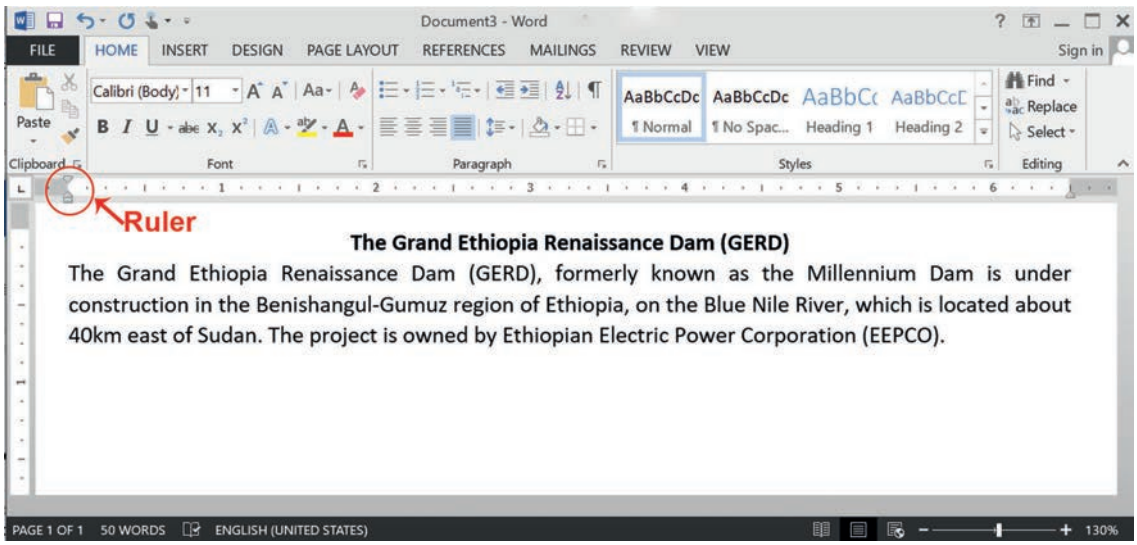


Figure 3.8 Ruler indenting options

Table 3.3 Ruler indenting markers and their descriptions

Ruler Indenting Option	Picture	Usage
First-line indent marker		Adjusts the first-line indent
Hanging indent marker		Adjusts the hanging indent
Left indent marker		Moves both the first-line indent and hanging indent markers at the same time (this will indent all lines in a paragraph)

4. Select All Paragraph you want to indent. In our example, select both paragraphs.

Tip:
To select all paragraphs in a word document, you can use Ctrl + A key board short cut keys.

5. Click and drag the desired indent marker. In the example below (See Figure 3.9), first-line indent marker or top ruler marker is moved to the right.

6. Release the mouse. The paragraphs will be indented.

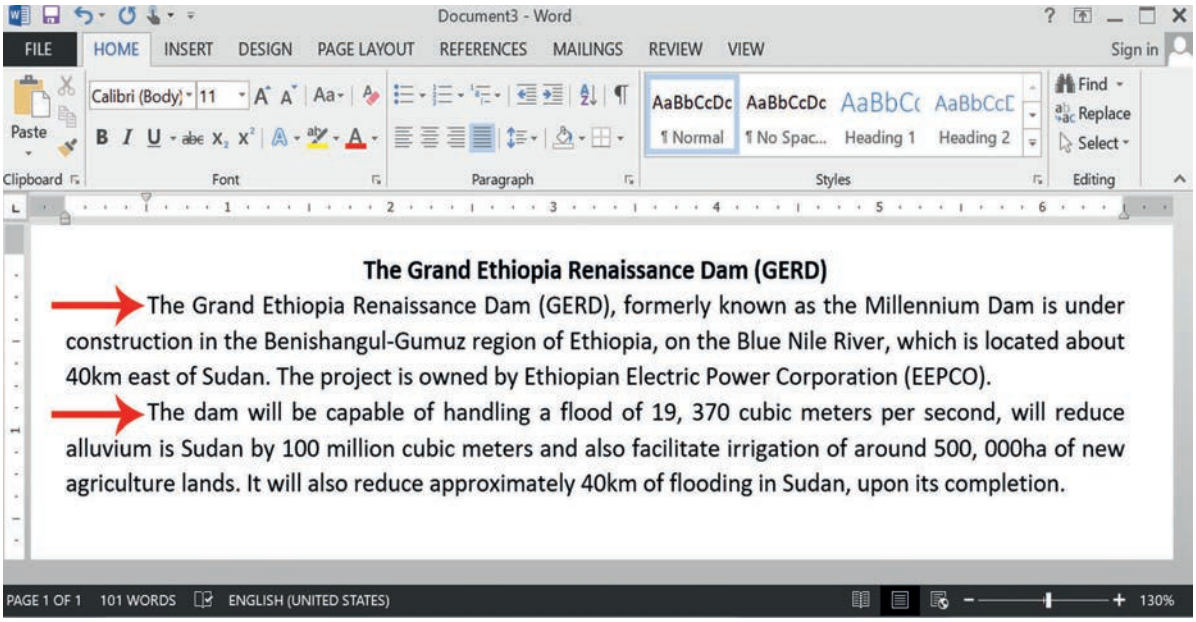


Figure 3.9 Using first line indent

The Indent Commands Method

If you want to indent multiple lines of a text or all lines of a paragraph, you can use the Indent commands. The Indent commands will adjust the indent by ½ inch increment. To indent a paragraph or a text using indent commands method, follow the steps listed hereunder.

1. Select the text you want to indent.

2. On the Home tab, click the Increase Indent or Decrease Indent command.

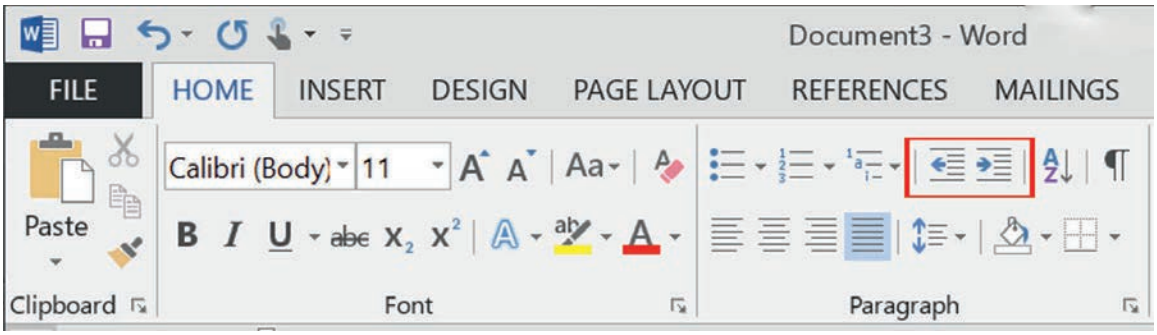


Figure 3.10 Indent command

3. The text will be indented.

To customize the indent amounts, select the Layout tab near the desired values in the boxes under Indent (See Figure 3.11).

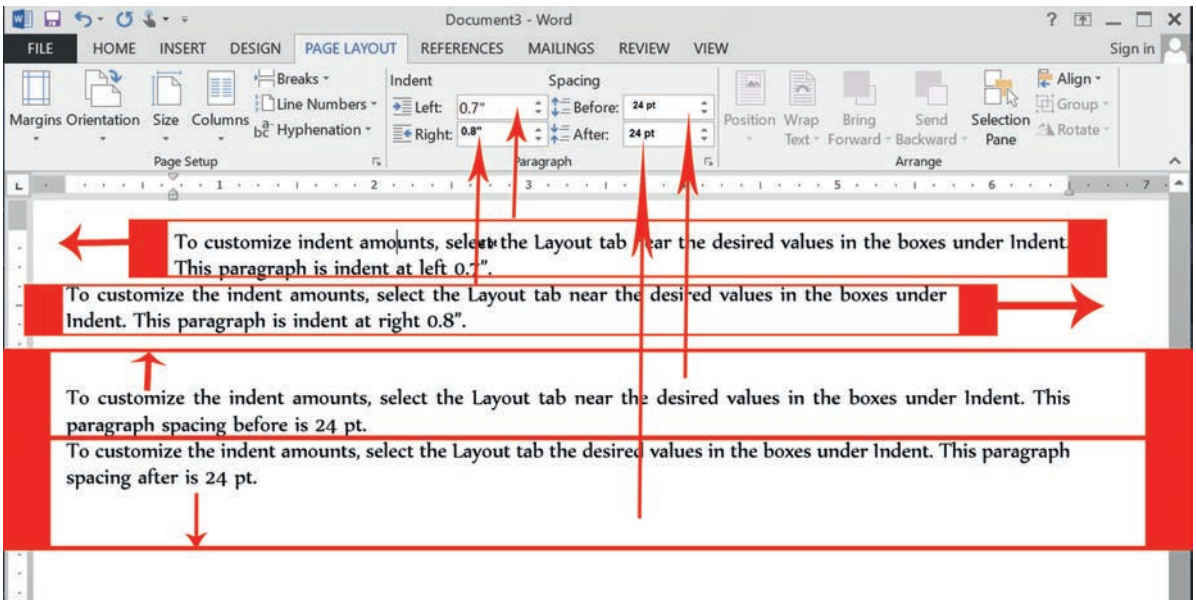


Figure 3.11 Customize indentation amount

NOTE

Increase or Decrease the Left Indention in a Word:
How far you want to move the paragraph away from the left margin is called Increase Left indention.

Increase or Decrease the Right Indention in a Word:
How far you want to move the paragraph away from the right margin is called Increase Right indention.

The Paragraph Dialog Box Method

To indent a paragraph or a text using paragraph dialog box method, uses the following steps.

1. Select the Home tab in the ribbon.
2. Select all the paragraphs in the document you want to indent.
3. Select the Paragraph group's dialog box launcher (See Figure 3.12).

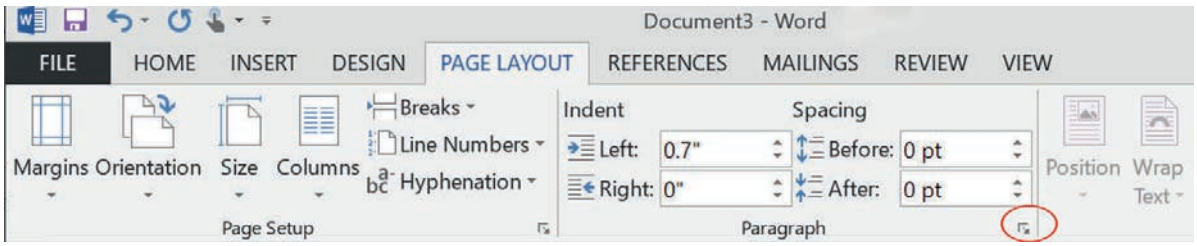


Figure 3.12 Paragraph group dialog box launcher

Make any adjustments to alignment or line spacing in Paragraph group dialog box (See Figure 3.13).

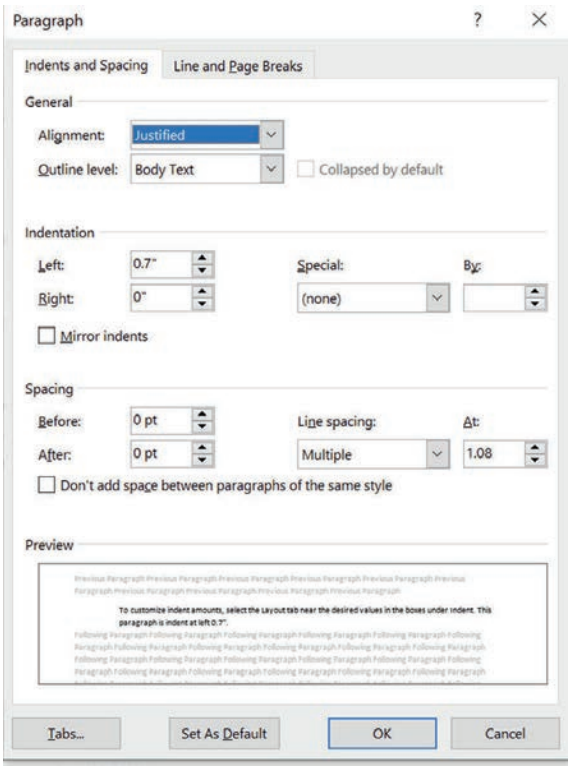


Figure 3.13 Paragraph group dialog box

4. Select the OK button to save your selection(s) and close the Paragraph dialog box.

Practical Exercise 3.1

Indenting a Paragraph

Write a paragraph entitled "The effects of trafficking on children" and use one of the above methods to indent it.

b. Text Alignment

Alignment determines the appearance and orientation of the edges of the paragraph (i.e. left-alignment, right-alignment, centered or justified text).

The paragraph section offers four buttons for controlling the horizontal alignment of a paragraph (See Figure 3.5 above). To alter the paragraph alignments, simply put the cursor anywhere in the paragraph and click one of these buttons.

Left-aligned Text

Left-aligned paragraph's text is aligned evenly along the left margin. Most of the time, this alignment of paragraph will create "jagged" space on the right of the paragraph (See Figure 3.14). The following steps show you how to create left aligned text.

1. Select the text that you want to align. In our example, select the two paragraphs (See Figure 3.14).
2. On the **Home** tab, in the **Paragraph** group, click **Align Left** or press Ctrl + L.

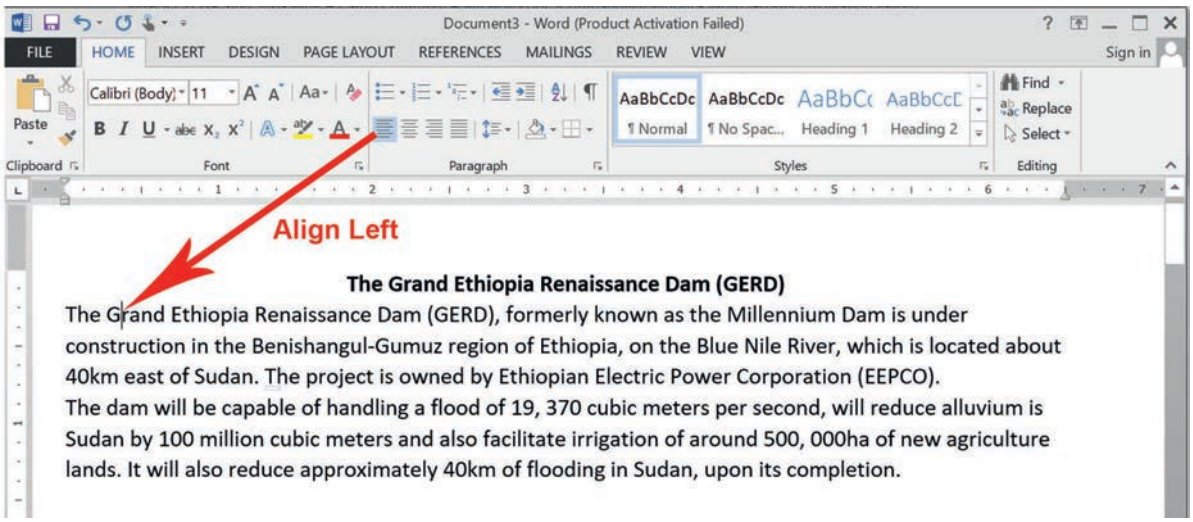


Figure 3.14 Left-aligned paragraph

Right-aligned Text

Right alignment is exactly the mirror of the left alignment. Word will line up the last character of the last word of each line against the right page margin.

Practical Exercise 3.2

Aligning the Text to Left or Right

Use the "Grand Ethiopian Renaissance Dam" document you created above and track the following steps to create left-aligned text.

1. Select the text that you want to align. In our example, select the two paragraphs.
2. On the Home tab, in the Paragraph group, click Align Right or press Ctrl + R.

Center-aligned Text

Centre alignment aims to make equal spaces between the left and right page margins. Therefore, the line of text will be at the relative center of the page. The use of center alignment is for titles and headings, not often used for large paragraphs.

Justified Alignment

Justified alignment creates justified text by adjusting the space between each word until all lines within a paragraph are equal in length. Unlike left or right alignment, justified alignment removes the jagged appearance.

Practical Exercise 3.3

Creating Center-aligned and Justified Texts

Use the "Grand Ethiopian Renaissance Dam" document you created above and follow the steps listed below to create centered and justified text.

1. Click anywhere on the paragraph you want to align and click the Center button available on the Home tab or simply press the Ctrl + E keys. In our example, we click the title of the document and press Center button from paragraph command (See Figure 3.15).
2. On the Home tab, in the Paragraph group, click Justify.

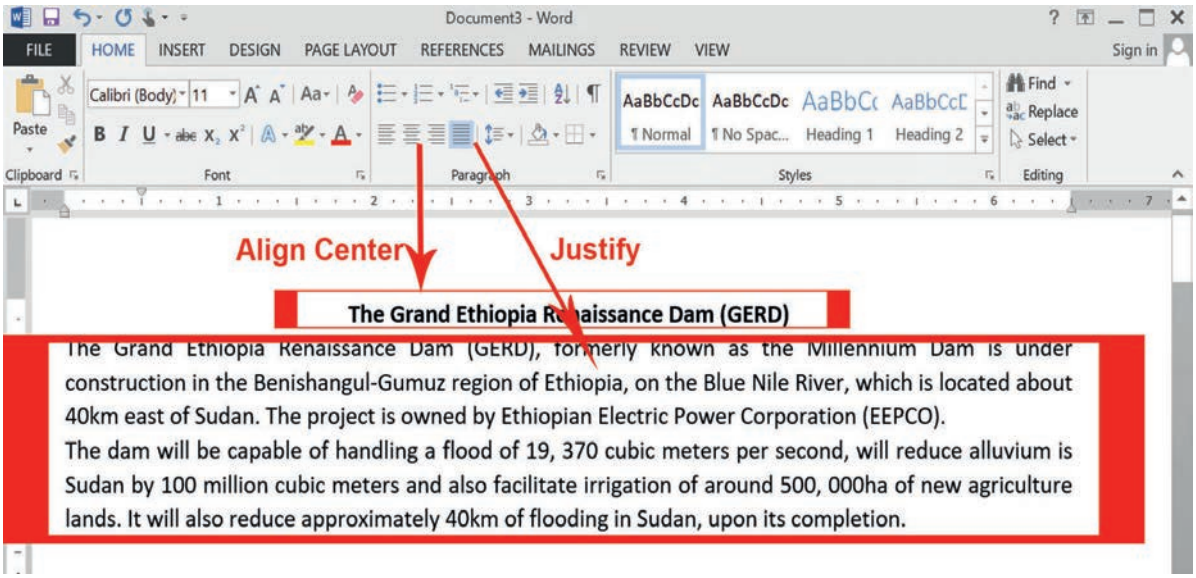


Figure 3.15 Center-aligned and justified text

c. Manipulating Lists

In Word, there are two types of lists: bulleted and numbered lists. Bulleted and numbered lists can be used in your documents to outline, arrange and emphasize text. In this section, inserting new bulleted and numbered lists are discussed. To insert bulleted and numbered list in a document, follow the steps stated below.

1. Open Microsoft word and type **12 Principles of Business Ethics** as shown in Figure 3.16.
2. Select the text you want to format as a list (See Figure 3.16).

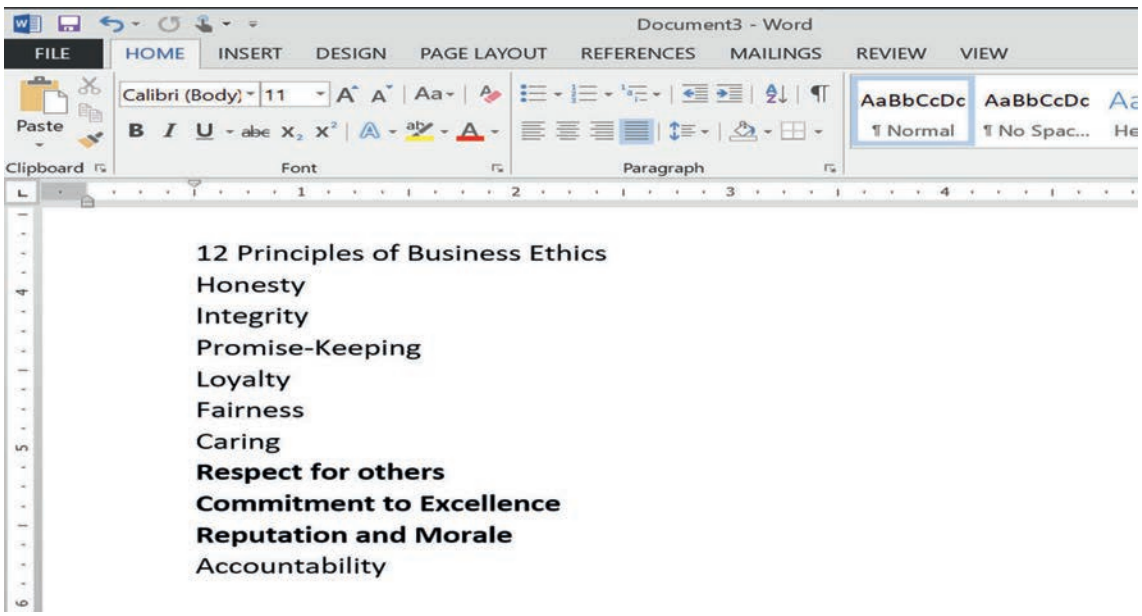


Figure 3.16 Select lists to be bulleted

3. On the **Home** tab, click the **drop-down arrow** next to the **Bullets** command. A menu of bullet styles will appear.

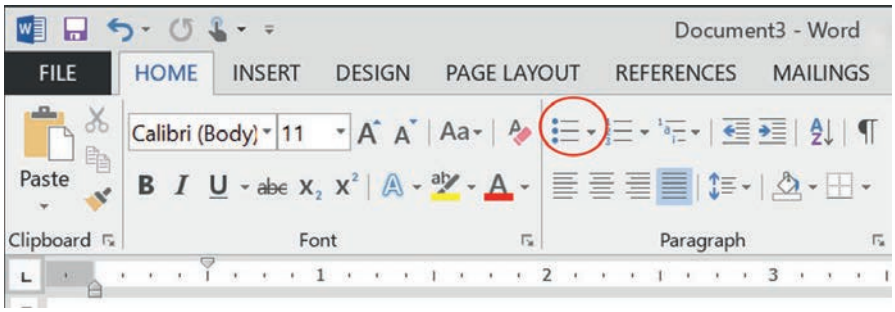


Figure 3.17 Bullets command

4. Move the mouse over various bullet styles. A live preview of the bullet style will appear in the document. Select the bullet style you want to use (See Figure 3.18).

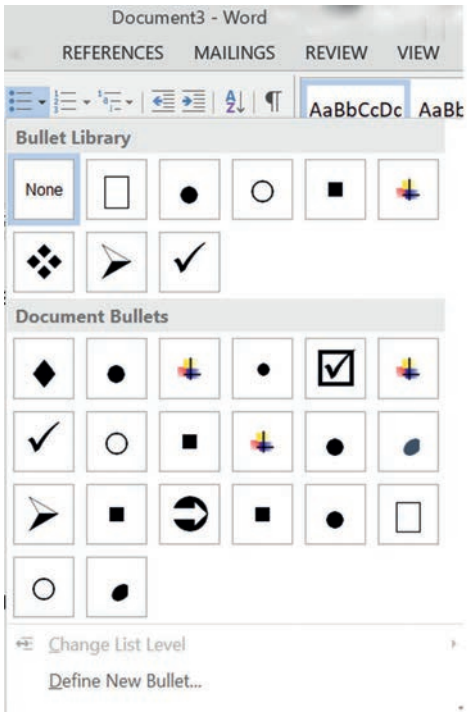


Figure 3.18 Select various bullet styles

5. The text will be formatted as a bulleted list (See Figure 3.19).

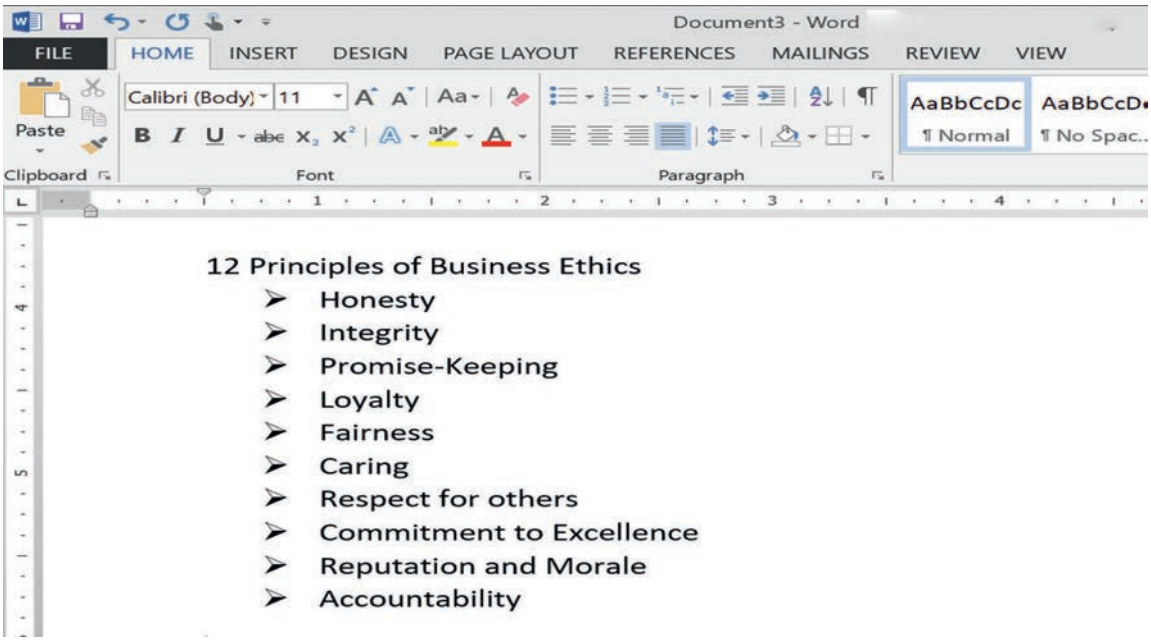


Figure 3.19 Text formatted with bulleted list

To remove numbers or bullets from a list, select the list and click the Bulleted or Numbered list command.

When you are editing a list, you can press Enter to start a new line, and the new line will automatically have a bullet or number. When you have reached the end of your list, press Enter twice to return to normal formatting.

By dragging the indent markers on the Ruler, you can customize the indention of your list and the distance between the text and the bullet or number (See Figure 3.20).

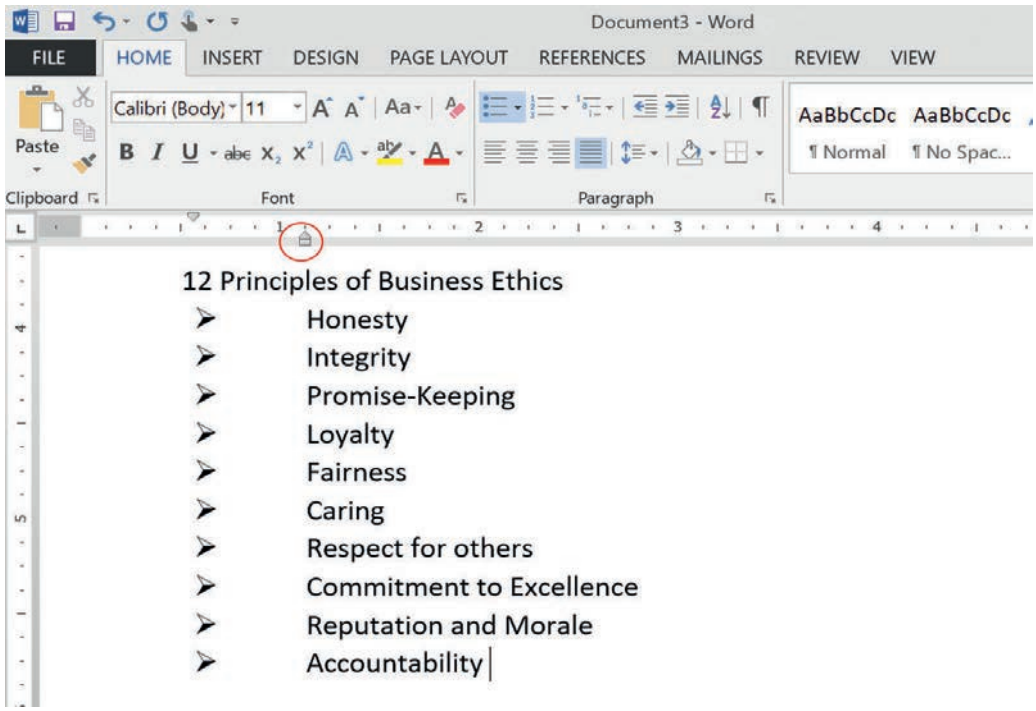


Figure 3.20 Adjusting the indentation of bulleted list

Creating a Numbered List

When you need to organize text into a numbered list, Word offers several numbering options. You can format your list with numbers, letters or Roman numerals, as shown in Figure 3.18 below. To create a numbered list, keep the following steps.

1. Select the text you want to format as a list. In our example, select **12 Principles of Business Ethics** in the above document.
2. Move the mouse over various numbering styles. A live preview of the numbering style will appear in the document. Select the numbering style you want to use (See Figure 3.21).

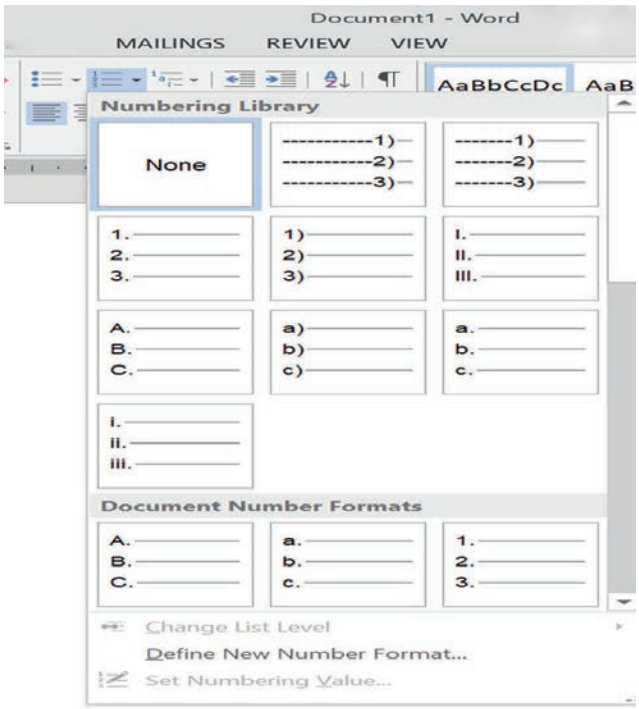


Figure 3.21 Numbering command options

3. The text will be formatted as a numbered list (See Figure 3.22).

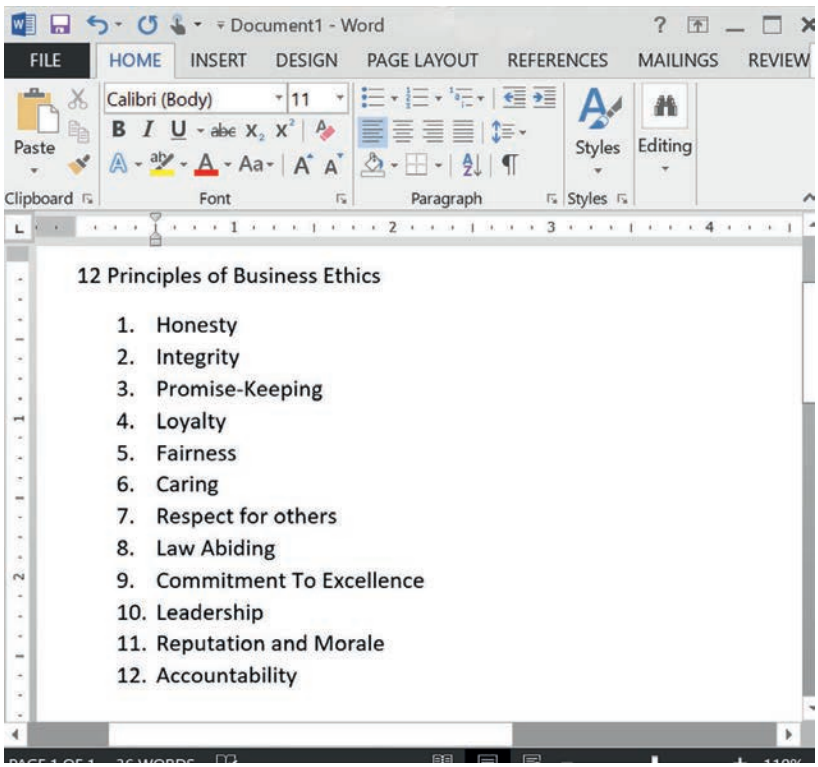


Figure 3.22 Numbered list

If you want to restart the numbering of a list, right click on number list and choose restart option. It can be applied also to numeric and alphabetical lists.

Creating Multilevel Lists

In the above section, we created numbered and bulleted list that have the same level. Multilevel lists allow you to create lists or outlines with multiple levels. Any bulleted or numbered list can be turned into a multilevel list by using the Tab key. Keep the following steps to create a multilevel list.

1. Open Microsoft Word and type the following list which describes classifications of computer system.

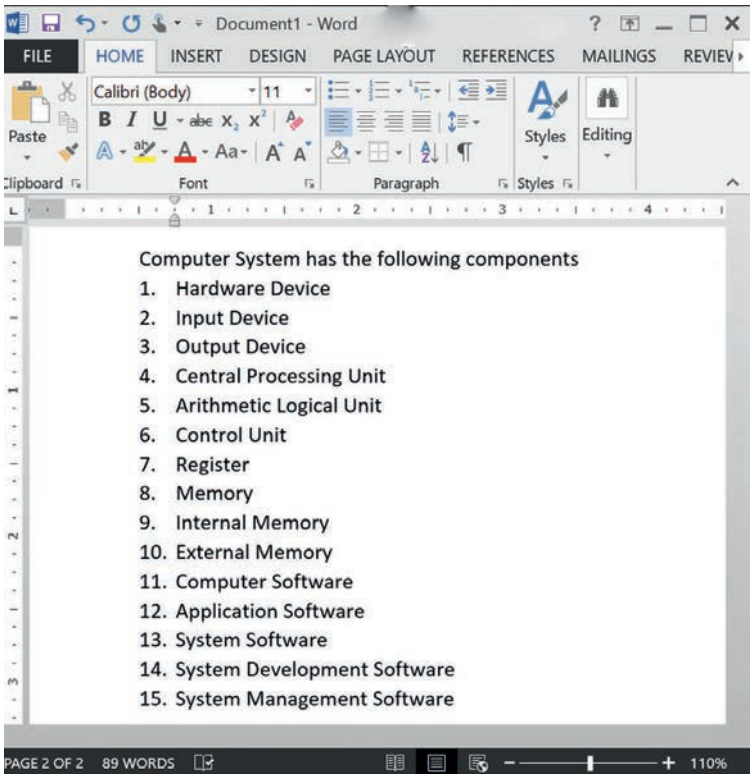


Figure 3.23 Multilevel list text

2. Select input devices, output devices and central processing unit text from the paragraph together and increase the indent by one level by pressing Tab key. It will look like the following (See Figure 3.24).

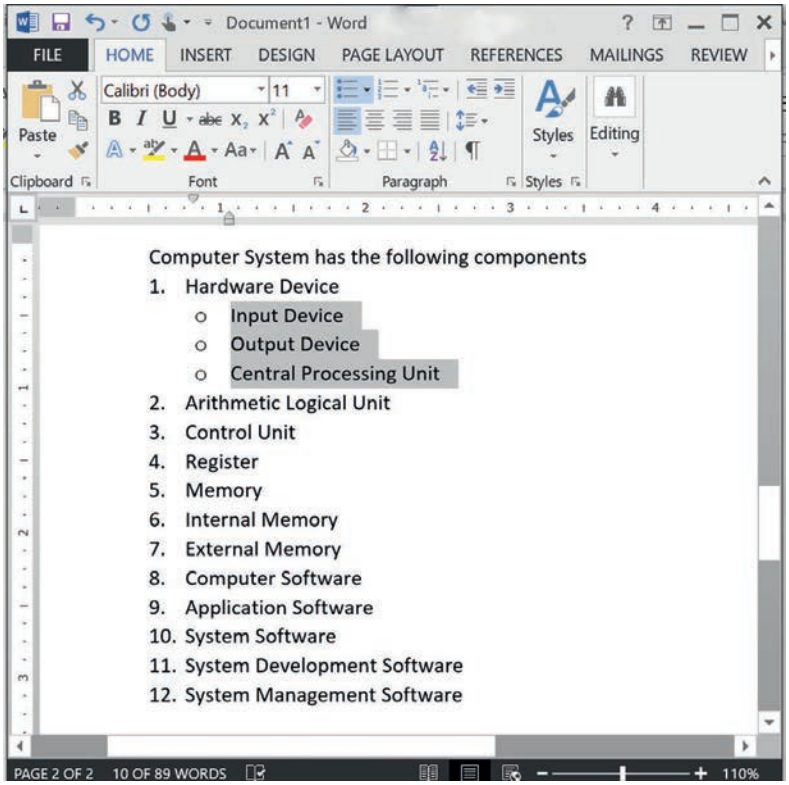


Figure 3.24 Indent a selected paragraph by one level pressing Tab key

3. Select Arithmetic Logic unit, control unit and register text and increase indent by two levels pressing the Tab key two times. It will look like the following (See Figure 3.25).

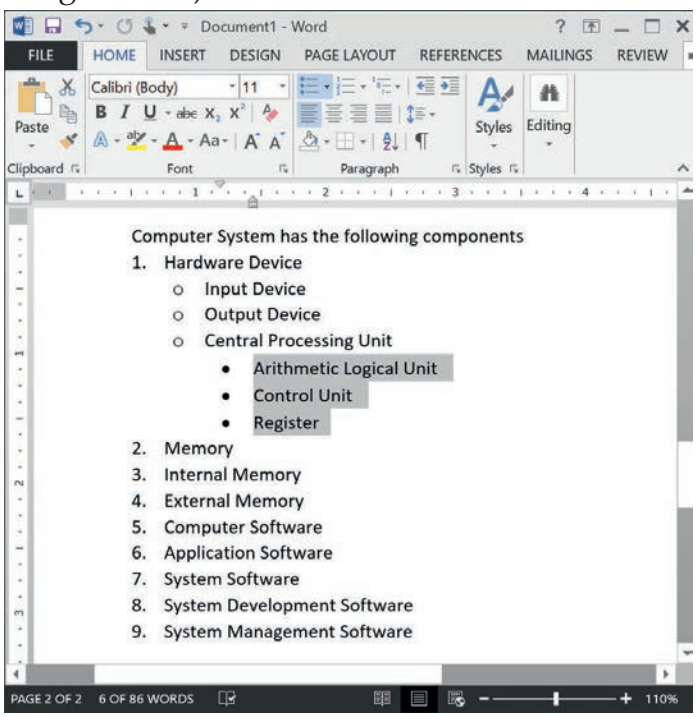


Figure 3.25 Indent a selected paragraph by two levels pressing Tab key twice

4. Place the insertion point at the beginning of the Memory text line and increase the indentation by one level pressing Tab key (See Figure 3.26).
5. Select Internal Memory and External Memory text and increase the indentation by two levels pressing Tab key twice (See Figure 326).
6. Select Application Software and System Software text and increase the indentation by one level pressing Tab key (See Figure 3.26).
7. Select System Development Software and System Management Software text and increase the indentation by two levels pressing Tab key twice (See Figure 3.26).

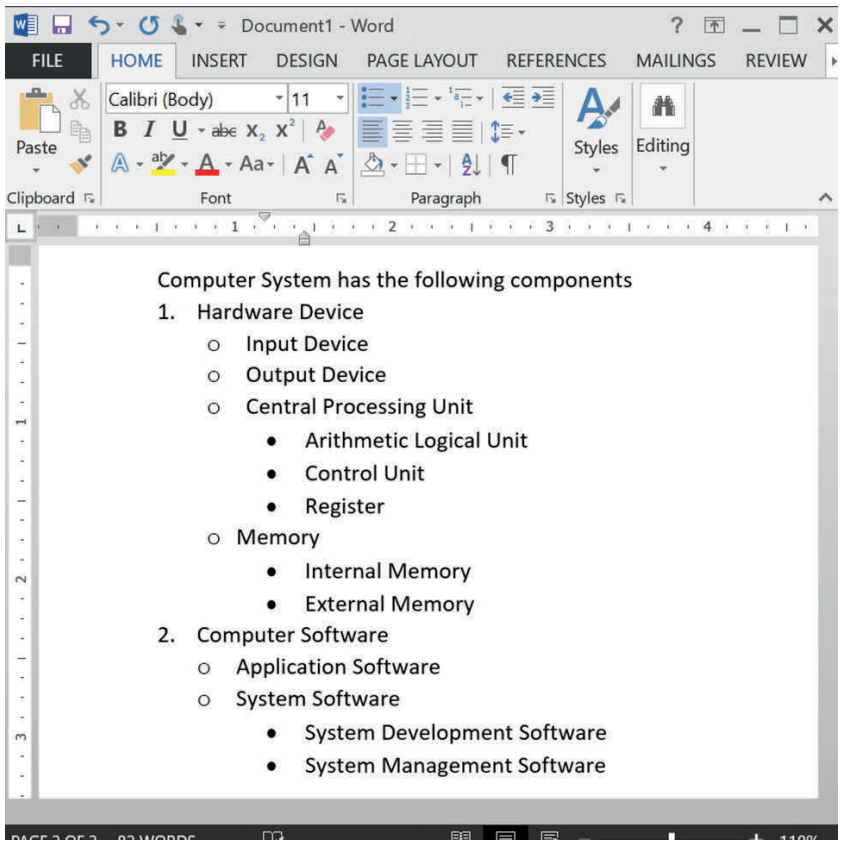


Figure 3.26 Creating multilevel list

Tip

To decrease the indention level, place the insertion point at the beginning of the line; then hold the Shift key and press the Tab key.

You can also increase or decrease the levels of text by placing the insertion point anywhere in the line and clicking the Increase Indent or Decrease Indent command.

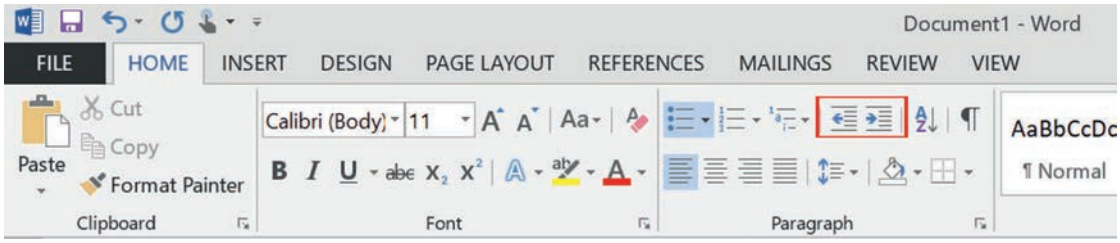


Figure 3.27 Create multilevel text using paragraph commands

When formatting a multilevel list, Word will use the default bullet style. To change the style of a multilevel list, select the list, and then click the multilevel list command on the Home tab (See Figure 3.28).

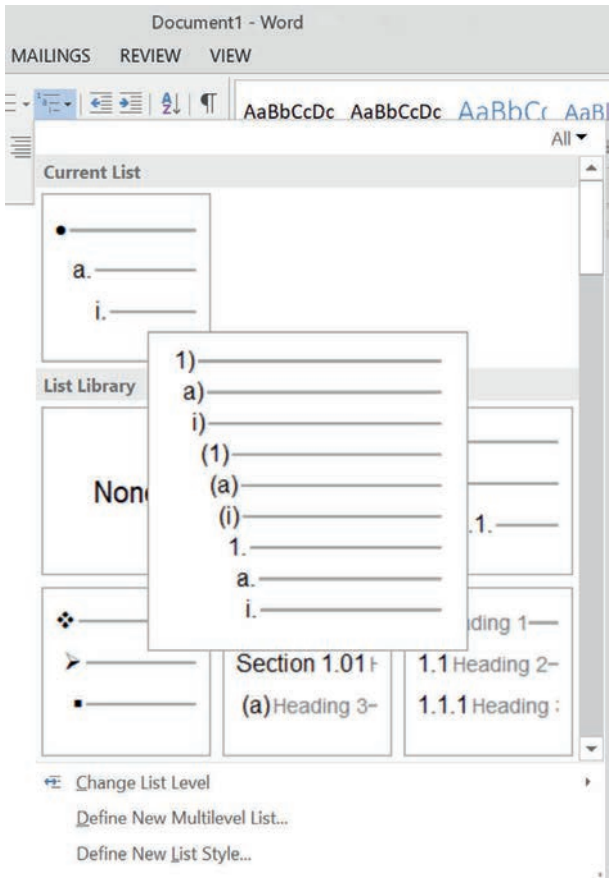


Figure 3.28 Change multilevel list style

Practical Exercise 3.4

Creating Multilevel Lists

Form a group of two to three students and open word processor and create the following multilevel list as shown below.

Inventory

1. Office
    a) Desk
        i). Top drawer
            (1). Pencils
            (2). Stapler
            (3). Ruler
        ii). Middle drawer
            (1). Paper
            (2). Tax forms
    b) Filing cabinet
2. Laboratory equipment

d. Line and Paragraph Spacing

The space between lines and paragraphs can be increased or decreased in Microsoft Word document using ***line and paragraph Spacing command***. In Microsoft Word document, the default space between the lines is 1.15". Similarly, the space between the paragraphs is 8 points. To format line and paragraph spacing, perform the following steps.

1. Open Microsoft Word and type the following two paragraphs taken from the paper "The Potential of Dagu Communication in Northeastern Ethiopia by Gulilat Menbere and Terje S. Skjerdal, Research Gate, January 2008" (See Figure 3.29).

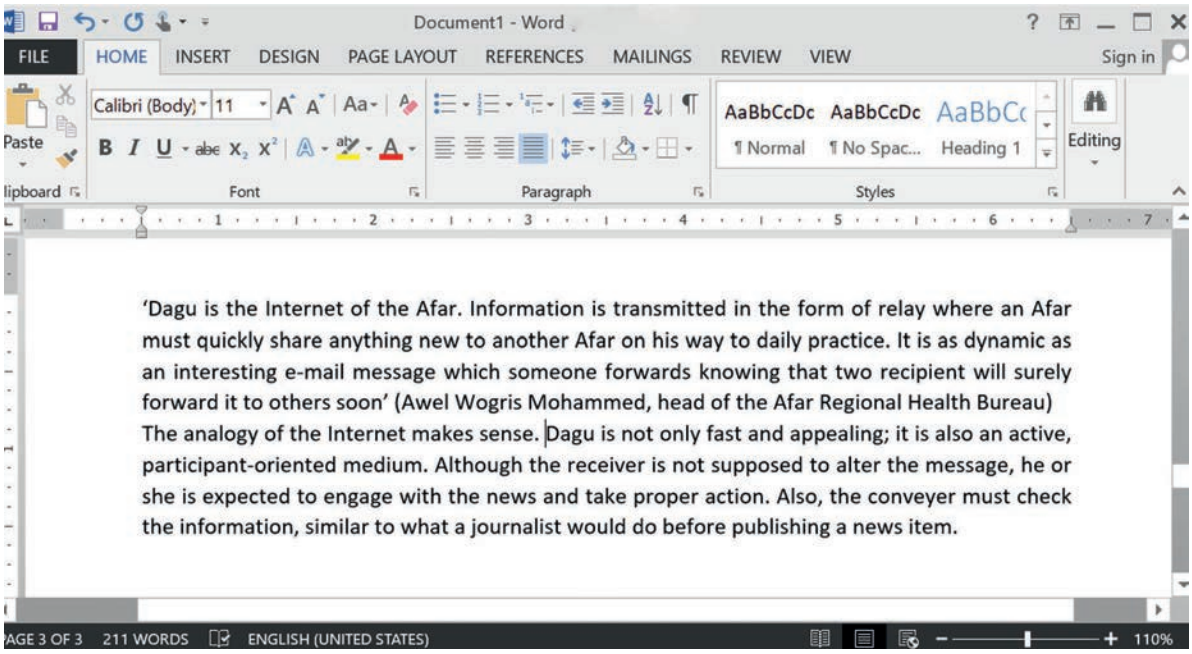


Figure 3.29 Line and paragraph formatting

2. To format line spacing of the above paragraphs, select both paragraphs.
3. On the Home tab, click the Line and Paragraph Spacing command, and then select the desired line spacing, say 2.0 (See Figure 3.30).

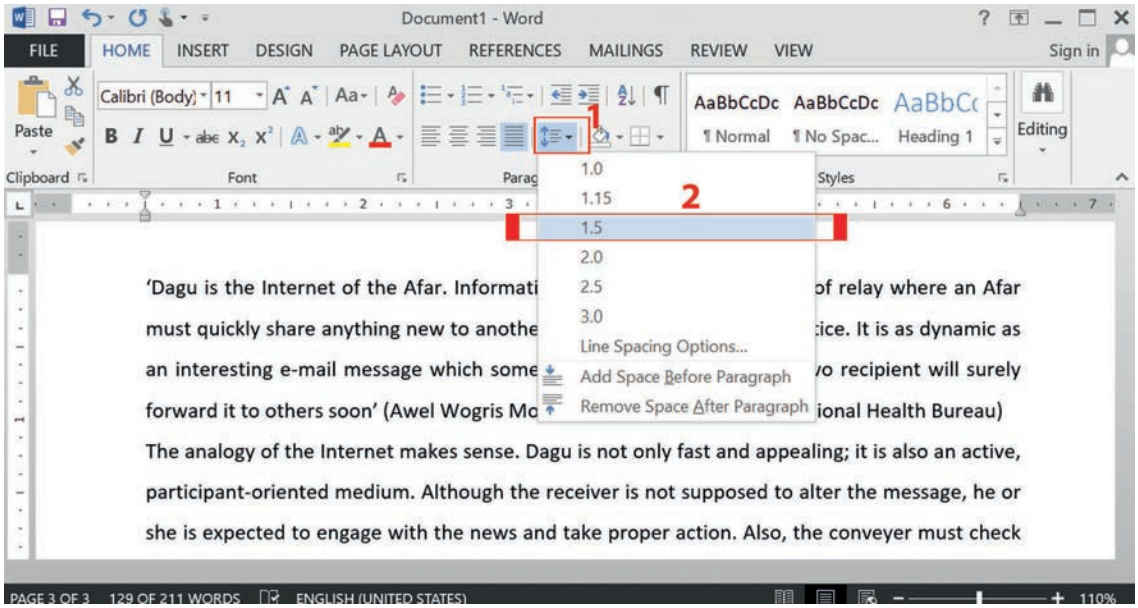


Figure 3.30 Select line spacing

4. The line spacing will change in the document (See Figure 3.30).Just as you can format spacing between lines in your document, you can adjust spacing before and after paragraphs. This is useful for separating paragraphs, headings and subheadings.
5. To format the paragraphs, select both paragraphs.
6. On the Home tab, click the Line and Paragraph Spacing command. Click Add Space Before Paragraph or Remove Space After Paragraph from the drop-down menu. In our example, we will select Add Space Before Paragraph (See Figure 3.31).

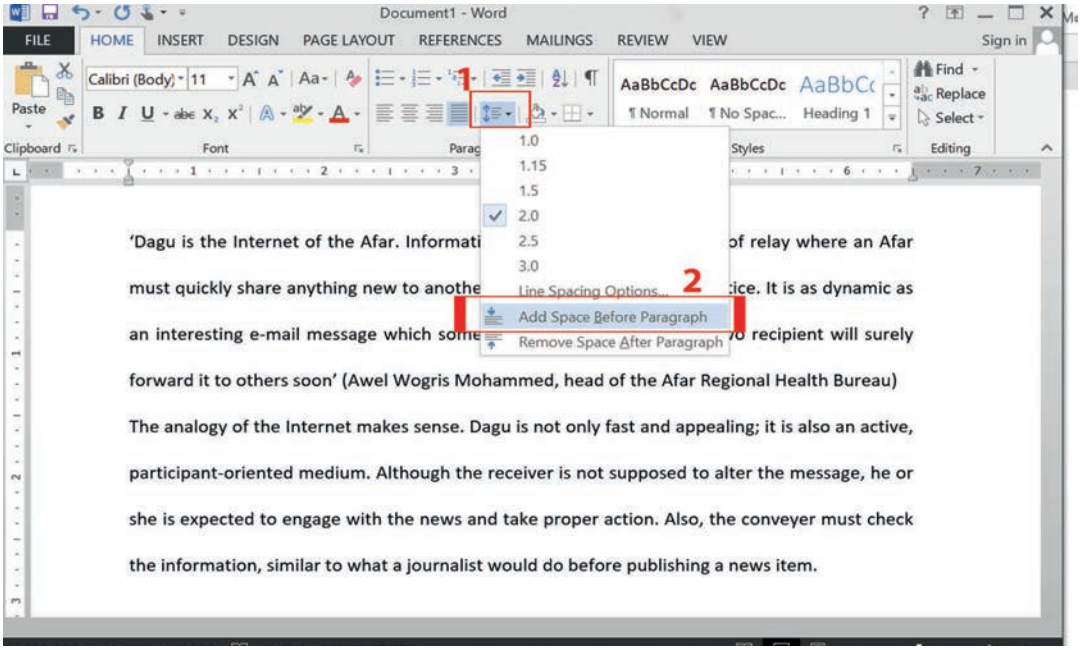


Figure 3.31 Select Add Space before Paragraph

7. The paragraph spacing will change in the document (See Figure 3.31 above). From the drop-down menu, you can also select Line Spacing Options to open the Paragraph dialog box. From here, you can control how much space there should be before and after paragraphs.

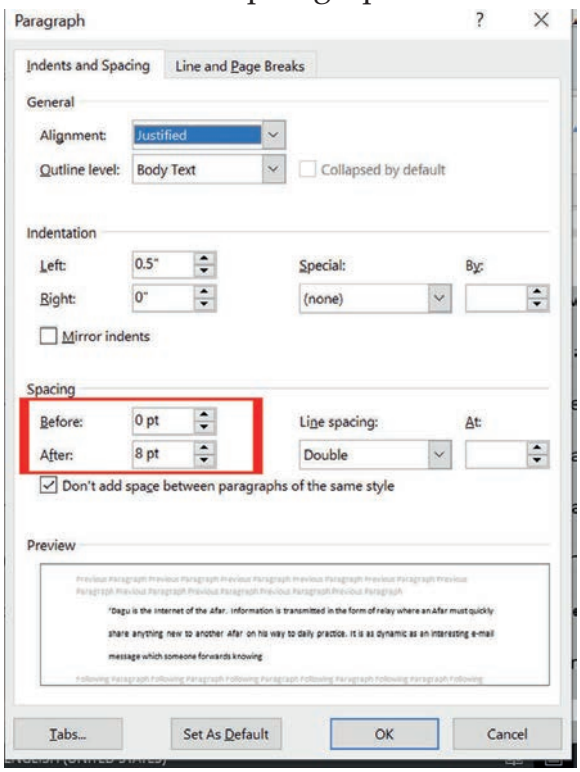


Figure 3.32 Paragraph spacing using Paragraph dialog box

3.2.4 Inserting and Deleting a Page Break in a Document

A page break is the location in a document where one page ends and a new page begins. When we are working on multiple pages, word automatically starts a new page in long documents when the text reaches the bottom of the page. In some cases, for example, some statements which are part of a paragraph can extend to the next page which makes it uncomfortable to read.

You can let Word determine where the break will occur, and you can also decide where to insert a manual page break or set specific options for those page breaks. Manual page breaks display as a single dotted line when the Word's Page Break appears in the center when you enable the Show/Hide button (as shown in Figure 3.35). In Print Layout view, Word displays a document page-by-page, one after the other. In this section, you will learn how to insert and remove a manual page break. The Breaks menu contains options for inserting three types of breaks:

- **Page Inserts**: Inserts a manual page break where one page ends and the new page begins.
- **Column**: Inserts a manual column break where a text will begin in the next column after the column break.
- **Text Wrapping:** Separates the text around objects on a web page, such as caption text from body text.

To insert and delete a page break in a document, keep the following steps.

1. Write the following document, which has a paragraph description for a picture in page 7 and a picture in another page (page 8) of the document, due to Word's automatic break (See Figure 3.33). So, we need to make the description paragraph along with the picture in the same page (page 8) manually by breaking the page. It is possible to just press Enter until that text reaches the top of page eight, but it could easily be shifted around when we added or deleted something in another part of the document. Instead, we will insert a page break.

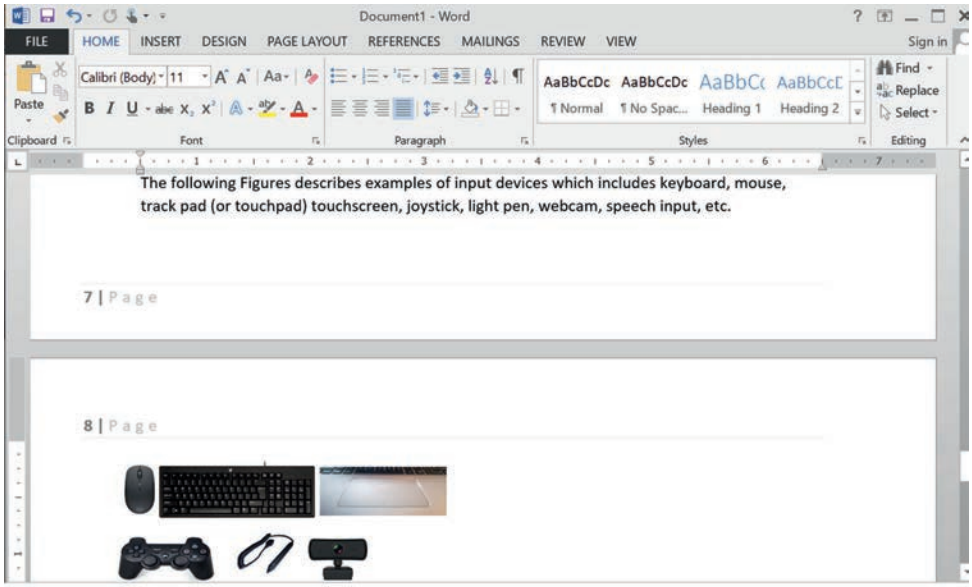


Figure 3.33 Page break

2. Place the insertion point where you want to create the page break. In our example, we will place it at the beginning of the paragraph which describes the picture (See Figure 3.35).

3. On the Insert tab, click the Page Break command (See Figure 3.34). Alternatively, you can press *Ctrl + Enter* on your keyboard.

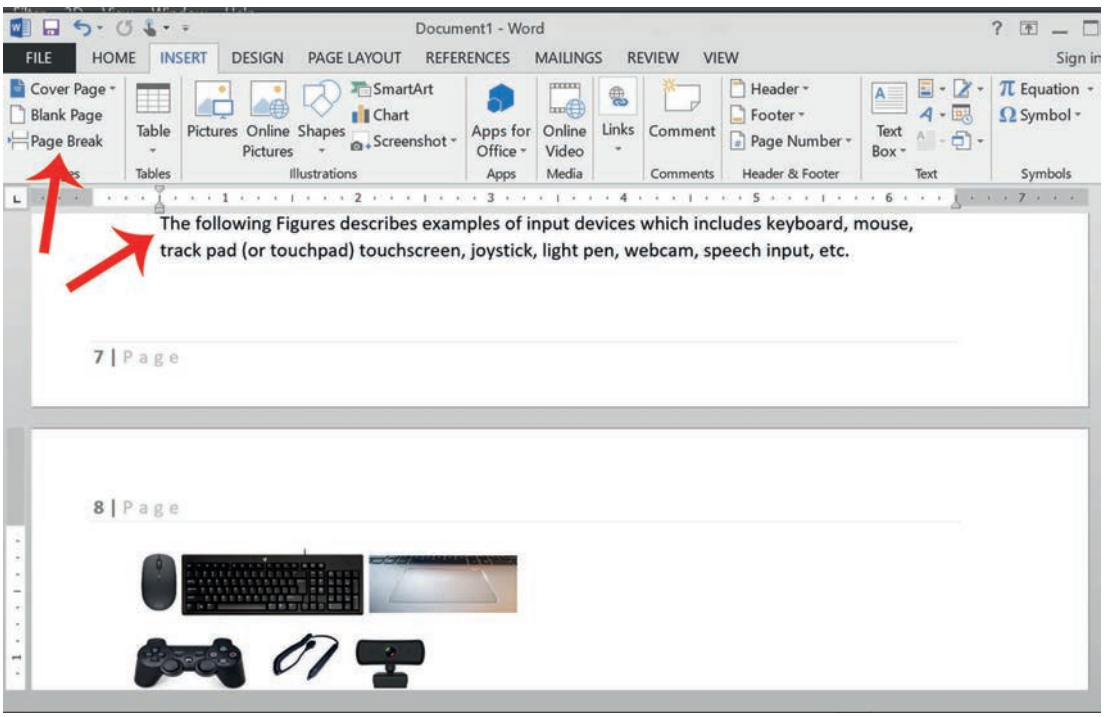


Figure 3.34 Selecting the Page Break command on the Insert tab

4. The page break will be inserted into the document, and the text will move to the next page (See Figure 3.35).
5. By default, breaks are invisible. If you want to see the breaks in your document, click the Show/Hide command on the **Home** tab.

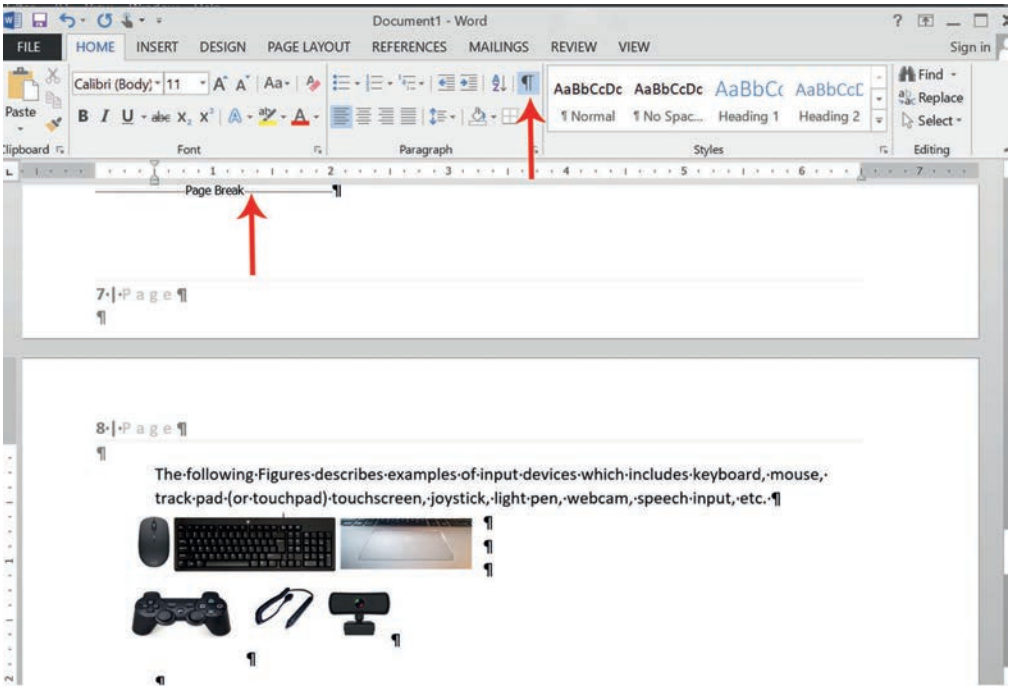


Figure 3.35 Using the Show/Hide command on the Home tab

To delete a page break, follow the steps stated below.

1. If you want to delete a page break, you will first need to` show the break in your document as in in step 4 above (See Figure 3.35).
2. Locate the page break you want to delete, and then place the insertion point at the beginning of the break.
3. Press the Delete key. The break will be deleted from the document.

3.2.5 Insert and Delete Page Number in Document

To identify different pages in Word document, page number is used. Page number is used in Word document to automatically number each page. In Microsoft Word, there are a wide range of page number formats and they can be customized to suit your needs. Page numbers are usually placed in the **header, footer or side margins**. When you need to number some pages differently, Word allows you to **restart page numbering.**

Adding Page Numbers in Word Document

To insert a page number in a Word document, follow the following steps.

1. Create a multiple pages document in Word; it can be a blank document.
2. On the Insert tab, click the Page Number command (See Figure 3.36).

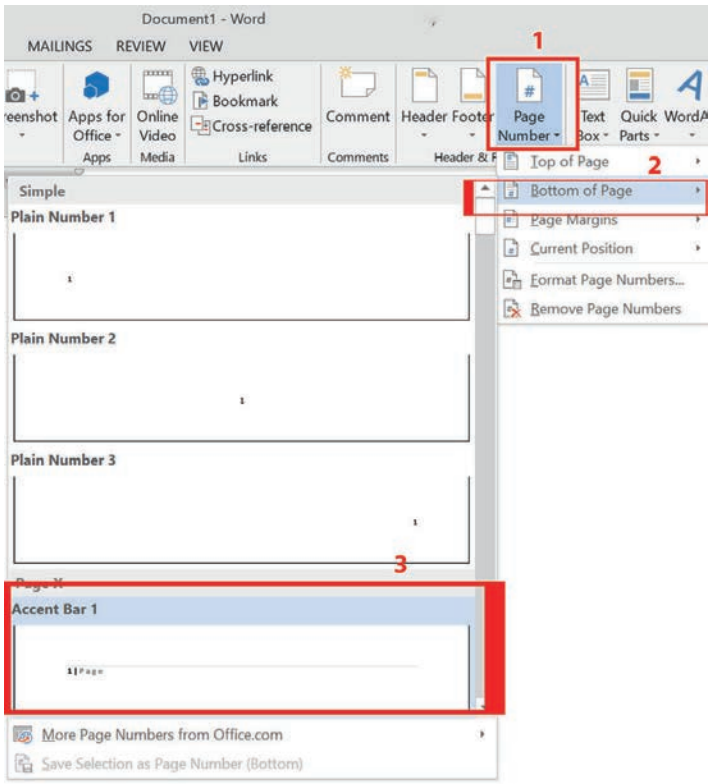


Figure 3.36 The Page Number command on the Insert tab

3. Open the Top of Page, Bottom of Page or Page Margins menu, depending on where you want the page number to be positioned, and then select the desired style of header. In our example, we select Bottom of the Page. (See Figure 3.37).
4. Select a header style.
5. Page numbering will appear.

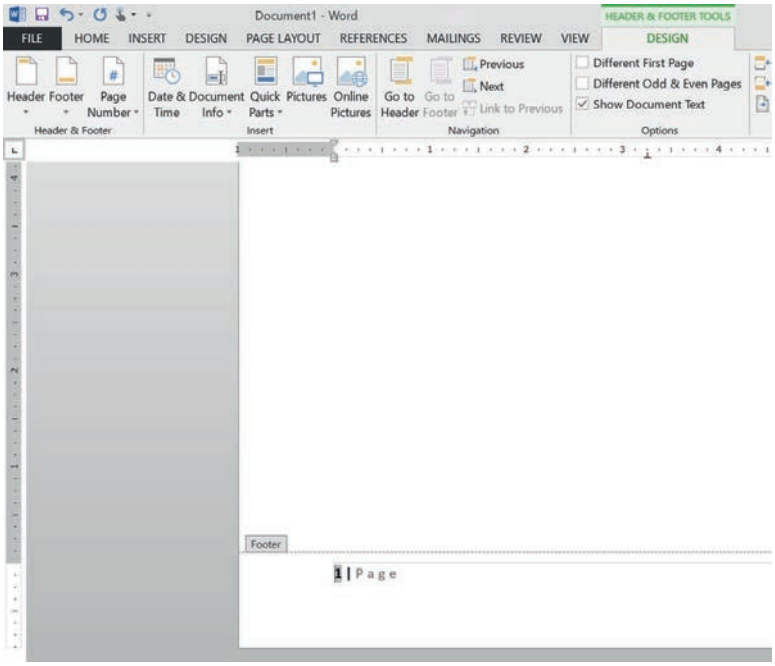


Figure 3.37 Page numbering in the Footer

6. Press the Esc key to lock the header and footer.
7. If you need to make any changes to your page numbers, simply double-click the header or footer to unlock it. In our example, double click the footer.

3.2.6 Adding and Deleting Headers and Footers in Document

A header appears at the top of a document page, and the footer appears at the bottom. Headers and footers generally contain additional information such as page numbers, dates, author's name and footnotes, which can help you keep longer documents organized and make them easier to read. The text entered in the header or footer will appear on each page of the document. To add and delete headers and footers in a document, use the document created in Figure 3.38 and follow the following steps.

In this example, the title of the paper is required to be displayed at the top of each page by placing it on the header.

1. Double-click anywhere at the top or bottom margin of your document. In our example, we will double-click the top margin (See Figure 3.38).

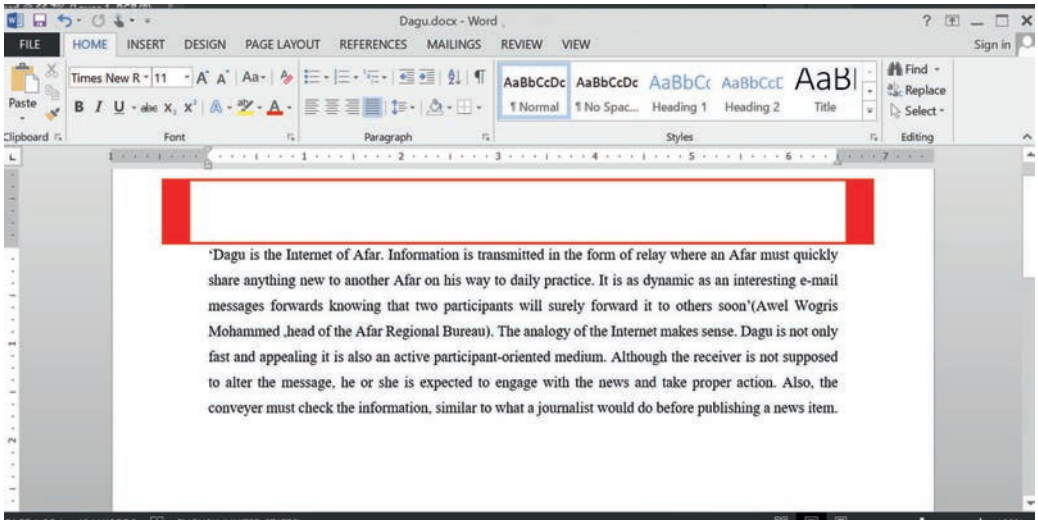


Figure 3.38 Double-clicking on the header

2. The header or footer will open, and the insertion point will appear in the header or footer.

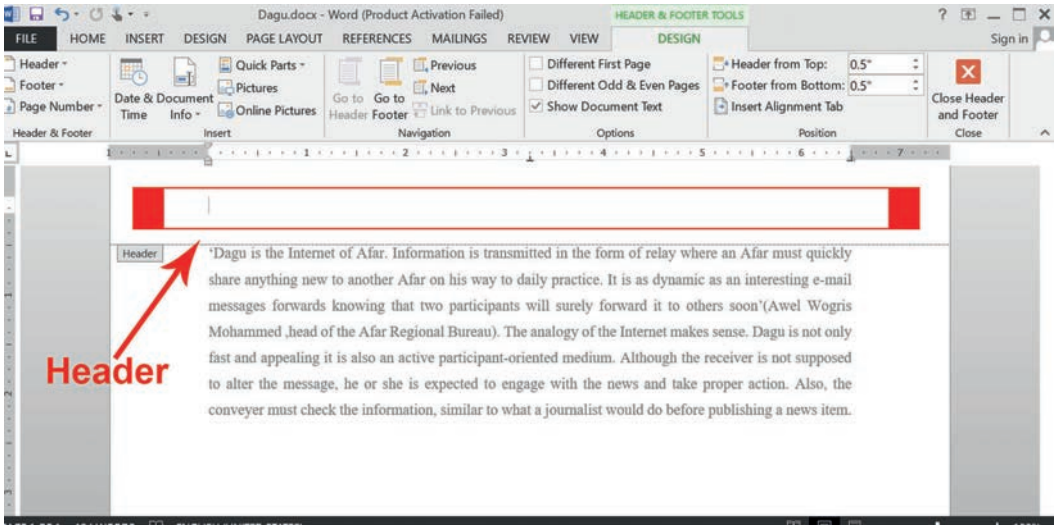


Figure 3.39 Opening header

3. Type the desired information into the header or the footer. In our example, we will type the paper's title and date.

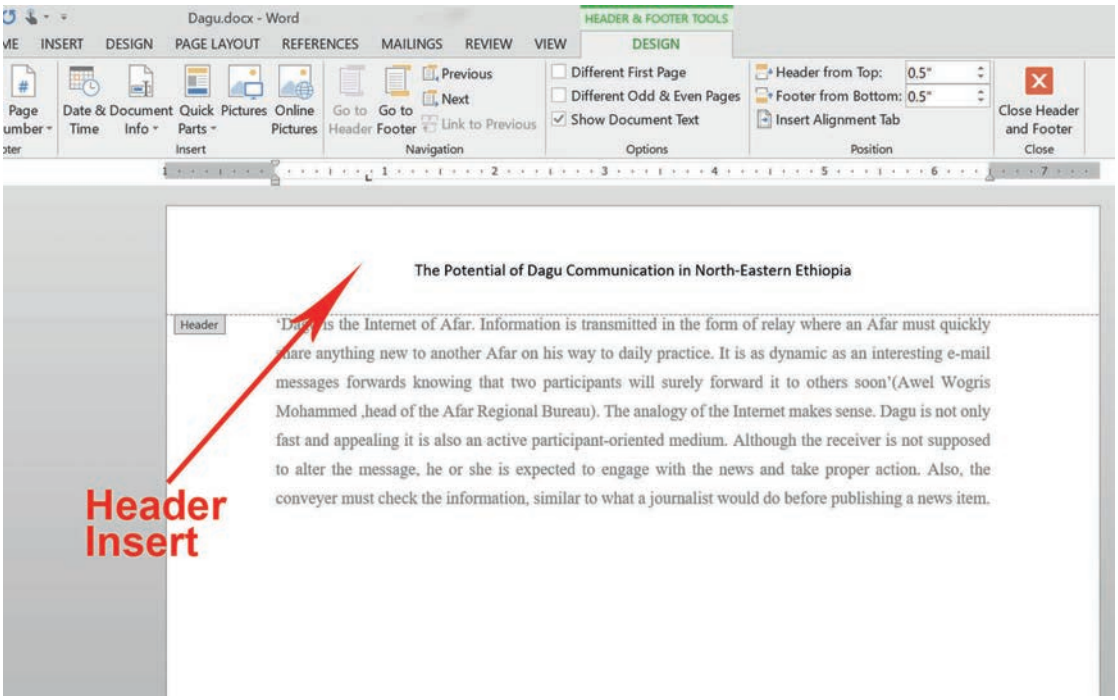


Figure 3.40 Typing text into a header

4. When you have finished, click Close Header and Footer. Alternatively, you can press the Esc key.
5. The header or footer of the text will appear (See Figure 3.40).

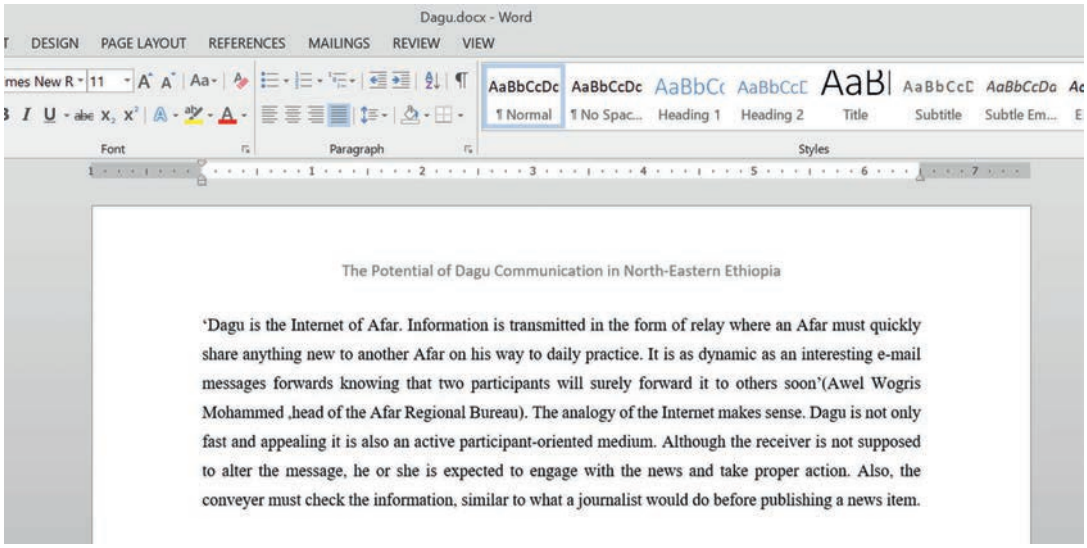


Figure 3.41 The finished header

Notice that the header appears in all pages of the document with all color differences from the paragraph.

a. Inserting Preset Header or Footer

Word has a variety of preset headers and footers you can use to enhance your document's design and layout. In our example, we will add a preset header to our document.

1. Select the Insert tab, and then click the Header or Footer command. In our example, we will click the Header command.
2. In the menu that appears, select the desired preset header or footer.

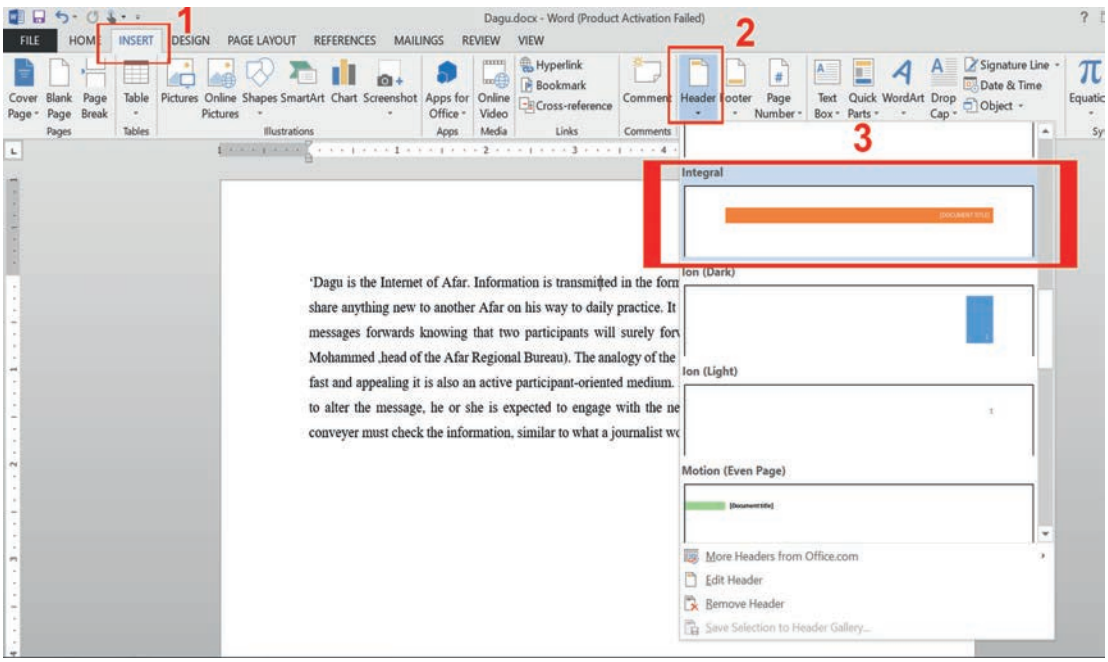


Figure 3.42 Select preset header

3. The header or the footer will appear. Many preset headers and footers contain text placeholders called Content Control fields. These fields are good for adding information like the document's title, author's name, date and page number.
4. To edit a Content Control field, click it and type the desired information (See Figure 3.42).

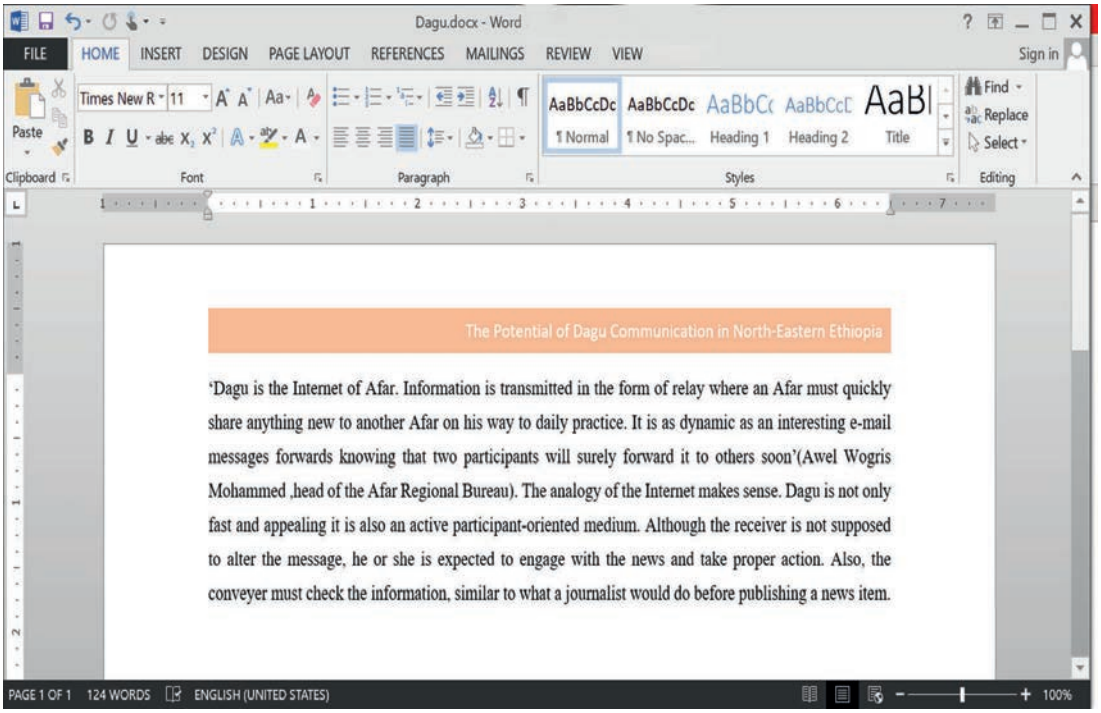


Figure 3.43 Finished header using preset header

5. When you have finished, click Close Header and Footer. You can also press the Esc key.

b. Editing Headers and Footers

After you close the header or footer, it will still be visible, but it will be locked. Simply double-click a header or footer to unlock it, which will allow you to edit it.

c. Removing Header and Footer

If you want to remove all information contained in the header, click the Header command and select Remove Header from the menu that appears. Similarly, you can remove the footer using the Footer command.

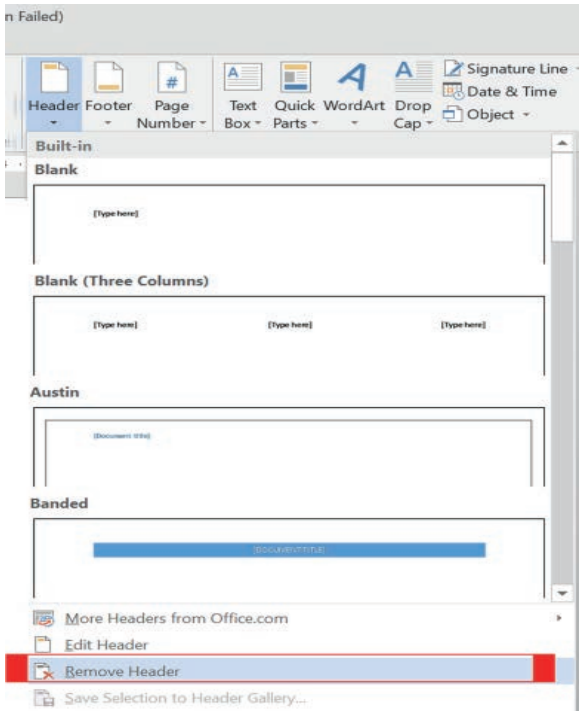


Figure 3.44 Removing header

Practical Exercise 3.5

Prepare a document for IT note on Introduction to Computer for grade 7 students or use the document created in practical Exercise 3.1 of this textbook about Effects of Trafficking on Child document. Then follow the instruction to manipulate the paragraph using the techniques you learned in the above sections.

1. Change all titles' text alignment to centre.
2. Apply Roman number format for all lists (small).
3. Make line spacing 1.5".
4. Use page break to sort all parts of the paragraph together in one page that makes it comfortable to read
5. Justify the paragraph.
6. Change the typeface of the entire document to Arial 12 point.
7. Add a page number (Arabic number).
8. Set the header a title of the document, for example Effects of Child Trafficking on Children or Introduction to Computer Note for Grade 7 Students.

9. Set the footer as Prepared by Grade 9 Students for your document.
10. Create a folder on the Documents called Word Project and save the document as *Child Trafficking.docx* or *Introduction to Computer Note.docx* in the folder you created.

KEY CONCEPTS

- Paragraph formatting is a modification of the paragraph so that it will appear readable for the reader. This includes indention, alignments, bulleting and numbering, and line and paragraph spacing.
- Indentation is how far you want to move the paragraph away from the left or the right margin. There are four methods for doing indentations: Tab key method, Ruler method, Indent Command method and Paragraph Dialog Box method
- Alignment is orientation of a text and a paragraph which is aligned evenly along the left and right margins. Alignments can be left, right, center and justify.
- Bulleting and numbering is used to outline, arrange and emphasize texts.
- Line and paragraph spacing options allows you to control how much space should be between lines and paragraphs in Word.
- A page break is the location where a new page begins. It can be either automatic or manual.

3.3 Manipulating Data in Spreadsheet

Brainstorming

1. Have you ever process tabular data? What do you use to process this kind of data?
2. What is the use of spreadsheet software? Can you mention some of proprietary and free spreadsheet software?
3. What is the difference between word processing and spreadsheet software?

Spreadsheet software is application software capable of organizing, storing and analyzing data in tabular form. An example of spreadsheet software is Excel. As you have learned in grades 7 and 8, Microsoft Office Excel provides powerful tools that enable users to organize, analyze, manage and share information easily.

One of the most powerful features of Excel is its ability to calculate numerical information using formulas. Excel can add, subtract, multiply and divide. In this section, we see how to use cell references to create simple formulas.

3.3.1 Using Mathematical Operators

Excel uses standard operators, such as a plus sign for addition (+), a minus sign for subtraction (-), an asterisk for multiplication (*), a forward slash for division (/) and a caret (^) for exponents, for formulas.

Table 3.4 Mathematical operators of Excel

Arithmetic Operator	Meaning	Example
+ (plus sign)	Addition	=3+3
– (minus sign)	Subtraction	=3–3
* (asterisk)	Multiplication	=3*3
/ (forward slash)	Division	=3/3
% (percent sign)	Percent	30%
^ (caret)	Exponentiation	=3^3

When you enter a formula in a cell, the formula is stored internally and the results are displayed in the cell. You can view the underlying formula in the formula bar when the cell is active, when you double-click the cell to edit it or when you use the Formulas tab.

To allow Excel to distinguish formulas from data, all formulas should begin with an **equal sign** (=). To display formula in Excel, follow the following steps.

1. Launch Microsoft Excel and then open a new blank workbook.
2. Click cell A1.
3. Type =5+3*3/2-4 and press Enter. You just entered a formula.

Take note that formulas should be typed without spaces, but if you type spaces, Excel eliminates them when you press Enter.

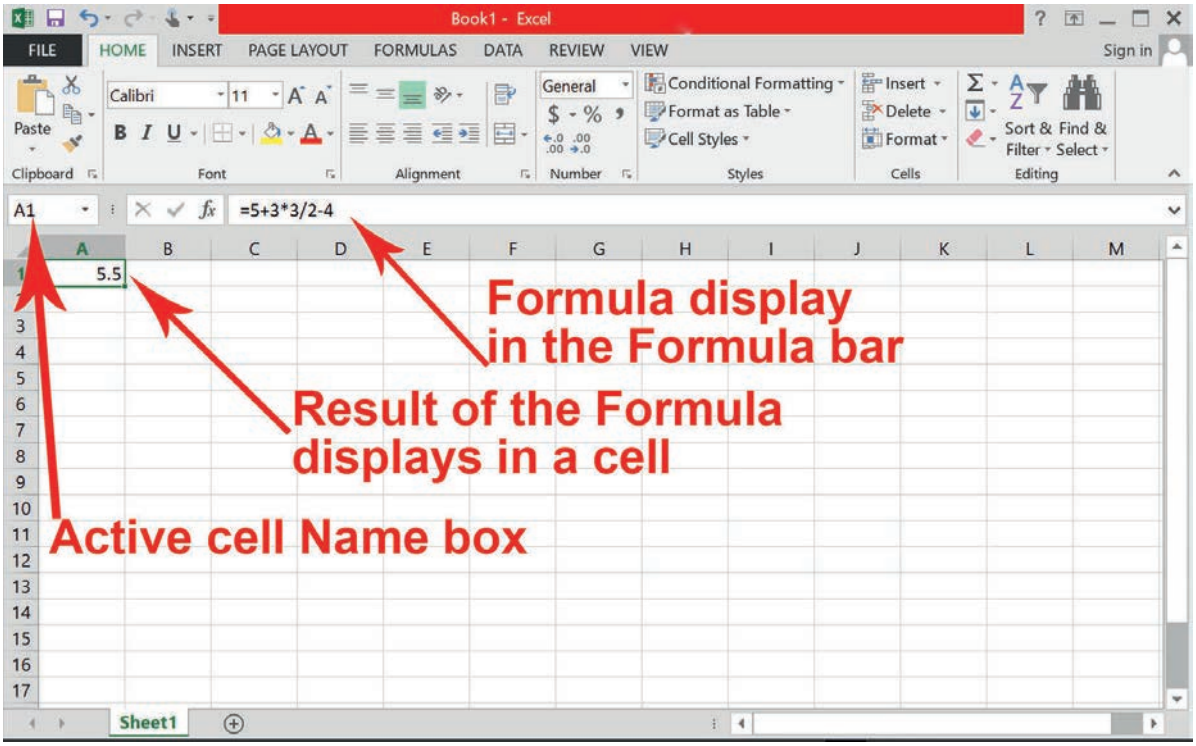


Figure 3.45 Viewing formula in the formula bar

4. Click cell A1. Notice that the result of the formula displays in the cell, but the formula appears only in the formula bar (See Figure 3.45).
5. Double-click cell A1. The formula appears in both active cell and the formula bar. You can edit the formula in this mode.
6. Press Enter.
7. On the Formulas tab, in the Formula Auditing group, click Show Formulas. The formula in cell A1 displays.

NOTE

While you are displaying formulas in the worksheet, you will not see the results of those formulas.

8. Click Show Formulas again to turn off formula display.
9. Save the workbook.

3.3.2 Using Cell References in Formulas

A cell reference identifies a cell's location in the worksheet, based on its column letter and row number. Each cell in an Excel worksheet has a unique identifier indicating its column and row, for example A1 (refers to Column A, Row 1) and E4 (refers to Column E, Row 4). When you create a formula, you can reference a cell's identifier rather than typing the number that appears in that cell. Using a cell reference, rather than the data displayed in a cell, gives you more flexibility in your worksheet. Using cell references will ensure that your formulas are always accurate because you can change the value of referenced cells without having to rewrite the formula. For example, if the cell E1 contains the number 10 and if 10 is changed to 18 later, any formula that references cell E1 updates automatically. The same principle applies to a cell that contains a formula and is referenced in another formula.

3.3.3 Using Relative Cell References in Formula

A relative cell reference is the one that adjusts the cell identifier automatically when you insert or delete columns or rows or copy the formula to another cell. A relative cell reference is, therefore, one whose references change "relative" to the location where it is copied or moved.

You can use either uppercase or lowercase when you type a cell reference in a formula. For example, it does not matter whether you type B4 or b4 in the formula you enter. Excel changes the reference to uppercase when you press Enter.

To use relative cell references in formulas, follow the following steps.

1. Launch Microsoft Excel and type 5 students' IT subject marks on a new work book, as shown in Figure 3.47.
2. In order to calculate the total marks (out of 100 %) of Individual Assignment, Mid Exam, Projects and Final Exam for each student, click on cell that will contain formula. In our example, click F2.
3. Type equal (=) sign to start the formula; notice how it appears in both the cell and the formula bar.

4. Instead of typing = 10.5 + 15 + 23.5 to calculate total marks for student 1, type the cell address of the cell you want to reference first in the formula, cell B2 in our example which contains the value 10.5. A blue border will appear around the referenced cell.

Tip

An alternate way to use a cell reference is to click the cell being referenced while creating or modifying a formula. For example, instead of typing *B* and *2* from the keyboard, you can click on B2 cell, and then B2 cell reference is added into the formula. This method is usually quicker and eliminates the possibility of typing an incorrect cell identifier, especially if you need to create a formula with many cell references.

5. Type the mathematical operator you want to use. In our example, we will type the addition sign (+) (See Figure 3.47).
6. Type or select the cell address of the cell you want to reference second in the formula, cell C2 in our example. A red border will appear around the referenced cell. (See Figure 3.48).
7. Type the mathematical operator you want to use. In our example, we will type the addition sign (+) (See Figure 3.47).
8. Type or select the cell address of the cell you want to reference third in the formula, cell D2 in our example.
9. Repeat steps 7 and 8, but for E2 cell reference (See Figure 3.47).
10. Press Enter on your keyboard. The formula calculates and the value will be displayed in the cell. If you select the cell again, notice that the cell displays the result while the formula bar displays the formula.

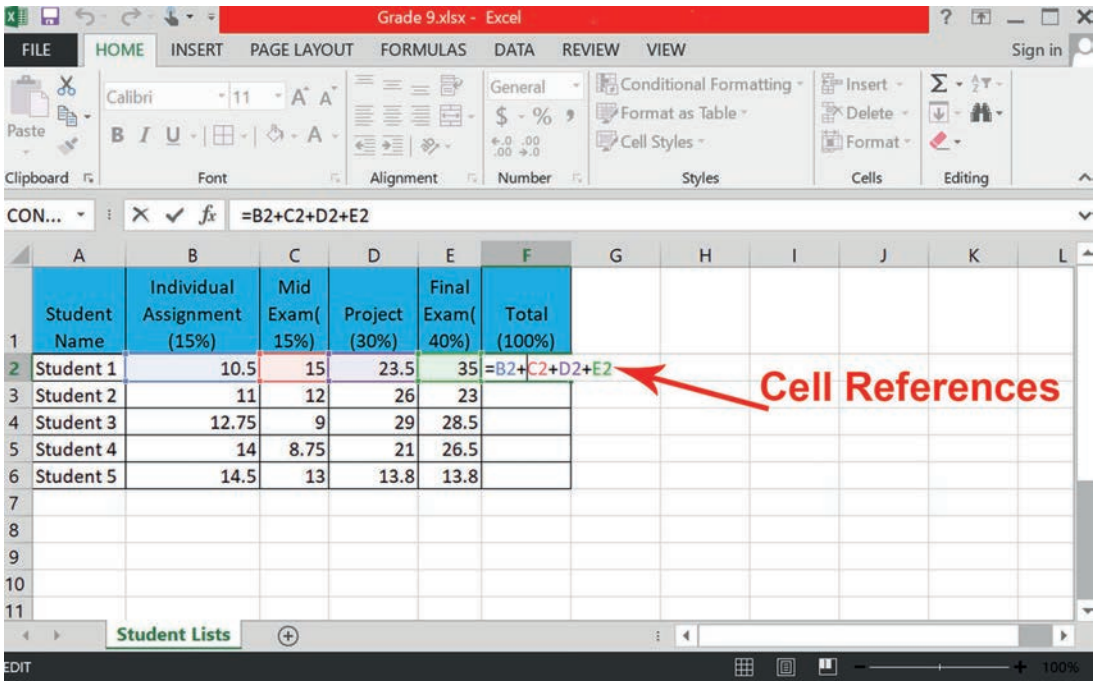


Figure 3.46 Using cell reference in formula

3.3.4 Copying Formulas with the Fill Handle

Formulas can also be copied to adjacent cells with the fill handle, which can save a lot of time and effort if you need to perform the same calculation multiple times in a worksheet. The fill handle is the small square at the bottom-right corner of the selected cell(s) (See Figure 3.48).

Use the following steps to copy formulas.

1. To do the same for Student 2, select the cell containing the formula you want to copy, in our example F2, then click and drag the fill handle over the cells you want to fill (See Figure 3.48).

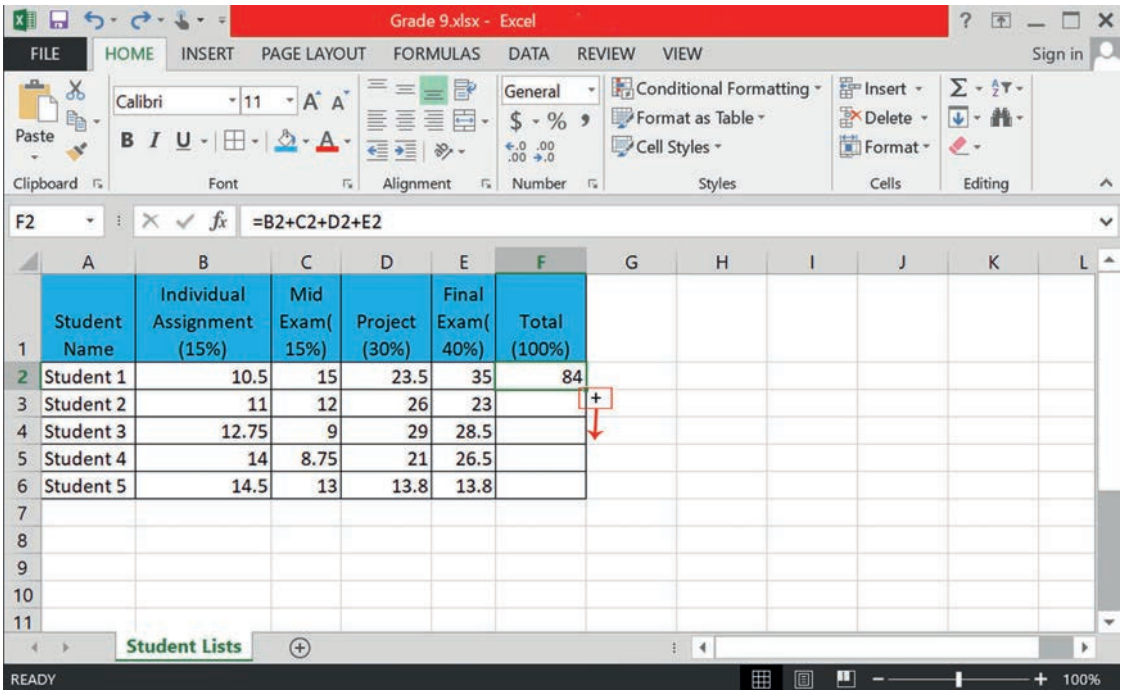


Figure 3.47 Press enter to complete the formula and display the result

2. After you release the mouse, the formula will be copied to the selected cells (See Figure 3.48).

3. Save the workbook in your Excel folder as *G9 IT Students' Mark Sheet.*

Tip

Instead of dragging the fill handle over the cells you want to fill, you can double click the fill handle and the formula copied over the cell you want to fill.

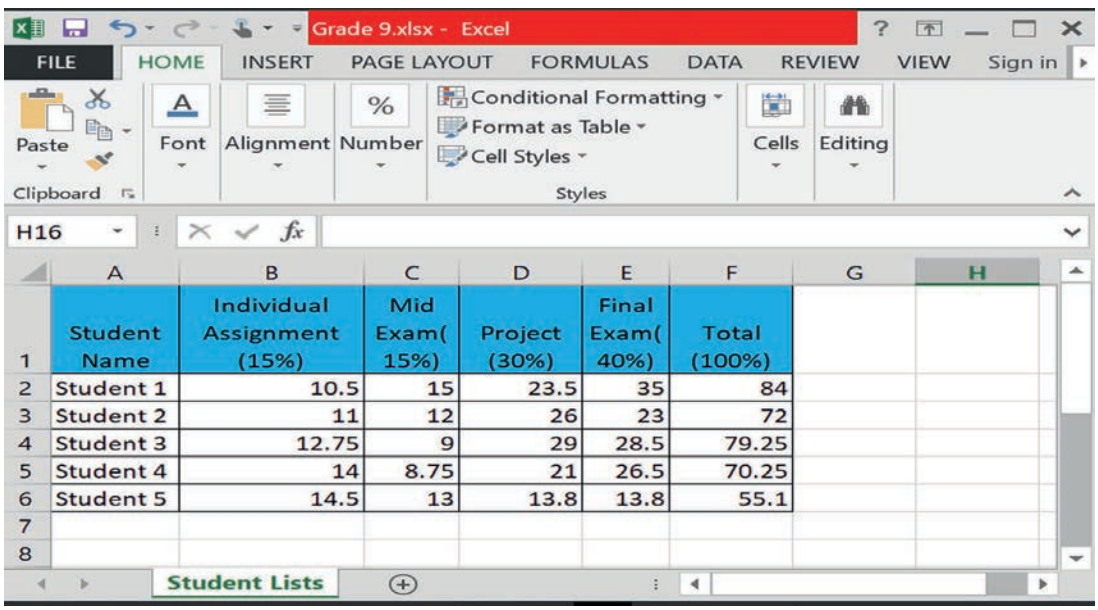


Figure 3.48 Copying the formula into the selected cells

To edit the formula, double-click the cell to view and edit the formula directly within the cell. Notice that, by default, new formulas in Excel use relative references, i.e. in cell F3 it will be =B3 + C3 + D3 + E3 and in F4, the formula becomes =B4 + C4 + D4 + E4. It continues like this until F6. You can see the formula in formula bar (See Figure 3.49 below).

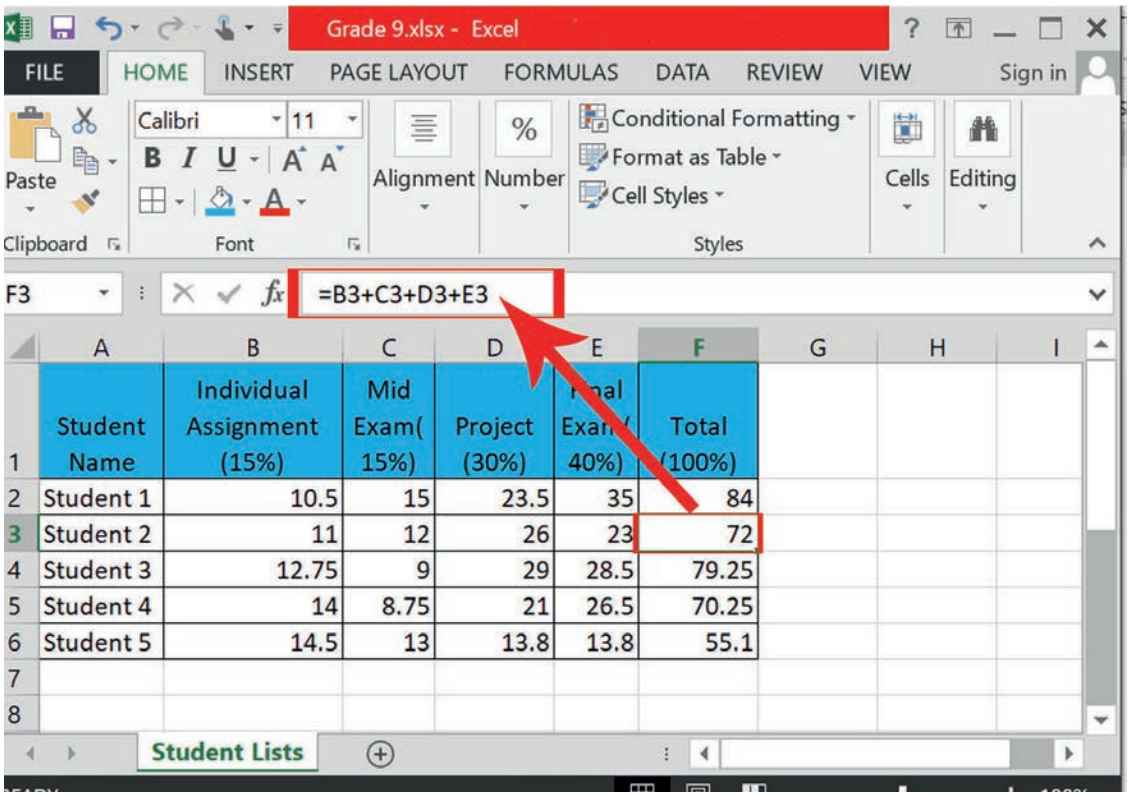


Figure 3.49 Relative cell reference of copied formula

3.3.5 Using Absolute Cell References in Formula

An absolute cell reference is a cell reference in a spreadsheet application that remains constant even if the reference is copied or moved to another cell or sheet.

Sometimes you do not want a cell reference to change when you move or copy it. To make an absolute cell reference, use the dollar sign ($) before the column and row of the cell you want to reference.

Tip

Press F4 for making cell reference absolute, after selecting it.

To use absolute cell references in formula, use the above created work book saved as G9 IT Students' Mark Sheet and follow the steps below.

1. Open G9 IT Students' Mark Sheet that you created as Figure 3.50 above.
2. Assume we need to add a common bonus mark for all students. In our example, we add B9 to the total mark. The formula is updated to =B2 + C2 + D2 + E2 + B9 (See Figure 3.51).
3. We need to make B9 absolute reference, since it is the same for all students and should not be changed as we copy the formula to the other student. To make it absolute, you can press F4 after selecting it or type dollar sign ($) before B and 9 (See Figure 3.51).

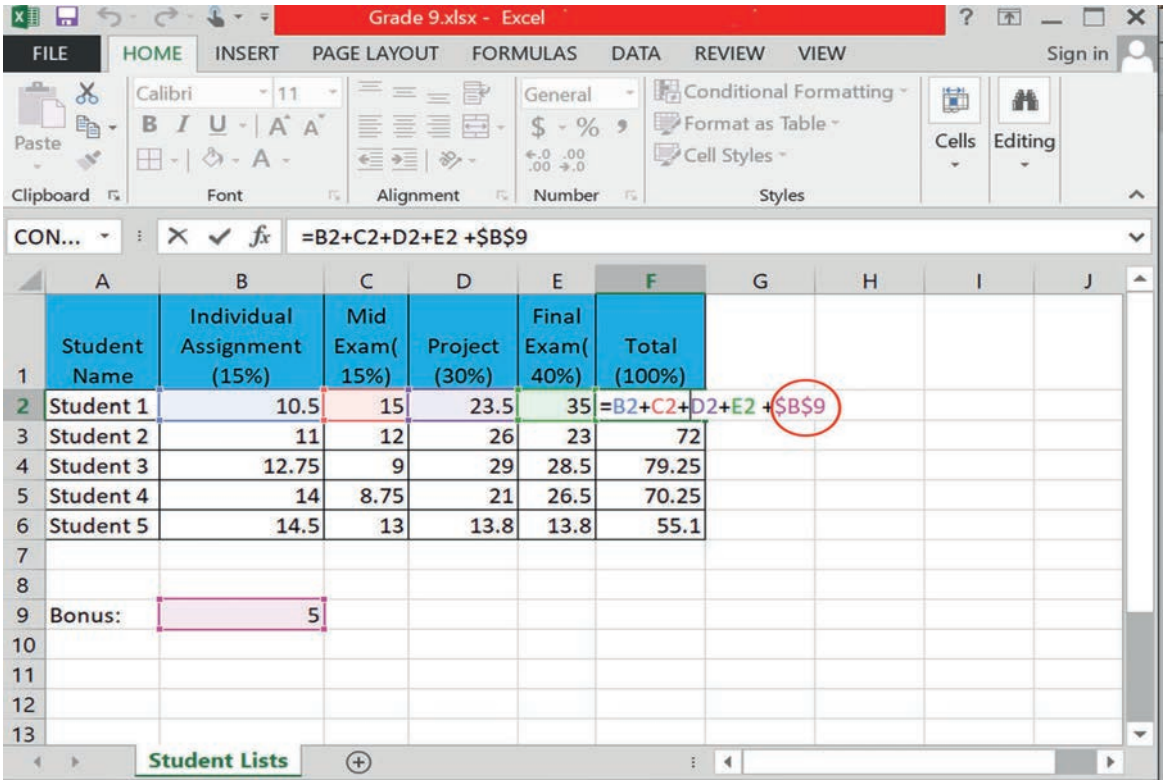


Figure 3.50 Using absolute reference

4. Press Enter. The formula in cell F2 now uses an absolute cell reference to cell F9.
5. Copy the formula to another cell by selecting the F2 cell containing the formula and drag the fill handle over the cells (See Figure 3.52).

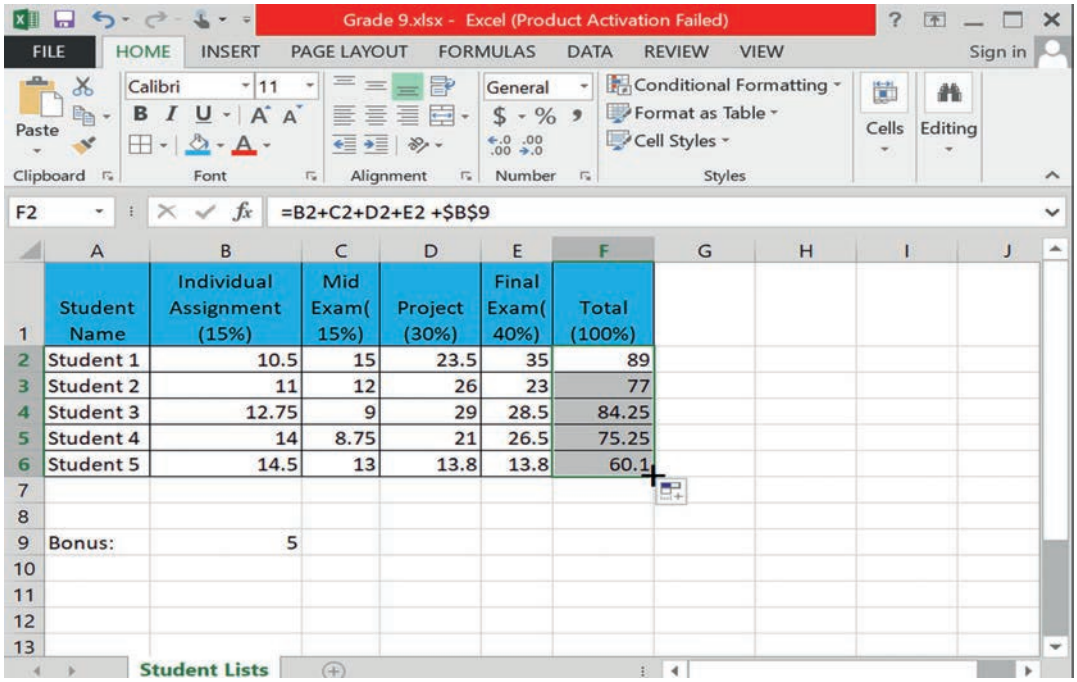


Figure 3.51 Copying absolute formula

6. Make sure that the relative cells are changed on cells F3, F4, F5 and F6 according to the location while B9 is common for all formulas (See Figure 3.53).

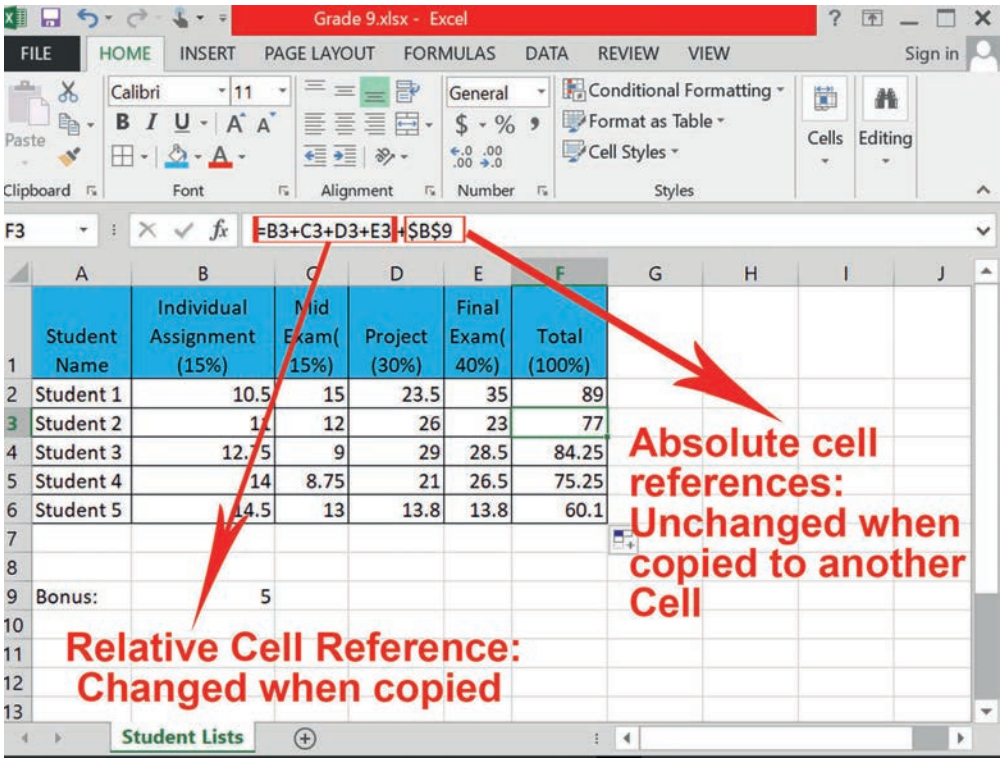


Figure 3.52 Unchanged cell reference

Practical Exercise 3.6

Read the following case carefully and answer the questions that follow it.

Student Ebsa is a grade 9 student. His mother ordered him to buy 1 kilo potato, ½ kilo sugar, 1 kilo onion, ½ kilo banana, ¼ kilo coffee bean and ½ kilo salt from a small local market, called gulit, found around his village. The price information is provided in the following Excel sheet (See Table 3.5 below). We want to create a formula that will multiply each item's price by the quantity.

1. Create a single formula that calculates the total price for each item in cell E3, and then copy it to the other rows.
2. In response to question number 1 above, we calculated total price in column E without tax. Now we will use 15% sales tax rate in cell G1 to calculate the sales tax for all items in column F (See Table 3.6). Create a formula that will calculate sales tax for all items in column F, and then copy it to the other rows.

   (Hint: You need to use the absolute cell reference G1 in your formula. Because each formula is using the same tax rate, we want that reference to remain constant when the formula is copied and filled to other cells in column F).
3. Create the formula in G3 to calculate the net price by adding total price and sales tax for each item and copy it to the other rows.
4. Finally, calculate the grand total that sums up all net prices in cell G9 so that student Ebsa will pay.

Table 3.5 Using relative cell reference for calculating total price

	A	B	C	D	E
1	Sales Tax				
2	No	Items	Quantitiy (kilo)	Price/Kilo (Birr)	Total Price
3	1	Potato	1	20	
4	2	Sugar	0.5	50	
5	3	Onion	1	15	
6	4	Banana	0.5	30	
7	5	Coffee	0.25	300	
8	6	Salt	0.5	15	

Table 3.6 Calculating tax and net price

	A	B	C	D	E	F	G
1	Sales Tax						15%
2	No	Items	Quantitiy (kilo)	Price/Kilo (Birr)	Total Price	Sales Tax	Net Price
3	1	Potato	1	20	20		
4	2	Sugar	0.5	50	25		
5	3	Onion	1	15	15		
6	4	Banana	0.5	30	15		
7	5	Coffee	0.25	300	75		
8	6	Salt	0.5	15	7.5		
9						Grand Total	

KEY CONCEPTS

1. Spreadsheet software is application software that is capable of managing tabular data.
2. Excel is one of spreadsheet software.
3. Excel sheet is arranged in rows and columns.
4. In Excel, all formulas start with equal (=) sign.
5. Cell reference identifies cell's location and values.
6. Cell references can be absolute and relative.
7. An absolute cell reference remains constant even if the reference is copied or moved to another cell or sheet.
8. Relative cell reference is the default behavior of a formula in which the reference changes according to the position of the cell when it is copied to other cell,

3.4 Creating Presentation

Brainstorming

1. Have you ever presented your ideas in front of your classmates? What do you think a good presentation should have?
2. What is the use of presentation software? Can you mention some of proprietary and free presentation software?

As you learned in Grades 7 and 8, Presentation software is a category of application software that is specifically designed to allow you to display slides using a computer during a presentation. Some of very popular presentation software includes Microsoft PowerPoint, Google slides, and LibreOffice Impress. Presentations consist of a number of individual pages or ***slides***. Each slide may contain text, graphics, sound, movies and other objects that can be freely arranged. In this section, you will learn about the presentation environment using Microsoft PowerPoint.

3.4.1 Opening PowerPoint

The most common choices for opening a presentation after launching PowerPoint application are:

- **New -** allows you to open a **blank presentation** or you may choose from options of **Templates** and **Themes**.
- **Open -** lets you navigate to an existing file to view and/or modify a presentation that has already been created.
- **Recent -** displays a list of your most recently created presentations and their file locations.

To open a PowerPoint 2016 presentation, click on the File tab in the upper left corner (See Figure 3.54).

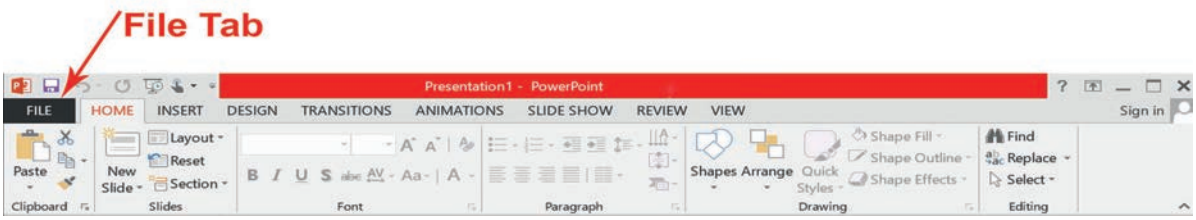


Figure 3.53 Click the file tab

To create a blank presentation, Select New, choose Blank presentation and click on the Create icon.

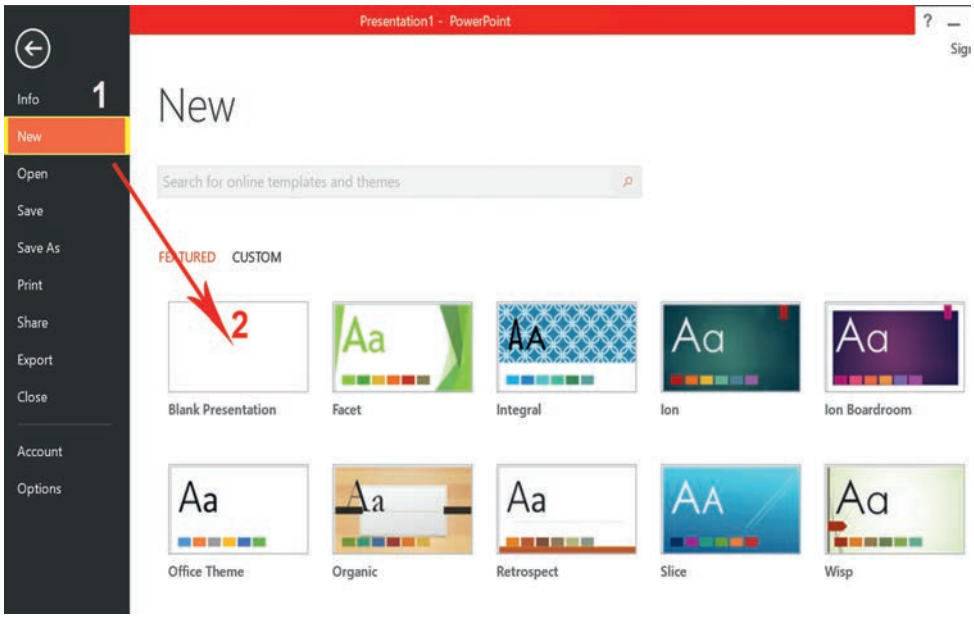


Figure 3.54 PowerPoint file menu

3.4.2 Adding PowerPoint Slides

When we click a blank presentation, PowerPoint will open a presentation with a Title Slide. Once the Title Slide is open, you will see a slide with Click to Add Title and Click to Add Subtitle placeholder text for a title and a subtitle. Click inside the placeholder box and the box will become empty and then start typing to add the title. If you want to add a subtitle, click and type inside the smaller placeholder.

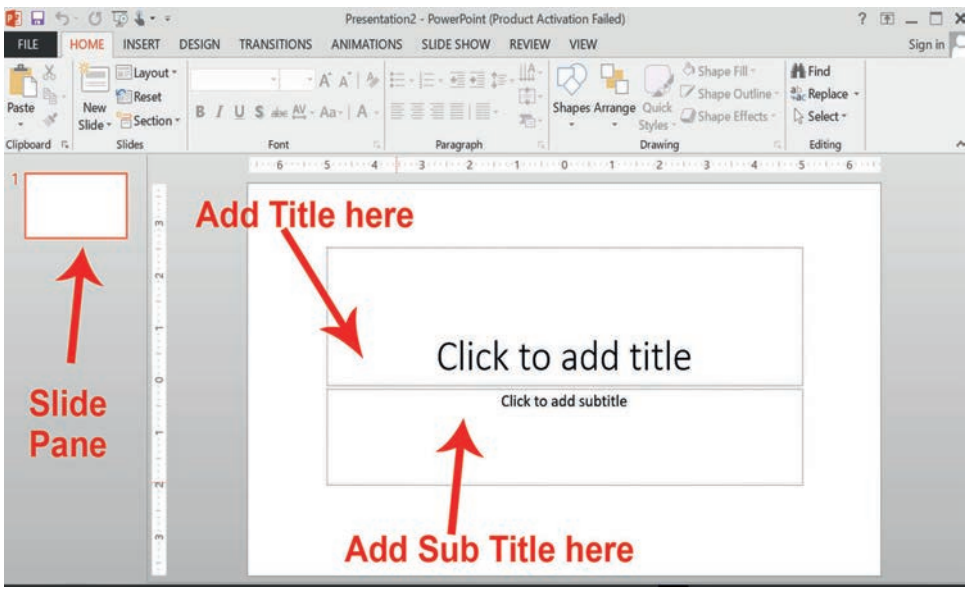


Figure 3.55 Blank presentation

To add a new slide, make sure that you are on the Home tab. The New Slide button of the Home tab will add slides to your presentation.

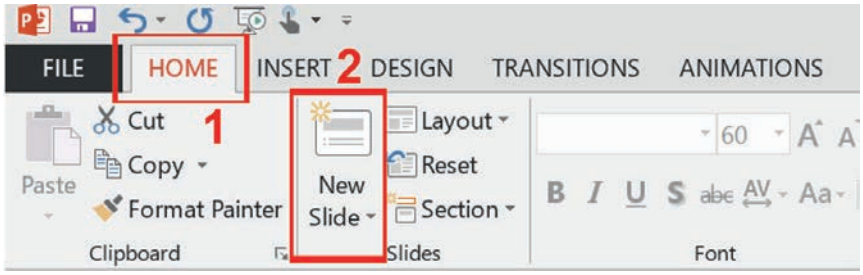


Figure 3.56 PowerPoint new slide button

The **New Slide** button has two parts.

- Clicking on the top part will automatically insert a new slide with default layout. 
- Clicking on the bottom will give you a choice of layouts. You can choose which layout you want for your next slide. Select a slide layout by clicking on its image in the **Office Theme** gallery. 

Tip
To insert new slide page, you can use ***Ctrl + M*** short cut keys.

3.4.3 Slide Layouts

The slide layout in PowerPoint is the arrangement of all the items that make up your slide, such as title, graphics or text boxes. There are several standard slide layouts to choose from when adding new slides. To change slide layout, follow the steps listed below.

1. A unique layout can be chosen by clicking on the bottom half of the New Slide button in the Home tab.
2. When the layout gallery opens, click on the style you want and a new slide with that layout will appear in your presentation. Each layout caption describes the layout type. Content can be texts, tables, charts, graphics, pictures, clip arts or videos.
3. If you decide later that the layout you chose does not work well for a particular slide, select the slide by clicking on it in the Thumbnail pane. Next, click on

the Layout button in the Slides group of the home tab. Click on a new layout and it will change the layout of the slide.

a)

b)

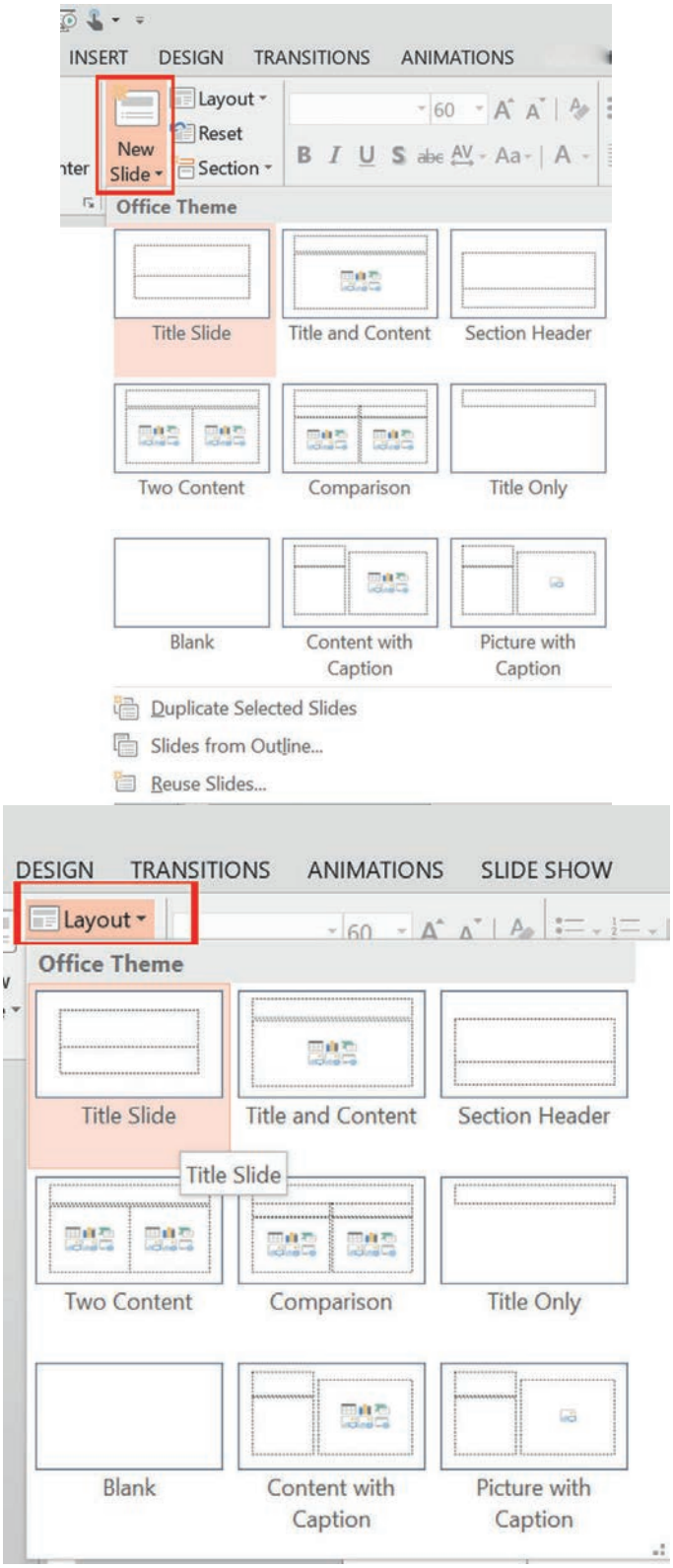


Figure 3.57 a) Slide layouts b)Slide layouts button

3.4.4 Applying a Theme

Once a new presentation has been created, a design or a color scheme can be added. Remember to use color carefully to enhance your presentation, not to detract from it. You need to maintain good contrast between the background color and the text color. Consider using a light colored background and dark text or vice versa, but avoid busy backgrounds and primary colors. Use sans serif fonts like Arial, Calibri and Helvetica for titles and size them between 44 and 60 points. Sub-headings should be between 32 to 40 points, and body text between 18 to 32 points. Try not to use more than two fonts.

PowerPoint has many preset designs and themes including complimentary colors and fonts. To add a theme to a presentation, follow the steps below.

1. Go to the Design tab in the ribbon. There are several themes immediately available.
2. To use one of the built-in themes, just click on its thumbnail.

a)

b)

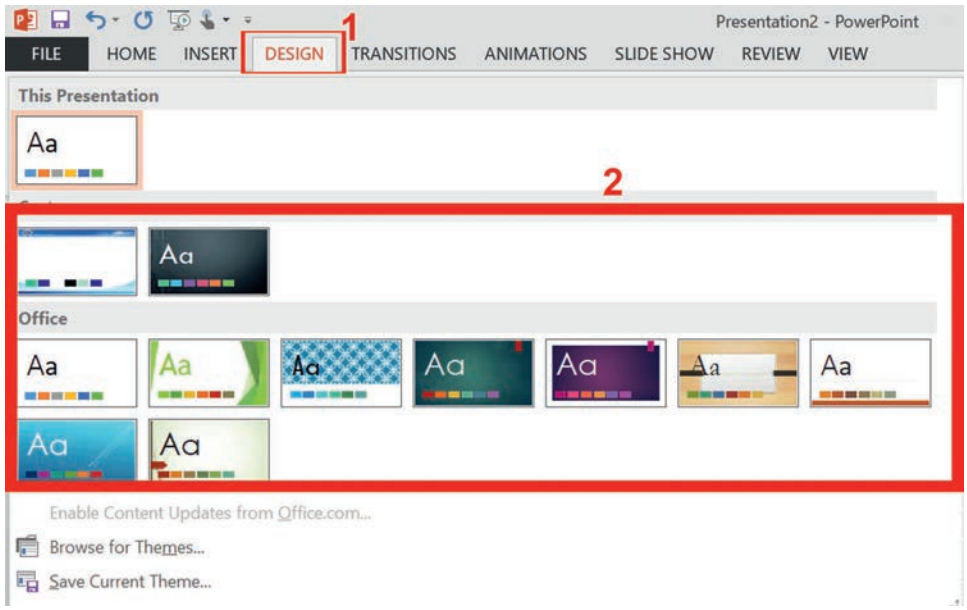


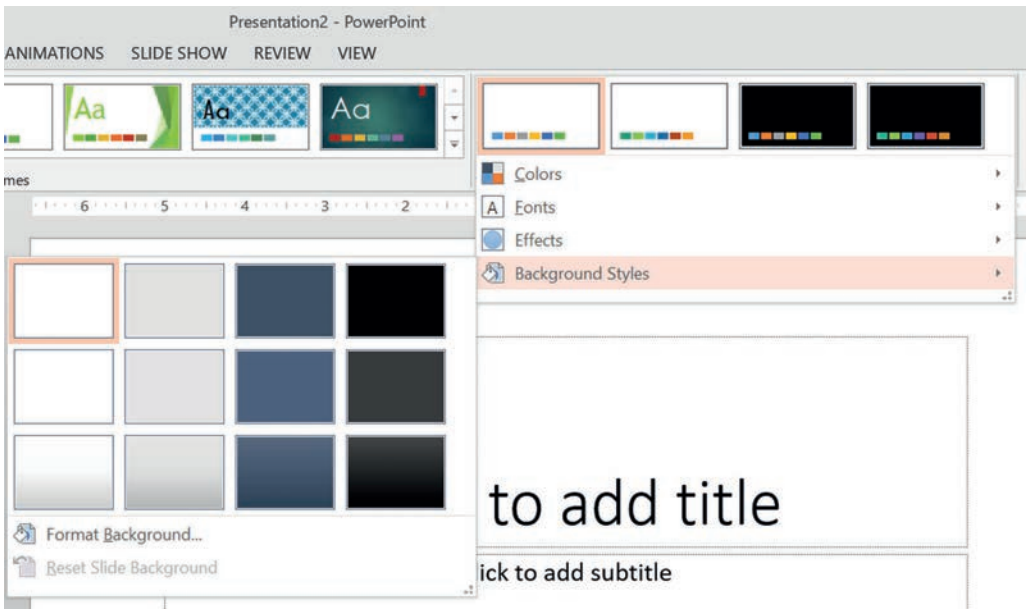
Figure 3.58 a) Powerpoint themes b) More PowerPoint themes

3. On the right side of the Theme thumbnails, there is a scroll bar and an Arrow Down button, which will offer more designs, as seen in Figure 3.57(b) above. If you are online, you can get more themes from Microsoft Office Online.

3.4.5 Changing Slide Backgrounds

If you do not want to use a theme, you can add background styles. From this selection, you can add some preset background styles that change according to the colors you have chosen.

a)



b)

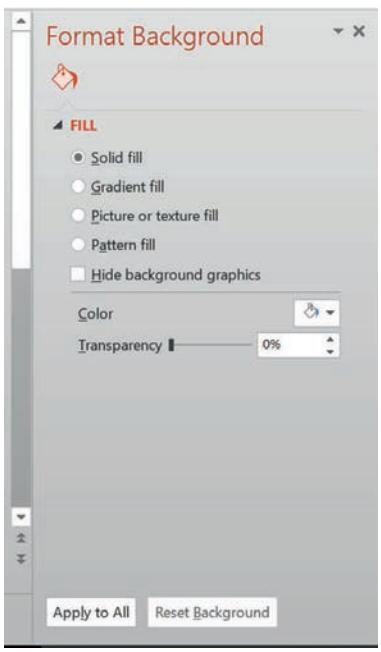


Figure 3.59 a) PowerPoint background styles b) Format Background dialog box

Using the **Format Background** feature, you can choose fill colors, gradients, transparencies, textures or pictures for your background. When you have desired background fill effect, select **Close** to apply it to the selected slide or choose **Apply to All** to add the background to all of the slides in the presentation.

Designs can be added to all of the slides or to selected slides. To select multiple slides, click on a slide in the **Thumbnail** pane of the navigation bar and then hold down the control key and click on any other slides you want to apply the design to.

3.4.6 Formatting Bulleted Lists

In PowerPoint, you can easily modify a slide's default bulleted list. To do this, we follow the steps given hereunder.

1. Click inside the text box.
2. The Format tab will automatically be highlighted.
3. Click on the drop down triangle next to the Bullets button in the Paragraph group.
4. From the **Bullets and Numbering** menu, you can make various changes to your list like:
   - The bullet size relative to the text
   - The color of the bullet
   - The shape of the bullet using either picture or character.
5. If you want to adjust line spacing between paragraphs or lists, you can do this through the **Paragraph** group tools by clicking the **Line Spacing** button and selecting **Line Spacing Options**.
6. Indents and Spacing controls will open in a separate dialog box.

3.4.7 Adding Content

Text is the default content of the slide below. The format for the default text is a bulleted list. To add text, click and begin typing. To add other content, follow the steps stated below.

1. Click on the icon within the content group on the new slide.
2. Each icon will open the appropriate dialog box or task pane in the **Drawing Tools** contextual tab.

3. Clicking on an icon will open the associated dialog box.

   Note that these icons, as well as several other insertion options, are also displayed in the Insert tab on the ribbon.

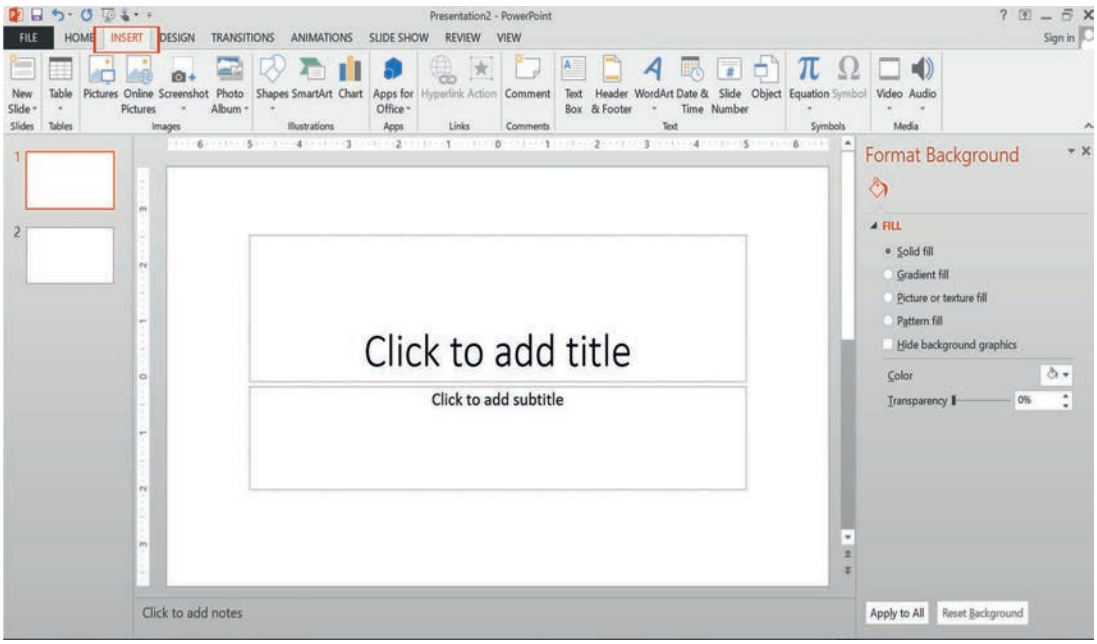
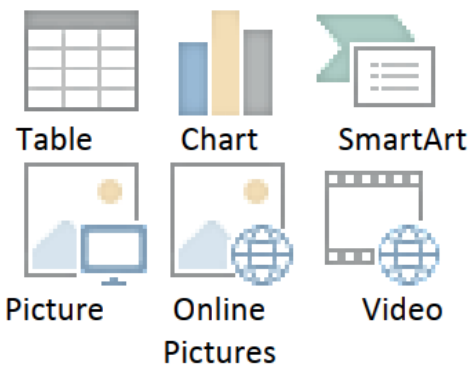


Figure 3.60: Add contents to blank presentation

The following icons represent the six standard graphical elements that you might want to insert in PowerPoint. These are:

- Table
- Chart
- SmartArt
- Pictures
- Online Pictures
- Video



a. Inserting Tables in PowerPoint (PPT)

1. Set the number of columns and rows as needed in the Insert Table dialog box and click OK. Methods for editing the design and the layout of your table are located on the Table Tools contextual tab.

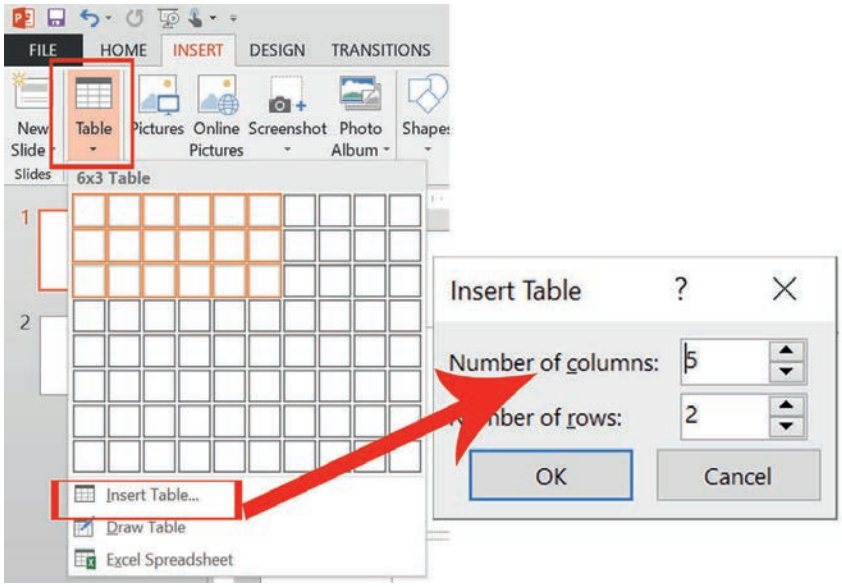


Figure 3.61 Insert table icon

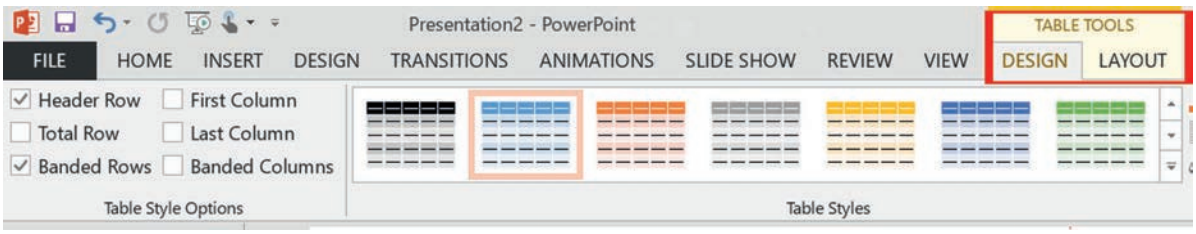


Figure 3.62 Table tools

b. Inserting Charts in PPT

1. Select the type of chart you want and click OK.
2. Once inserted into the slide, you can click on the chart to activate the Chart Tools contextual tab, where you will find tools for editing chart data and changing layouts and styles.

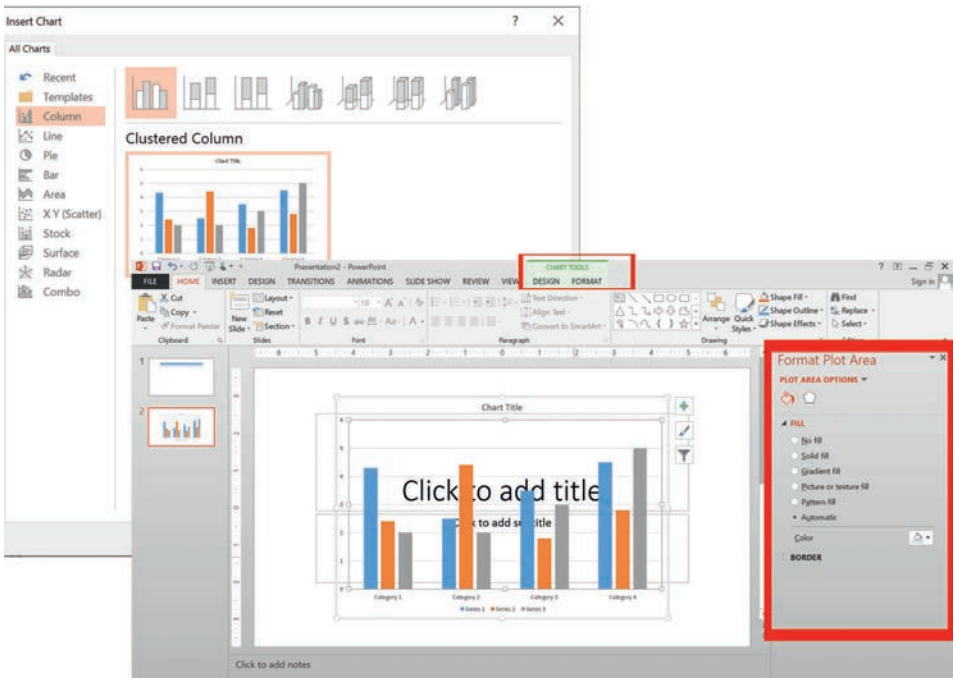


Figure 3.63 Charts

c. Inserting SmartArt Graphics in PPT

SmartArt graphics are shapes that are designed to represent the relationship between things or people. You might use SmartArt for an organizational chart or a timeline. SmartArt styles and layouts can be formatted in the SmartArt Tools contextual tab.

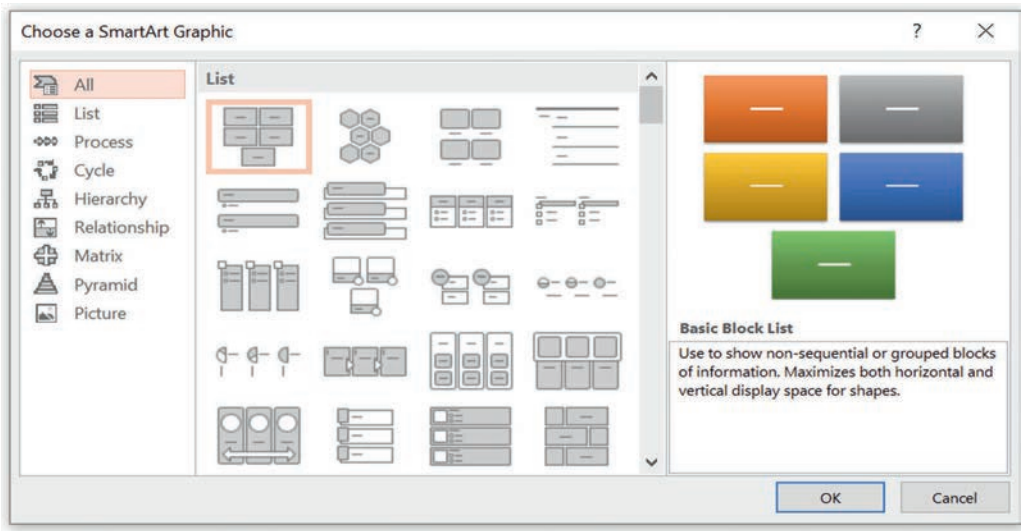


Figure 3.64 SmartArt graphics

d. Inserting Pictures in PPT

Rather than using too much text on your slides, consider using pictures along with text as a more interesting way to communicate your ideas. You can put lots of text into the Notes Section and refer to that as you are speaking.

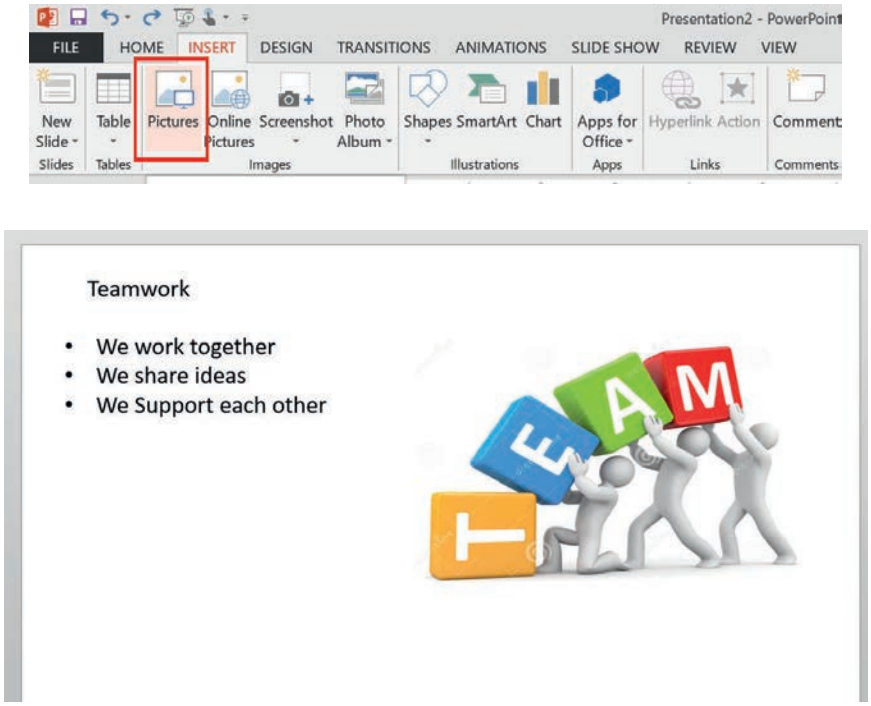


Figure 3.65 Inserting pictures from this PC

e. Inserting Online Pictures in PPT

Online pictures have replaced the old Clip Art. When you click on the Online Pictures button, you get a search box. You can type in a word or phrase and press enter to search for a specific image or you can click on the Bing Image Search icon to browse categories.

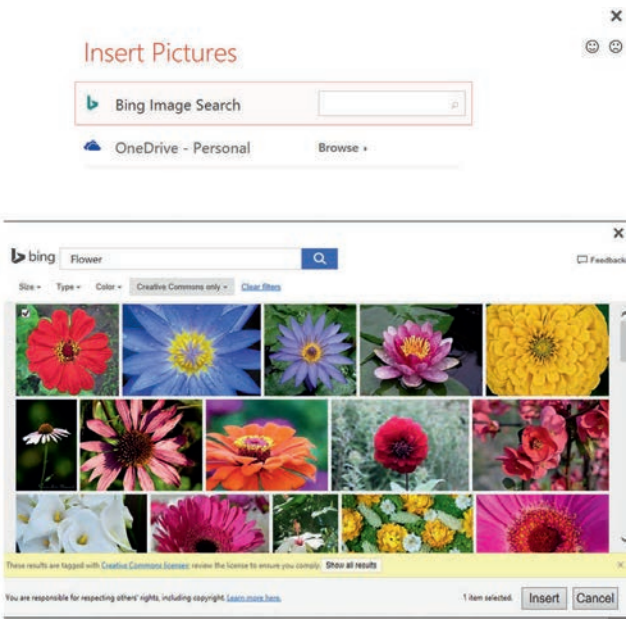


Figure 3.66 Inserting onlinie pictures

f. Inserting Videos/Media in PPT

You can embed a video or link to a video from your presentation. If you want to limit the size of your file, you can link to a video file on your local drive or to a video file that you uploaded to a web site such as YouTube.

All options to insert video or audio are located on the **Insert** tab, in the **Media** group.

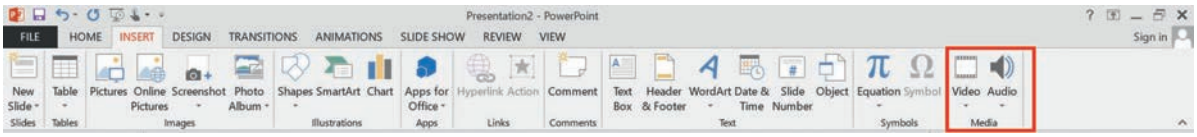


Figure 3.67 Inserting video/media

Practical Exercise 3.7

1. Prepare presentation slides using any available presentation software on one of the following topics for a group presentation in class.
   a. Road traffic and safety
   b. Local tourism resource
   c. Child trafficking
   d. Consumer protection

(Hint: You can use Internet resource, books from library, your family or any available resource as source of information). As a rule of thumb, you have to acknowledge or site the source of information in your presentation.)

2. Do the following tasks while you prepare your presentation on one of the above titles you selected.
   a. Change the first slide's layout to "Title Slide Header" and the other slide "title and content" layout.
   b. Insert a title and text in the first slide.
   c. Your slide 2 should contain your presentation outline.
   d. Change the theme to Damask.
   e. Change the background color to white (style 1).
   f. Format the bullet list as Arrow Bullets.
   g. Download and insert an image that relates to your title.
   h. Create a folder in the Documents with Presentation Project file name and save the presentation in the folder you created.

3.4.8 Viewing Presentations

There are four different ways to view your presentation in PowerPoint: normal, slide sorter, notes page and reading views. The views can be accessed using the buttons in the status bar or the View Tab on the ribbon.

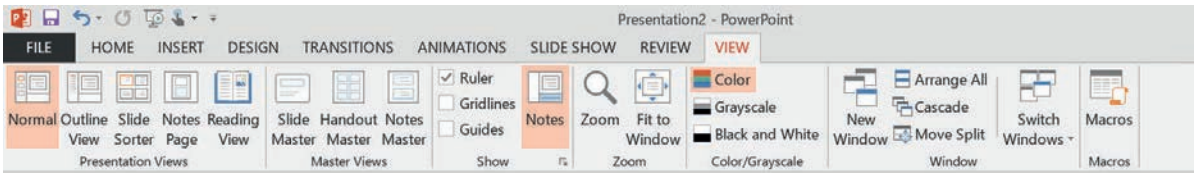


Figure 3.68 View menu

- **Normal View** displays a single slide as it appears in the presentation as well as thumbnails and an outline tab, where you can organize the structure. Speaker notes can be added in the bottom section of this window. This view is used to create and edit slides.
- **Slide Sorter View** shows thumbnails of your slides. From this view you can reorder slides by dragging and dropping them, or you can set the timing for the slide show. You can also hide slides in this view. Hiding a slide will keep it in the file, but it will not be shown when you display the presentation.
- **Notes Page View** allows the speaker to create notes to use during a presentation. Each page corresponds to one slide. These can be printed to assist the presenter during the presentation. Use this view when you are composing speaking topics.
- **Reading View/Slide Show View** displays the slides as an audience will see them. Use the arrows and icons on the lower right side of the **Status Bar** to advance slides or switch views.

  Use the Esc key to return to normal view.

Slide Show Tab

The Slide Show Tab allows you to review the slide show from the beginning to the end or from the current (active) slide. You can also control how the show will be presented and rehearse timings in the Set up Slide Show drop down box.

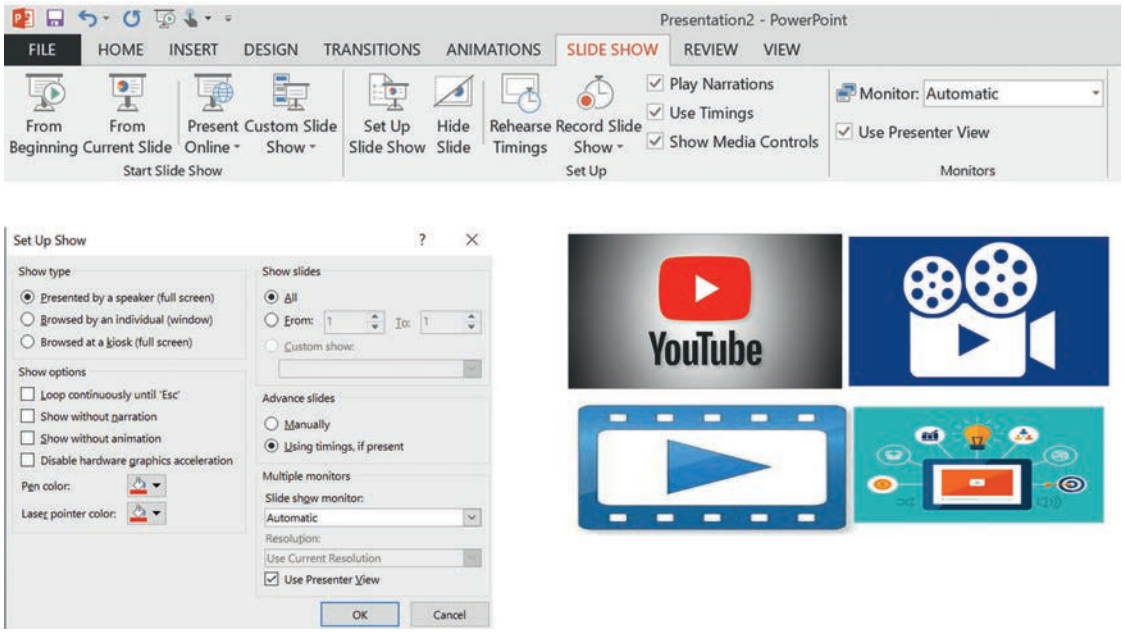


Figure 3.69 Slide Show menu

3.4.9 Changing Order of Slides in Presentation

In the slide sorter view, click and hold down the left mouse button and drag the slide to a new location. You will see a line where the slide will be placed when you release the mouse button. This can also be done in the Thumbnail pane area of the Navigation bar.

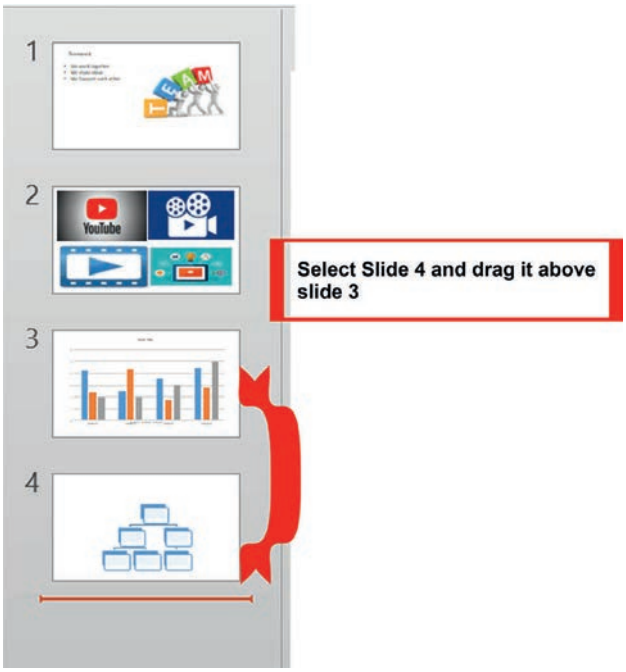


Figure 3.70 Changing slide order

Mini Project

Prepare a Presentation on Tourism Resources of Ethiopia following the instructions given below.

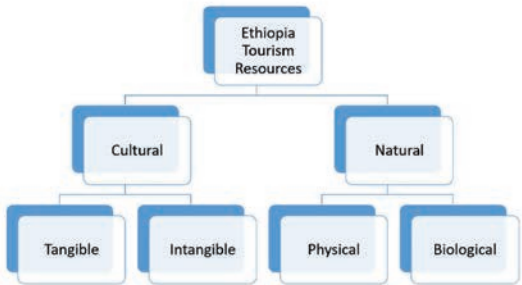
1. Launch New Microsoft Power Point.
2. Prepare a presentation on Tourism Resources of Ethiopia and save it in a file (See Figure 3.70 below).

The presentation should have the following.

- Slide Layout: two Contents - one content text description and the other picture
- Theme: Integral
- Background Style: Style-2
- Bulleted List
- Smart Art Graphics: use covert bulleted list as Vertical Bulleted List

3. Click Slide Show tab.
4. Click the left mouse button or press the spacebar/Enter key to view the next slide.

   All the slides in the presentation are shown in Figure 3.70.
5. Press Esc to exit the slide show.



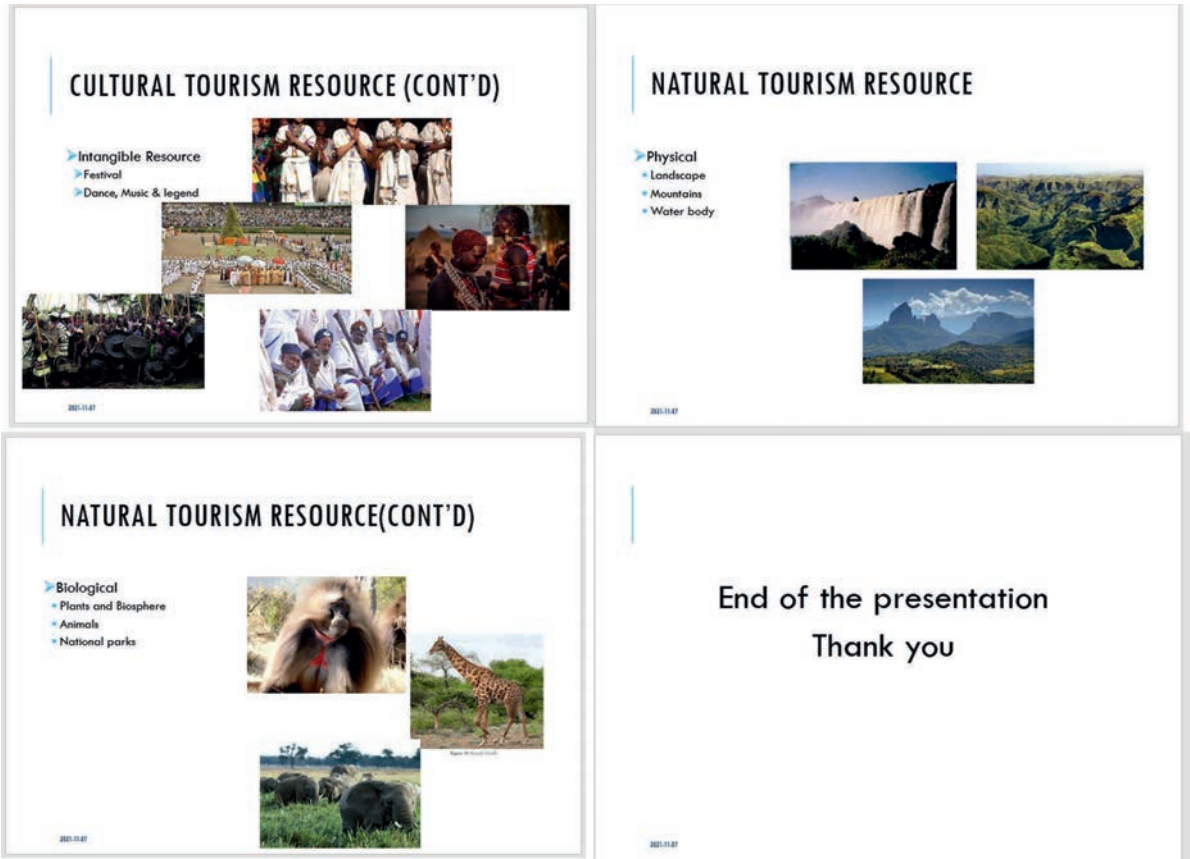


Figure 3.71 Sample presentation slides

KEY CONCEPTS

- Presentation software is application software that enables you to organize and present information.
- Microsoft PowerPoint is one of presentation software.
- In Microsoft PowerPoint, you can manage the layout of slide, apply theme, change slide background, and add tables, charts, SmartArts, pictures, online picturesand video contents.

3.5 Unit Summary

In this unit, you extended your knowledge of application software usage you learned in grades 7 and 8. Application software is a type of software used directly by a user. Some of mostly used application software include Word processing, presentation software, spreadsheet software, desktop publishing software and

database management software. The main points covered under this unit are summarized as follows.

- Word processing application software is used to process, create, edit, format, copy, save and print document including, but not limited to, reports, letters, memos, newsletters and brochures.
- A file created using Microsoft Office Word is known as a document.
- Formatting a paragraph means changing the appearance of the paragraph, which includes indenting, setting alignment, making a paragraph bulleted, numbered and multilevel lists, and inserting space between lines and paragraphs.
- To format a paragraph, you can use a command found in paragraph section of **Home** tab.
- Page break is a location in a document where one page ends and a new page begins and there are two types of page break, namely manual and automatic.
- Automatic page break is done automatically by the software program when it reaches to the end of the page.
- A manual page break is done when the part of a paragraph extends more than a page and, the document editor wants it to be in the same page.
- Page numbering is used to identify each page in a document, and a document can have more than one page numbering styles, especially if it has more than one section such as cover page, contents and body of the document.
- Headers and Footers contain additional information about the document and they will appear by default in each of the documents at the top and the bottom part of a document respectively.
- To manipulate tabular data and calculation, the best application software to be used is Microsoft Office Excel.
- MS Excel file created for managing data in tabular form is called worksheet.

- Excel differentiates data and formula by equal sign, i.e. if a data has equal sign, then the data is a formula.
- Excel formula can contain relative or absolute cell reference which identifies a cell's location absolutely without change and relative change according to the locations of the formula respectively.
- Presentation software is a tool used to create visual presentation.
- A presentation package helps both the speaker and the participant with access to his/her ideas and visual information respectively.
- After launching the PowerPoint application, we can create a PowerPoint using new option of file tab, open option of file tab or using recent that displays a list of recently created presentations.

3.6 Unit Review Exercise

Part I: Write whether the following statements are true or false.

1. Headers and footers in a document contain additional information about the document such as title, page number and author.
2. Absolute cell reference cannot be copied to other cells.
3. Relative cell reference is the same as absolute cell reference when they are copied.
4. Slide layout is an arrangement of contents on the slide and it is possible to create one's own layout.
5. Page break is dividing a single Word document page in to multiple columns.
6. Pressing the Enter key indents the first line of a paragraph.
7. You can use the ruler to set tabs.
8. Horizontal alignment refers to the position of text with regard to the top and bottom margins of a document.
9. Indents can be changed using the markers found on the ruler.
10. To allow Excel to distinguish formulas from data, all formulas begin with an equal sign (=).

Part II: Choose the correct answer among the alternatives provided.

1. Which one of the following activities is formatting a paragraph?

   A. Setting indents

   B. Aligning texts

   C. Creating bulleted lists

   D. All of the above.

2. To create a new paragraph in MS Word document, which of the following keyboard keys can be used?

   A. Tab

   B. Enter

   C. Alt

   D. Alt+@

   E. Shift

3. What is the name of the file created on MS Excel to manage data in tabular form by managing them into various cells?

   A. Document

   B. Docsheet

   C. Workspace

   D. Worksheet

   E. Spreadsheet

4. Which keyboard keys can be used to align the text to the left side of the document in MS Word?

   A. Alt+L

   B. Alt+Spacebar

   C. Ctrl+L

   D. Ctrl+Spacebar

   E. Tab+L

5. Which of the following is not a view format for a PowerPoint presentation?

   A. Slide View

   B. Outline View

   C. Slide Show View

   D. Presentation View

   E. All of the above.

6. Which of the following is tabular data processing software?

   A. Microsoft Word

   B. Microsoft Excel

   C. Microsoft Internet Explorer

   D. Microsoft File Explorer

7. To move the text to the left side of the page, you would use_____.

   A. Align left

   B. Align over one space

   C. Align right

   D. Align top

8. _____ is an area in the bottom margin of each page in a document where you can insert text or graphics.

   A. Headnote

   B. Top margin

   C. Footer

   D. Header

9. Which of the following is added to define bullets?

   A. Symbol

   B. Box

   C. Picture

   D. All of the above.

10. Which of the following is not an arithmetic operator?

    A. +

    B. −

    C. *

    D.]

11. In Excel formula, what is the symbol / used for?

    A. Division

    B. Multiplying

    C. Adding

    D. Subtracting

12. Which of the following is an example of an absolute cell reference?

    A. A9

    B. A$9

    C. A9

    D. A9:E9

13. If the cell A1 has the formula =2*6, them what is displayed in the cell and formula bar respectively?

    A. =2*6, 12

    B. 8, =2*6

    C. 12, =2*6

    D. -4, -4

14. Which short cut key is used to change relative cell reference to absolute cell reference?

    A. Ctrl + S

    B. F4

    C. Alt + F3

    D. F2

15. Which short cut is used to play/view your work?

A. F1

B. F2

C. F5

D. F12

Part III: Fill in the blank spaces.

1. _____ is a presentation program.
2. _____is the default PowerPoint standard layout.
3. The basic unit of any PowerPoint presentation is_____ .
4. _____and _____contain additional information about a Word document.
5. _____is used to copy the formula to the other cells.
6. A PowerPoint presentation consists of _____.

Part IV: Match the following items in Column A with Column B.

A		B	
1.	Insert New Slide page	A.	Page Break
2.	Change according to cell location	B.	Ctrl + M
3.	Fill handle	C.	B9
4.	Displays result of a formula	D.	Header
5.	Appears at the top of a document page	E.	Line Spacing
6.	A document's location where new page begins	F.	Footer
7.	Sets spacing between paragraphs	G.	Paragraph Spacing
8.	Easy method for creating multilevel list	H.	Used to copy formula
9.	Indent First line of paragraph(s)	I.	Formula Bar
10.	Paragraph Section	J.	First Line Indent Marker
		K.	Active cell
		L.	Tab Key
		M.	Ruler
		N.	Contains Paragraph formatting commands
		O.	B9

Part V: Provide clear and precise responses to the following questions.

1. What are the commonly used MS Office tools?
2. What is Word Processor?
3. What is the insertion point and how is it moved?
4. List the steps required to insert a formula that adds the value of two cells in Excel sheet, say the value of A9 and A10 on Cell A11?
5. What is the appropriate paragraph alignment used for documents like your grade 9 IT Textbook? Discuss each of the four alignments: right, left, center and justify.
6. List the steps required to display a presentation?
7. List all types of contents that can be included in PowerPoint slide (s)?
8. Write the steps to apply themes to a presentation?
9. Explain Slide Layout and write the steps to change a single presentation slide layout?
10. Write simple Excel formula that constitutes mathematical operation and mixture of relative and absolute cell reference.

Part VI: Project Work

Go to your school Finance Office to observe the payroll structure and prepare your own payroll for your teachers using Microsoft Excel application.

UNIT

4 IMAGE PROCESSING AND MULTIMEDIA

UNIT OUTCOMES

At the end of this unit, learners will be able to:

- Describe image processing
- Edit images captured from different sources such as digital camera.
- Use image software to create, import and save image files.
- Use image software to resize, cut and edit images.

UNIT OVERVIEW

In History, people use various ways to communication and convey ideas. Multimedia is a form of communication that combines different content forms such as text, audio, image, animation or video into a single interactive presentation. The use of multimedia to communicate ideas begins with ***newspapers***, which is the first mass communication medium, using ***text***, ***graphics*** and ***images***. Following this, ***radio*** and ***television*** become major media for audio and video broadcasting respectively. Therefore, multimedia is like a vehicle which can help you transfer information from a source area to its destination.

Image processing is a method to perform some operations on an image in order to get an enhanced image or extract some useful information from it. You can use different application software such as commercial adobe Photoshop and free Gimp to process images.

In this unit, we will discuss the basics of image processing such as image capturing, cropping, resizing, correcting and sharpening. We will end the unit with a practical section introducing adobe Photoshop facilities for basic image processing such as cropping, resizing, correction and sharpening.

4.1 Image

Brainstorming

1. How can image be made and used as communication?
2. Discuss the three basic colours?
3. Discuss the graphical elements that you see in the logo of Ministry of Education (MoE).

An image is a visual representation of a person, an animal or some thing in the form of photograph, paint, sculptured or otherwise made visible. Examples of image are:

- A painting
- A picture taken with a camera
- A picture that has been created or copied and stored in electronic form
- A scanned picture through image scanner

Figure 4.1 Images

4.1.1 Digital Images

As you have learned in grades 7 and 8, a computer is an electronic device which accepts input data such as numbers, text, and audio and video images, processes the data digitally to produce information, and stores the data digitally for later use. You also knows that computers do everything by processing series of zeros and ones (0's and 1's) called binary **digits (*bits*),** and the basic language of computers is binary code.

Whether you take a picture with a digital camera or use a scanner to bring a

photo or another artwork into Photoshop, you are digitizing the image. Therefore, digital image is an image or picture that is represented digitally, i.e. in groups of combinations bits (0 or 1) or specifically called ***pixels***. A pixel is the smallest element of an image.

4.1.2 Digital Image Processing

Image processing is a computational technique for analyzing, enhancing, compressing, reconstructing and generally performing some operations on an image. Digital image processing techniques help us in manipulation of the digital images through the use of computers to enhance the quality of the image and improve pictorial information for human perception, i.e. enhancing the quality of the image so that the image will have a better look.

Digital image processing starts with importing, in which an image is captured through scanner or digital camera; analysis and manipulation of the image is accomplished using various specialized software application and output (e.g. printer or monitor).

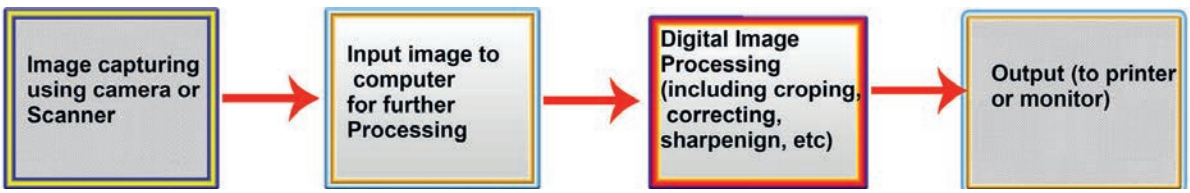


Figure 4.2 Digital image processing

Activity 4.1

Capture images from different sources to highlight the impact of environmental damage on Ethiopian society. You have to cite their sources as an acknowledgement if you take images from Internet or other sources.

KEY CONCEPTS

- Image is a representation of something.
- Digital image is an image which is stored in a computer.
- Digital image processing is a process of enhancing image and extracting useful information from it.

4.2 Multimedia Production Planning Strategies

Brainstorming
How do you think is a multimedia produced?

Multimedia is the field concerned with the use of a computer to present, store, transmit and combine text, graphics, audio and video with links and tools that let the user navigate, interact, create and communicate. Before producing multimedia product, whether it is animation, film, movie or book, we should use a planning strategy such as a storyboard, which clearly expresses how the story will flow in multimedia product.

Storyboard is a graphic layout that sequences illustrations and images with the purpose of telling a story visually. Film makers and video creators use storyboards to transfer ideas from their mind to the screen. Creating an effective storyboard requires skill, but you can gain some pro tips from storyboard examples.

To create a storyboard, you can use different software or rough sketch using a paper and pencil.

Developing Storyboard

Storyboarding refers to the process of creating a sequence of screens to provide an overview of the project, demonstrate the arrangement and functionality of the program elements. It helps us to delineate the program's navigation scheme. Multimedia storyboard can include elements of video, sketch, text, audio, photos and even physical prototypes used for the purpose of ***pre-visualization.*** It is a visual representation of how a story will play out, ***scene by scene***. See sample animated storyboard for children in Figure 4.3.

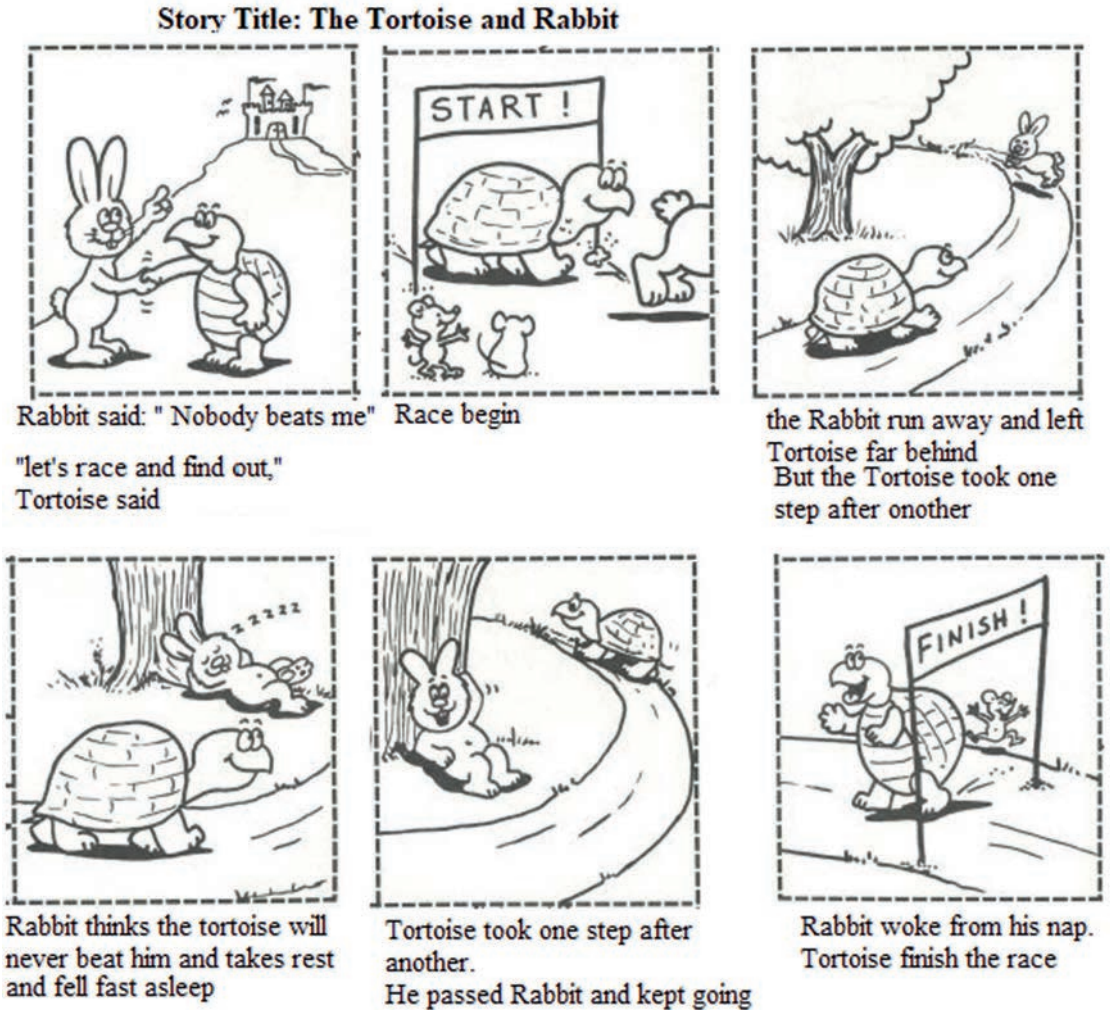


Figure 4.3 Sample video story board for kids

Practical Exercise 4.1

Prepare a storyboard for a video that teaches English Alphabet to Ethiopian KG students.

(Hint: Use chart board, PowerPoint or A3 paper to create a storyboard for specified video.)

4.3 Using Image Processing Software

Brainstorming

Have you ever used mobile application software for editing photos such as cropping, resizing, rotating, adjusting colour, adjusting saturation, adjusting light and clarity in your own or parent's mobile phone? List kinds of software that enable you to do this in the mobile and discuss with your classmates.

Image processing software is the software that is designed to organize, retouch and edit images that have been saved on CDs and DVDs, and scanned in or transferred directly from the camera to PC. This software allows you to edit and crop out unwanted "strange" images like the image with red-eye effect and the image in which one person's head is put on the other's body. Image processing software can be commercial and free. Some of the useful image processing application software kinds are Photoshop, Ms-paint, Gimp, Paint 3D, Photo styler, Photo editor and photo explosion.

Photoshop is a general-purpose application designed to work on any raster-based (made up of dots or pixels) image and perform any number of included manipulations. It is one of the most popular image processing software packages available today. The software provides many image editing features for raster (pixel-based) images as well as vector graphics. Photoshop is used by photographers, graphic designers, video game artists, advertising and meme designers. Adobe Photoshop enables you to create website layouts and attractive graphic designs. What is more, using the same software, you can create posters, business cards, greeting cards and many others. Adobe Photoshop is essential in both image editing and graphic design and that is the reason why you need to learn it. In this lesson, you will learn how to crop, resize, correct and sharpen/blur your images using Adobe Photoshop CC 2021 or later.

4.3.1 Launching Image Editing Software

Image editing software mentioned in the above section can be launched by the same mechanism you follow to launch other application software. For example, when you launch photoshop you will get similar screen shown in Figure 4.4 (a).

a)

b)

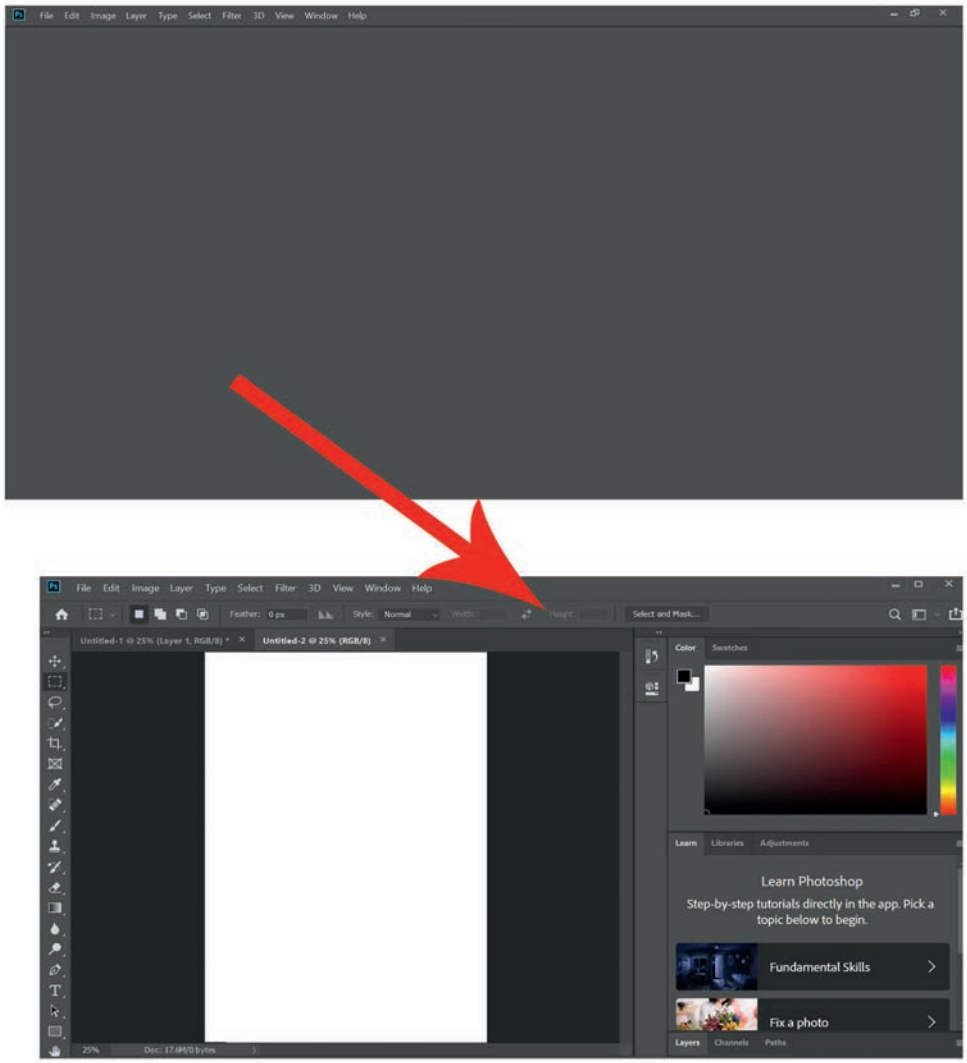


Figure 4.4 a) Photoshop Home screen b) Photoshop Workspace

After Launching an image editing application, you can create a new image or open an existing one from file menu. For example, to create a new image using Photoshop, you can use the following procedure.

1. Click the Create New button on the **Home** screen to start a new project (See Figure 4.4 (a).
2. Then select the template from the alternatives found (See Figure 4.5).
3. After selecting the template, adjust the properties at the right side by starting from any of your choice, the **project name**, **width**, **height**, **orientation**, **resolution** or **color mode.**
4. **Click on Create** to open a new document and begin your work on it.

5. The new project work will be opened (See Figure 4.6) on the workspace, which is completely black and white. It is called **Canvas**, which is full of a pixel that you can change.

Image resolution is typically described in ***Pixel per Inch (PPI)***, which refers to how many pixels are displayed per inch of an image. Higher resolutions mean that there are more pixels per inch (PPI), resulting in more pixel information and creating a high-quality, crisp image.

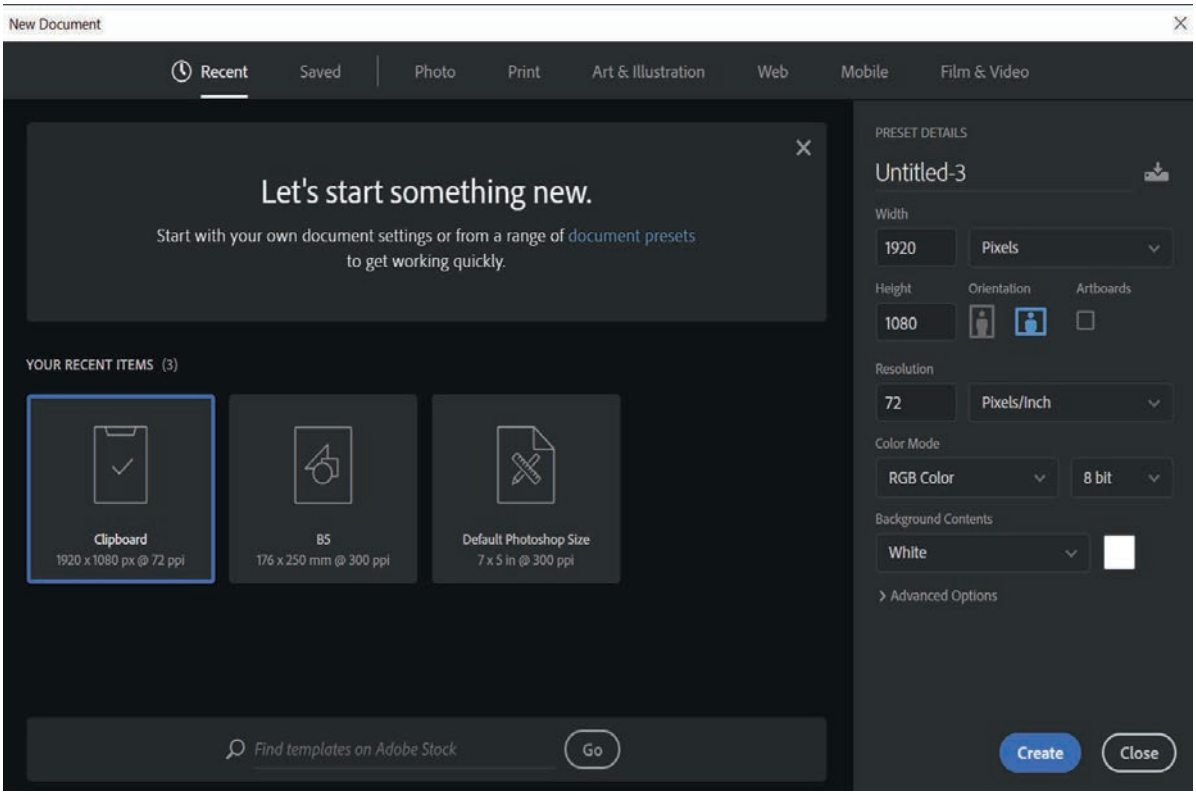


Figure 4.5 Create new document

4.3.2 Anatomy of Image Editing Software Main Interface

Immediately after you have launched image editing software, you will notice the menu bar at the top side of the program and you will see a sidebar in which the main tools are placed at the left side. At the right side, there are layer and color tools you may use to make adjustments. For example, Figure 4.6 and Table 4.1 describes the main interface elements of Adobe Photoshop.

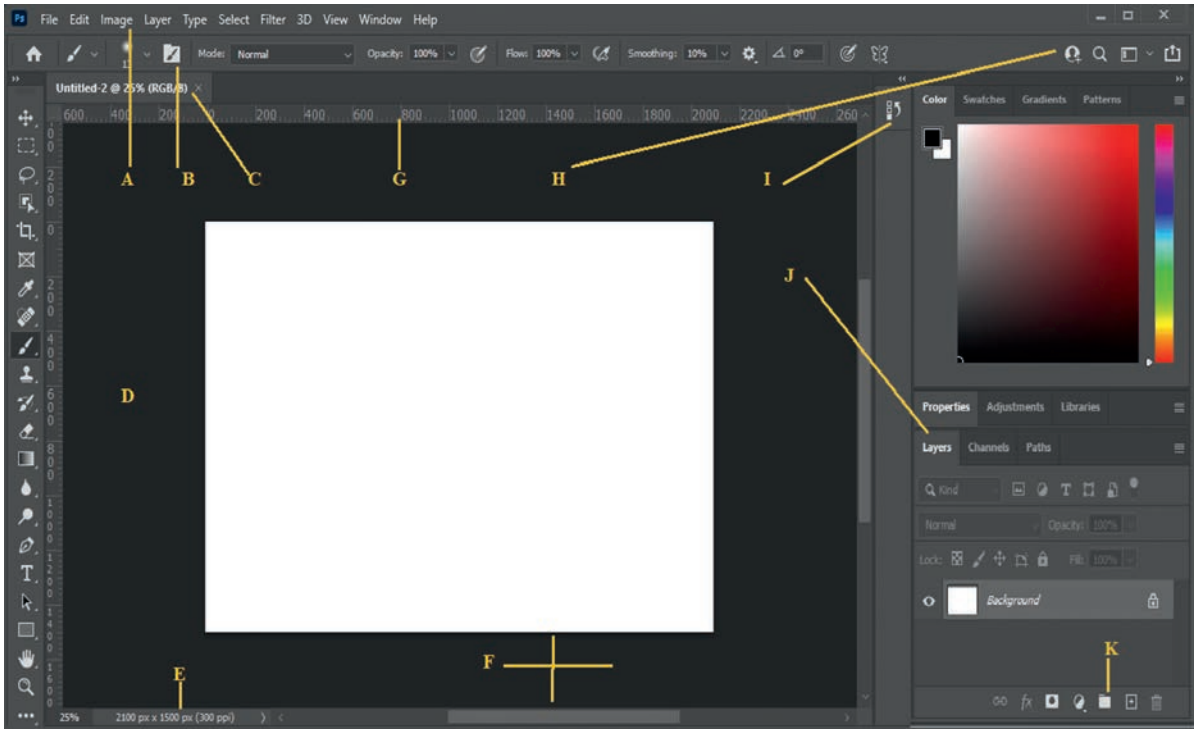


Figure 4.6 Adobe main interface

Table 4.1 Description of Adobe main interface components

Indicator Letters	Interface Element Name	Usage and Description
A	Menu Bar	This is an options menu bar.
B	Tool Options Bar	This is the bar that shows the available option which is attached to every tool selected. For intance, if you pick a brush tool, there will be some options such as size, softness and a lot more.
C	Document Window	Each document you open will have its separate bar that shows its identity, such as document name, current scaling and color space being in use.
D	Toolbar or Palette	This is the place to find the main editing tools. Once you click on an individual tool, it will show separate function you can do with it.
E	Document Details	This shows you the compressed and real size of your document.

F	Active Image	This represents the interface of a large area to work on your image with a darker background color.
G	Rulers	This is used to measure the exact position of your image and you can drag guidelines from here for text and layer line up.
H	Search and Share	A link to search for any content, amend the workspace arrangement and sharing your image on social media.
I	Palettes	There are various interchangeable palettes that you can select from the Window menu.
J	Layer Palette	This is an area of the current image layer you are working on. The layer at the top of the stack will be shown above those below.
K	Layer Option	It gives you the right to add effects, adjustments, layers style and other options that you can add to your currently active layers.

4.3.3 Image Editing Software Toolbox

Brainstorming
Can you locate main editing tools you use to edit image?

As shown in Figure 4.6 above, the left side box is the Photoshop toolbox. The toolbar appears to be single by default but you can make it double column by clicking on the **top double arrow**, which will make it to be expanded and shorter. Click the **double arrow** again to return it to the single column toolbar again (See Figure 4.7).

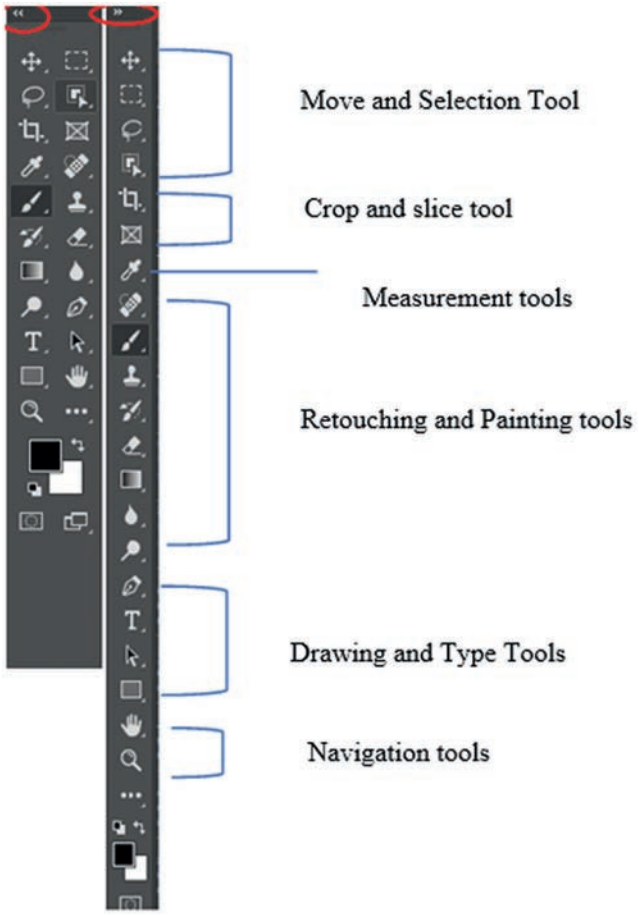


Figure 4.7 Single Column and Double Column Tool Box and their parts

NOTE

To see more option tools for a given tool, click the **Small Arrow** in the bottom right of tool icon; alternatively, **right click** on the default or the current tool in use and you will be able to see full tools available (See Figure 4.8 for Photoshop).

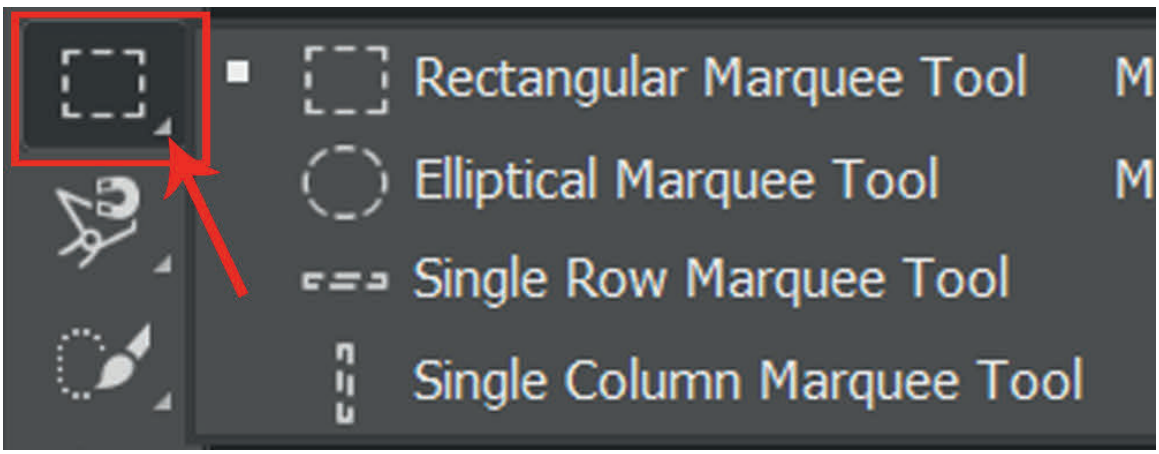


Figure 4.8 More Option tool

Tip

Hovering the mouse over the tool provides short description of the tool and usage video of the tool (See Figure 4.9).

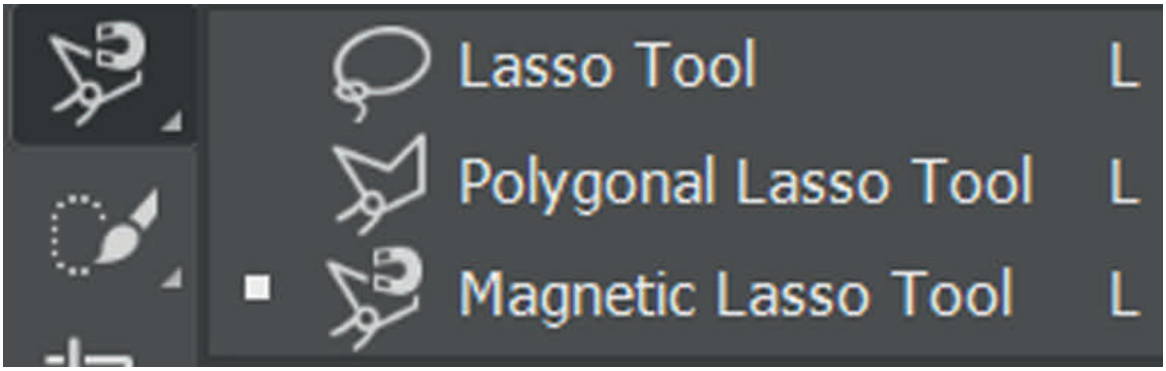


Figure 4.9 Hovering over the tool to see description and usage video

The following table (Table 4.2) describes each part of Photoshop toolbox elements.

Table 4.2 Photoshop toolbox elements description

a. Moving and Selection Tools

Buttons	Tools	Uses
	Move	It is used to moves layers, selections and guides within a Photoshop document by cicking the Small Arrow or right clicking on the tool you will be able to see the full available tools of move tool such as Artboard, Rectangular, Elliptical, Single row and single column Marquee.
	Lasso	It allows you to make free hand selections around the object. It consists of additional Polygonal, Magnetic lasso tools.
	Object Selection	It will select an object when you draw a rough selection around an object. It consists of additional Quick and Magic wand selection tool.

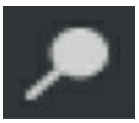
b. Crop and Slice Tools

Buttons	Tools	Uses
	Crop	It is used to crop an image to cut out or remove unwanted areas. It consists of additional Perspective crop, Slice and Slice Select crop tools.
	Frame	It allows you to place an image into rectangular or elliptical shapes.

c. Measurement Tools

Buttons	Tools	Uses
	Eyedropper	It samples the colors of an image. For a better representation of the sample area's color, you have to increase "Sample Size". It also consists of additional tools such as 3D Material, Eyedropper, Color, Sample, Ruler, Note and Count.

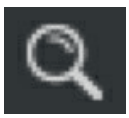
d. Retouching and Painting Tools

Buttons	Tools	Uses
	Spot Healing Brush	It removes blemishes and other minor problems area in an image quickly. It consists of additional tools, namely Healing Brush Tool, Patch, Content-Aware Move and Red Eye.
	Brush	It is used to paint-brush strokes on a layer or layer mask. It is referred to as a primary painting tool. It consists of additional tools, namely Pencil, Color Replacement and Mixer brush.
	Clone Stamp	It is the best basic of Photoshop retouching tools and used to sample pixels from one area of the image and paint them over pixels in another area. It consists of additional Pattern Stamp tool.
	History Brush	It restores part of an image to an earlier state and has Art History brush as additional tool.
	Eraser	It is used to erase pixels on a layer permanently. It can also paint in an earlier historical state. It has Background Eraser and Magic Eraser as additional tools.
	Gradient Tool	It is used to draw gradual blends between multiple colors with the Gradient Editor with which you can create and customize your gradient. It has Paint Bucket Tool and 3D Material Drop as additional tools.
	Blur	It simply blurs and softens areas you paint over with the tool. It has Sharpen Tool and Smudge tool as additional tools.
	Dodge	It is used to lighten an area of the image you paint over. It has Burn and Sponge as optional tools.

e. Drawing and Typing Tools

Buttons	Tools	Uses
	Pen	It lets you draw accurate shapes, vector, selection and paths. It has Freeform Pen, Curvature Pen, Add Anchor Point, Delete Anchor Point optional and Convert Point tools.
	Horizontal type	It is used to add standard types to your document. It has Vertical type, Vertical type Mask and Horizontal Type Mask optional tools.
	Path Selection	It is used to select and move an entire path at once and represented by black color. It has Direct Selection as optional tool.
	Rectangle	It draws rectangular paths, vector shapes or pixel shapes. Press and hold Shift, as you drag to set the shape to a perfect square. It has Rounded Rectangle, Ellipse, Triangle, Polygon, Line and Custom Shape as optional tools.

f. Navigation Tools

Buttons	Tools	Uses
	Hand	It can be used to click and drag an image around the screen to view different areas when zoomed in. It has Rotate View as optional tool.
	Zoom	Click on the image to zoom in a specific area. Press and hold Alt, and click with the zoom tool to zoom out.

4.3.4 Cropping Image

Brainstorming

Which tools are used for cropping image?

Cropping is one of the most basic editing techniques that are used to take a specific part of the image. It is the process of removing portions of a photo to create focus or strengthen the composition.

There are several ways to crop images. For example, in Adobe Photoshop you can use one of the following.

a. Cropping with the Crop Tool

b. Cropping to a specific size

c. Cropping with the Marquee Tool

a. Cropping with the Crop Tool

The Crop Tool allows you to make a precise selection of an image you wish to edit. To crop with the Crop Tool, we follow the steps given below.

1. Launch image processing application such as Adobe Photoshop.
2. Open the image you want to crop.
3. Select the Crop Tool from the Toolbox.
4. It will automatically select your entire image. Drag the edges to fit the dimensions you desire (For example in Photoshop See Figure 4.10).

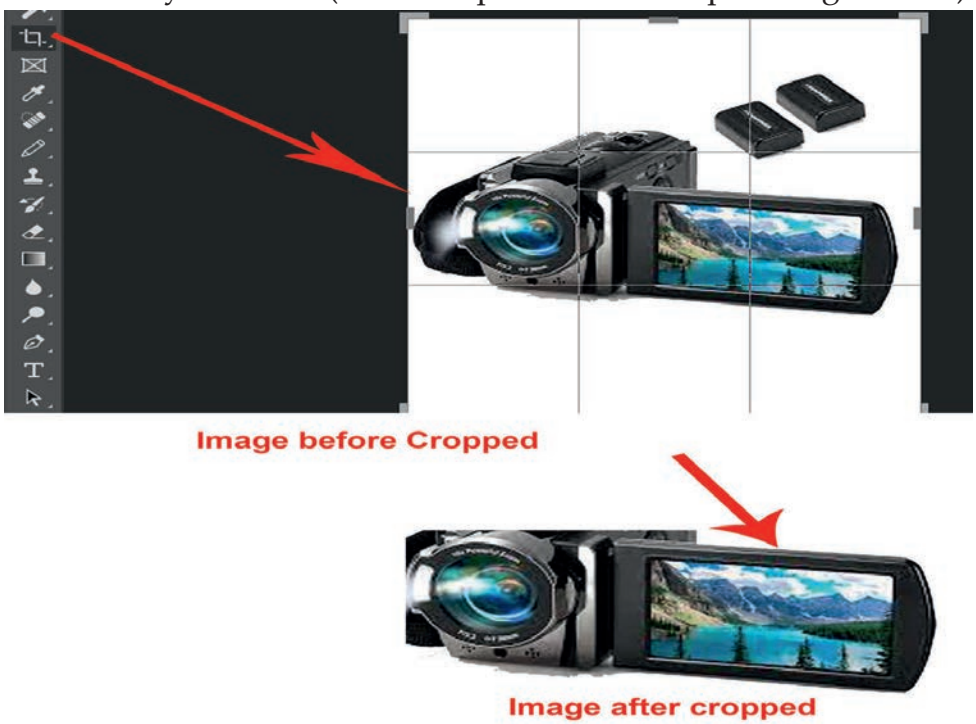


Figure 4.10 Cropping with crop tool

5. Resize the border by dragging the squares at the sides and corners until you are satisfied with the way your image looks.
6. Once you are completely satisfied with your cropped image, press Enter.

b. Cropping to a specific size

If you wish to print your digital photos or other images on standard size photo paper, you will have to crop your images to a specific size, such as 8x10. To crop an image to a specific size, do the following.

1. Open the image you want to crop.
2. Select the Crop Tool from the Toolbox.
3. Specify the values for Width and Height (See Figure 4.11).

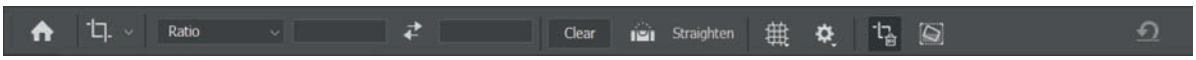


Figure 4.11 Crop Tool options bar

4. Click in your image and drag the cropping border. Notice that the border is constrained. You cannot make it wider or longer than the specified values. For example, if you entered 8 for width and 10 for height, whatever size you make the border, the area within it will fit on an 8x10 photo.

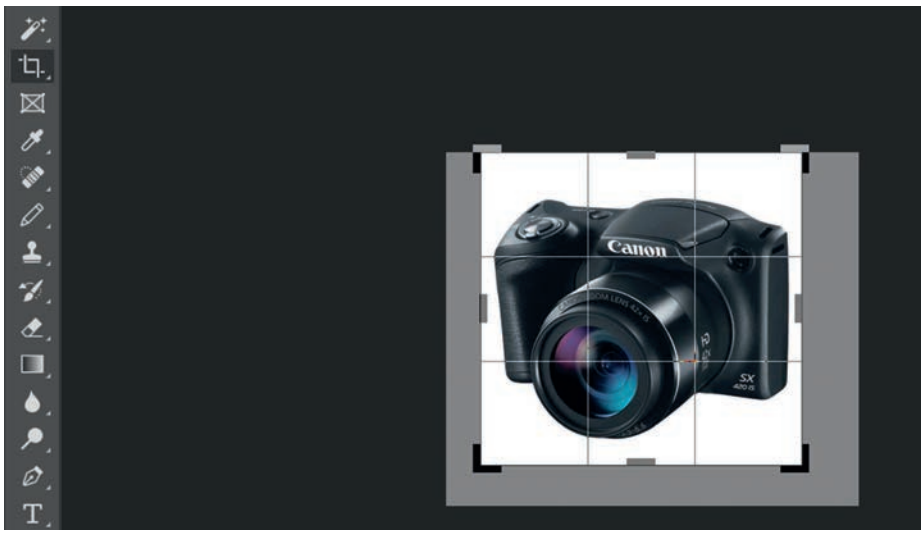


Figure 4.12 Cropping to a specific size

5. Once you are completely satisfied with your cropped image, press Enter or press "✓" at the right corner.

c. Cropping with the Marquee Tool

If you are in a hurry and need just a simple crop, you can use the Marquee Tool and a menu command. To crop with the Marquee Tool, follow the steps below.

1. Open the image you wish to crop.
2. Select the Rectangular Marquee Tool  from the Toolbox (See Figure 4.4).
3. Click and drag the mouse to draw a marquee around the area you want to crop.
4. In the main menu, go to Image ➔ Crop. The image will be immediately cropped.

4.3.5 Resizing or Scaling an Image

Image resizing or scaling can help you print your images in standard photo sizes, resize and preserve the high quality of digital photos and enlarge small images to a poster size. For example, to resize your image to a preset size in Photoshop, follow the steps mentioned hereunder.

1. Open your image.
2. Go to Image Menu.
3. Select Image Size (See Figure 4.13 for Photoshop software).

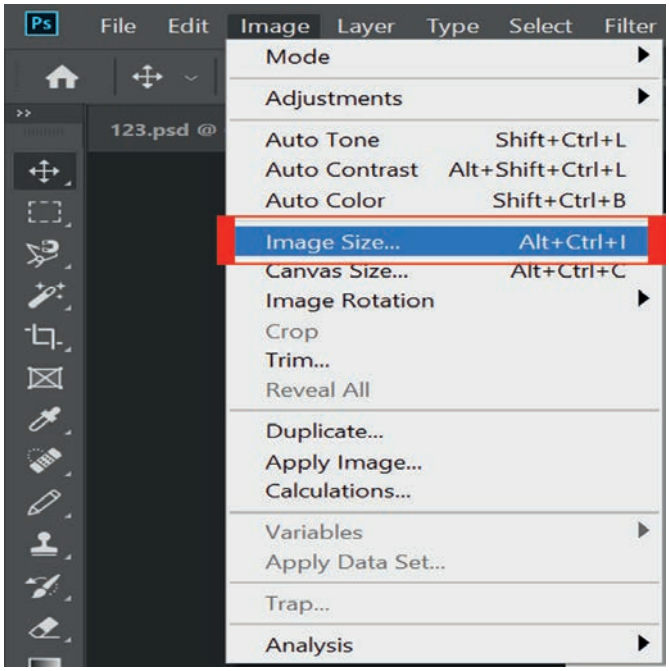


Figure 4.13 Selecting Image Size menu

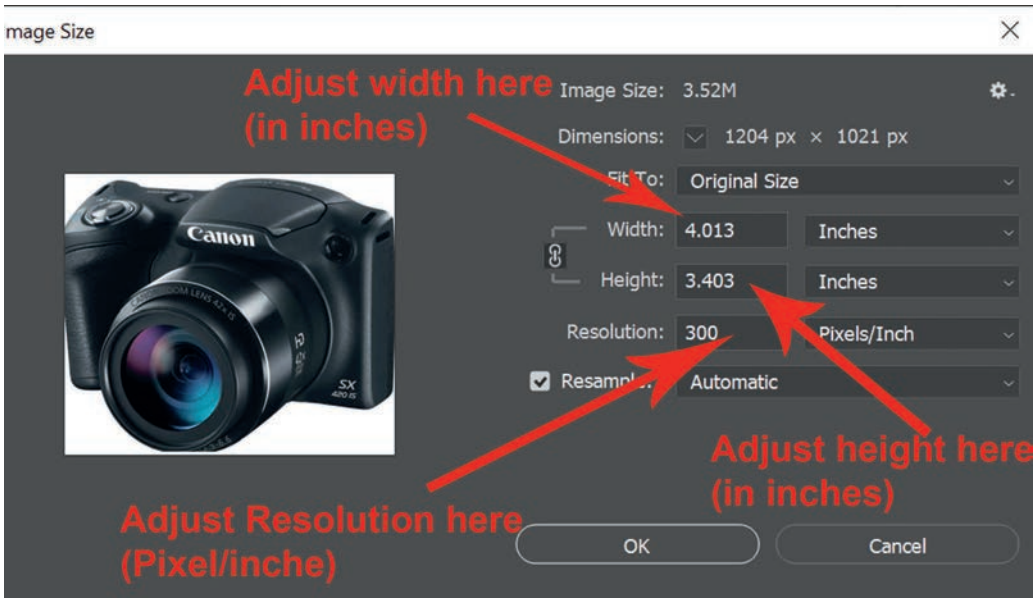


Figure 4.14: Image Size window

4. Choose the size that you want and click OK.
5. Save your file.

Practical Exercise 4.2

Cropping an Image

1. In Activity 4.1 you accumulated different images from different sources to highlight the impact of environmental damage on Ethiopian society. Use one of the cropping methodologies you have learnt to crop unnecessary parts of the image captured.
2. Discuss which methodologies are easy for cropping images?

4.3.6 Correction of Image Ton and Color

Images that come straight from a digital camera are not always perfect and tend to cause various problems such as *red eye* or *hot spots* if you use flash or underexposure. In image editing software, you can correct these problems as well as adjust the overall color of your digital photo.

Red Eye Removal

The digital camera flash is located right above the lens, which causes the red-eye;

however, you can fix your photos easily in image editing software. For example, follow the steps below to remove the red eye problem in images using Photoshop.

1. Open a photo you want to correct.
2. Select the Zoom Tool from the Toolbox. Click and drag a rectangle around the eye (See Figure 4.15).

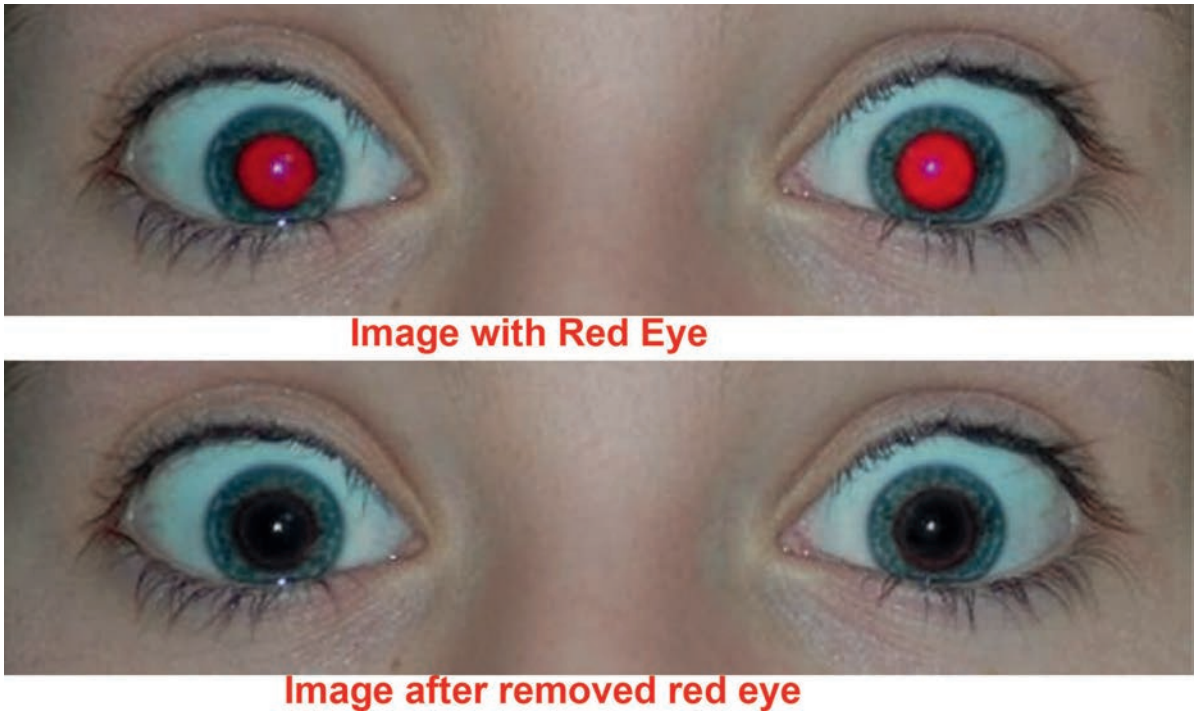


Figure 4.15 Zoomed red eye

3. Make sure that your default Foreground and Background colors are black and white.
4. Click and hold on the little black triangle of the Healing Brush Tool button and select the Red Eye Tool (Refer to Table 4.2 (d) and Figure 4.16).

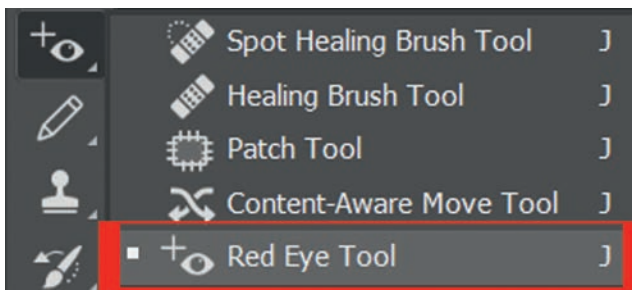


Figure 4.16 Red Eye Tool

5. Click on the red part of the eye and paint, holding down the mouse button. You will see how the red will disappear (See Figure 4.17).

NOTE

In Gimp to remove red eye first your have to select the boundary of iris of the eyes having a red pupil. Then you can find the "*Red Eye Removal*" in the *Enhance* submenu of *Filters* menu.

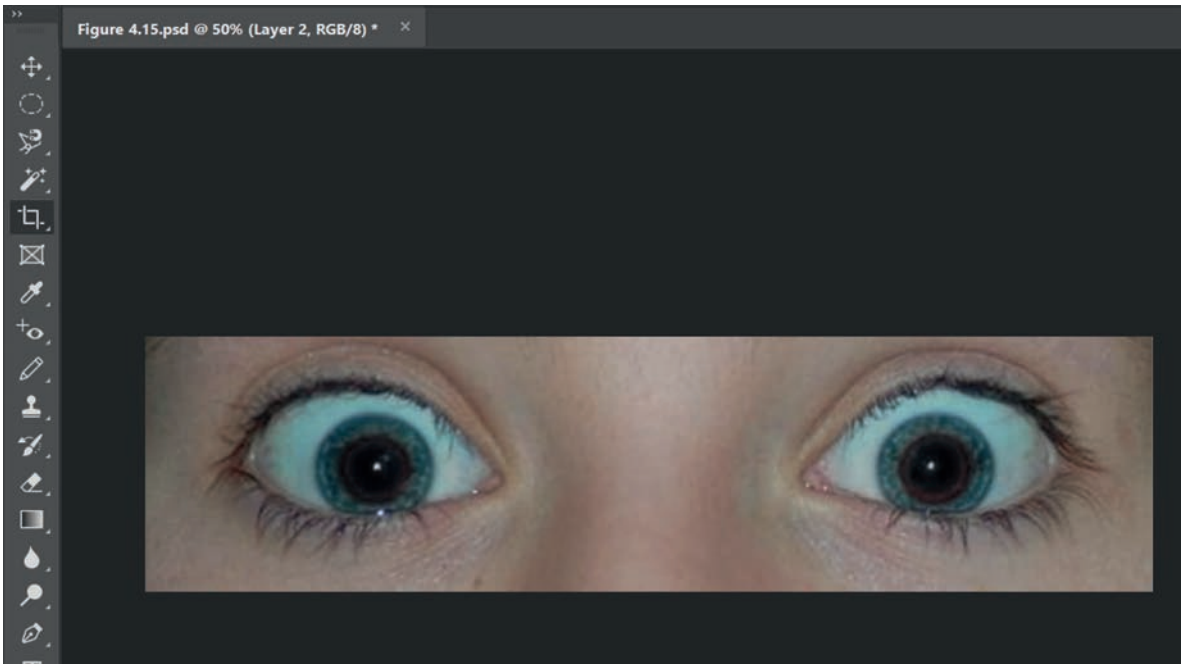


Figure 4.17 Red eye corrected

Adding Flash

If you take pictures indoors without a flash, they will turn out underexposed and dark. Follow the steps below to fix underexposed photos.

1. Open a digital photo you want to correct (See Figure 4.18).

Figure 4.18 Underexposed photo

2. In the main menu, go to Layers ➜ Right click the layer ➜Duplicate (or press **Ctrl + J**). In the next window, name the layer as Layer 1.

3. Make sure Layer 1 is selected in the Layers palette. Select Image from the menu, select Adjustments and select Exposure (See Figure 4.19). Select the amount of exposure. The whole image will be lightened.

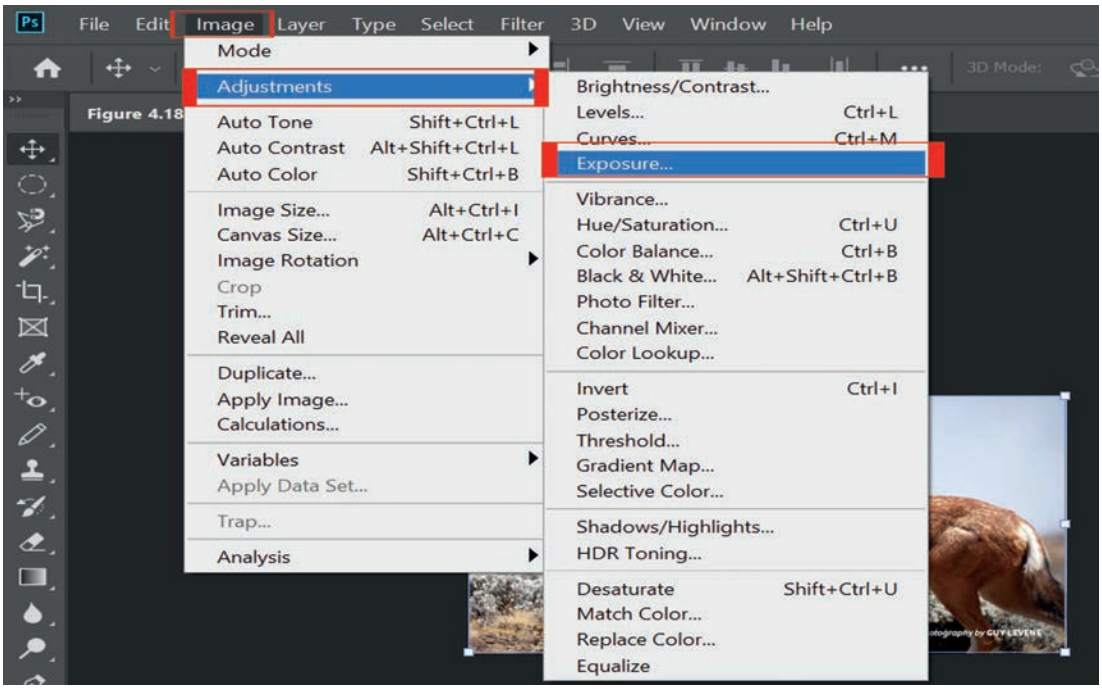


Figure 4.19 Duplicate layer and select Image Exposure menu on new layer

4. Keep duplicating Layer 1 until you are satisfied with your image (See Figure 4.20).

Figure 4.20 Corrected image

Use Adjust color Levels from Levels submenu of Colors menu in Gimp.

Hot Spot Removal

Using a flash can also cause shiny areas on peoples' faces or the flash to reflect on shiny surfaces. Follow the steps below to remove hot spot from images.

1. Open the photo you want to correct. Notice the shiny area on the top of the car, which is not the actual part of the car and called a spot.

Figure 4,21 A car's image with hot spot

2. Duplicate the layer and select the copied layer, not the background layer.
3. Select the **Clone Stamp Tool** from the **Toolbox**.
4. In the Options bar, change the Blend Mode from Normal to Darken (See Figure 4.22).

   The idea behind setting the mode to darken is to adjust the only pixels that will change, which are the ones that are lighter than our sample area. The hot spots are essentially light-colored pixels.
5. Choose a soft-edged brush, set the diameter to 40 or 50.

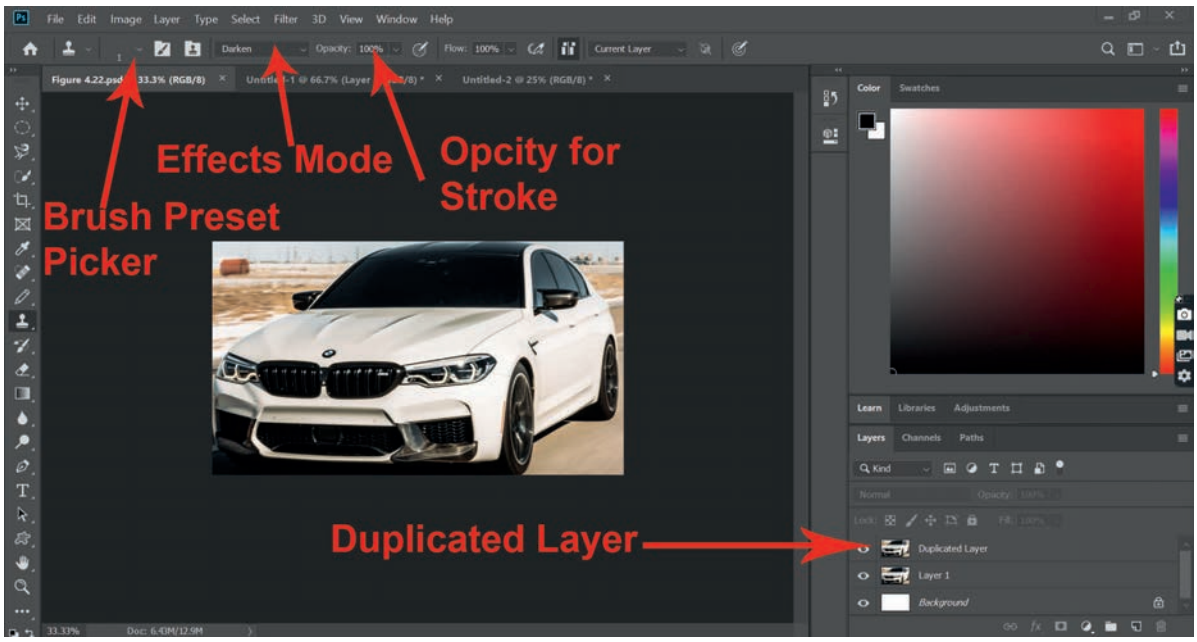


Figure 4.22 Setup for clone stamp tool

6. On your subject's face, in our example on the car body, choose an area of "clean" or non-hot spot skin. This will be the reference point and Photoshop will now only change pixels that are lighter than this. Hold down the Alt key and click to set the reference point or sample. The cursor will change to an eye-dropper.
7. Paint over the "hot spot", the light area will gradually darken (See Figure 4.23).

Practical Exercise 4.3

Adjusting Flash Effect on an Image

1. Select the images that has flash problem (underexposed and dark, red eye, hot spot) among the images you captured during Activity 4.1 above or deliberately capture image with or without flash and use any image processing software available to you to correct the flash problem in your image.
2. Save both original and corrected images in a folder called Image Processing Practice under Documents folder.

Figure 4.23 Hot spot corrected

Color Adjustment

Color corrections involve changing and specifically correcting colors that make an image appear unnatural. Some common examples include objects that lost its original color or human face with faded skin color or less visible.

There are different color correction methods that can make your images look dramatically better. Some of the corrections methods you can practice in this sub-unit are the following.

- **Levels and curves**
- **Saturation**
- **Auto-adjustment tools**

Figure 4.24 below provides examples with images that need to be color corrected, which we are going to work on in this section.

Figure 4.24 Some images that need color adjustment

a. Color Adjustment Using Level and curves

Levels

Every image has a mix of **shadows**, **highlights** and **midtones**. Shadows are the darkest parts of the image whereas highlights are the brightest parts, and midtones are everything in between. When you adjust levels, you are adjusting these different tones. While you could use the brightness and contrast tools for a similar type of adjustment, they are much less powerful than levels.

There are many reasons to use levels adjustment. For instance, if you have a particularly dark or underexposed image, you might want to make the midtones and highlights brighter while keeping the shadows relatively dark. You can see examples of this in the images below.

We use the following steps to adjust colors using levels.

1. Open a digital photo you want to correct to the Photoshop (See Figure 4.25).
2. In the Layers panel, add a **Levels adjustment layer** by clicking adjustment layer  in Adobe Photoshop

You can do this using the Levels submenu under the Color menu in Gimp.

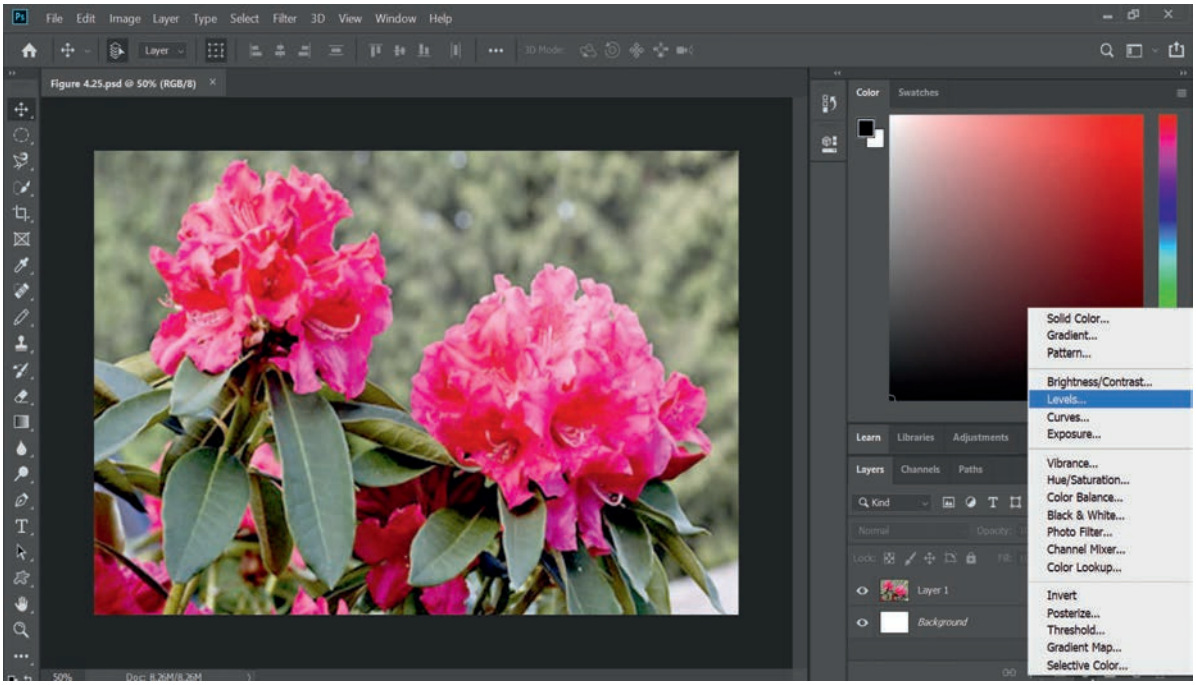


Figure 4.25 Creating level adjustment layer

NOTE

Adjustment layer is a type of non-destructive editing because it does not actually change anything about the original image. Because you can continue to tweak adjustment layers as you work, it is easy to try out different effects and get the image to look exactly the way you want.

3. Locate the graph in the middle of the Properties panel. This is called a *histogram*, and it shows information about shadows, highlights and midtones of the image. In this example, you can see that there is a big gap on the right side with no information, which means the image is underexposed. We can use a levels adjustment to fix this.
4. Notice the Input Levels sliders just below the histogram. These are the controls you will use to adjust the levels.

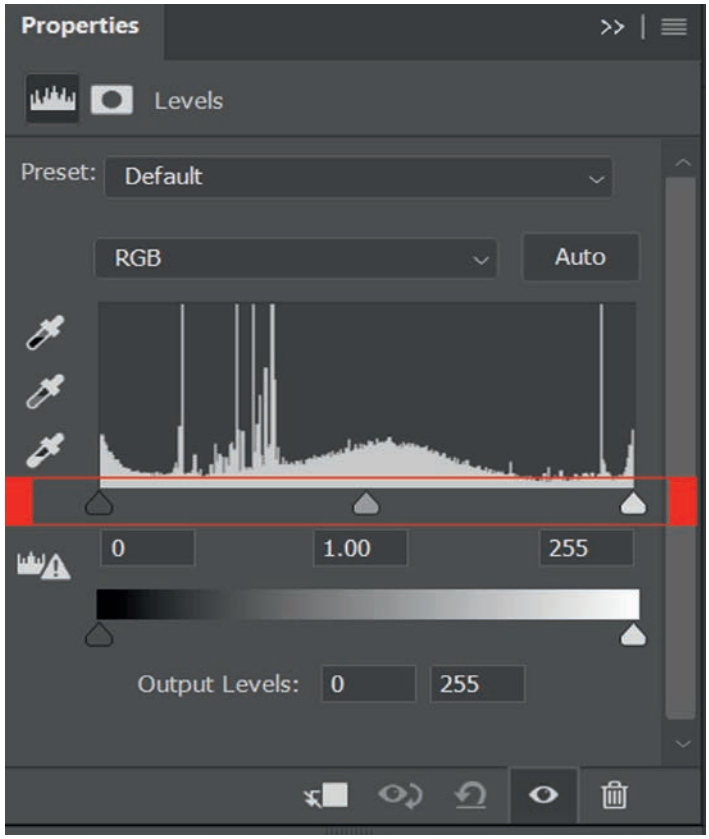


Figure 4.26 Histogram and its sliders

5. Because our image is too dark (underexposed), we will click and drag the white slider to the left. Notice how we drag the slider to the right-most edge of the histogram (See Figure 4.27). Be careful not to drag the slider past this point or you will begin to lose detail in your image. This is commonly referred to as *clipping*.
6. If the shadows in the image are too bright, you can click and drag the black slider to the right. In this example, we do not need to adjust this because the slider is already at the left-most edge of the histogram.
7. Optional: If the image still looks too dark or too bright, you can click and drag the middle (grey) slider to adjust the midtones. In this example, we will move the slider to the left to make the image brighter.
8. Optional: Try turning the adjustment layer off and compare the new levels adjustments with the original image. You can see the difference between underexposed and corrected images (See Figure 2.27).

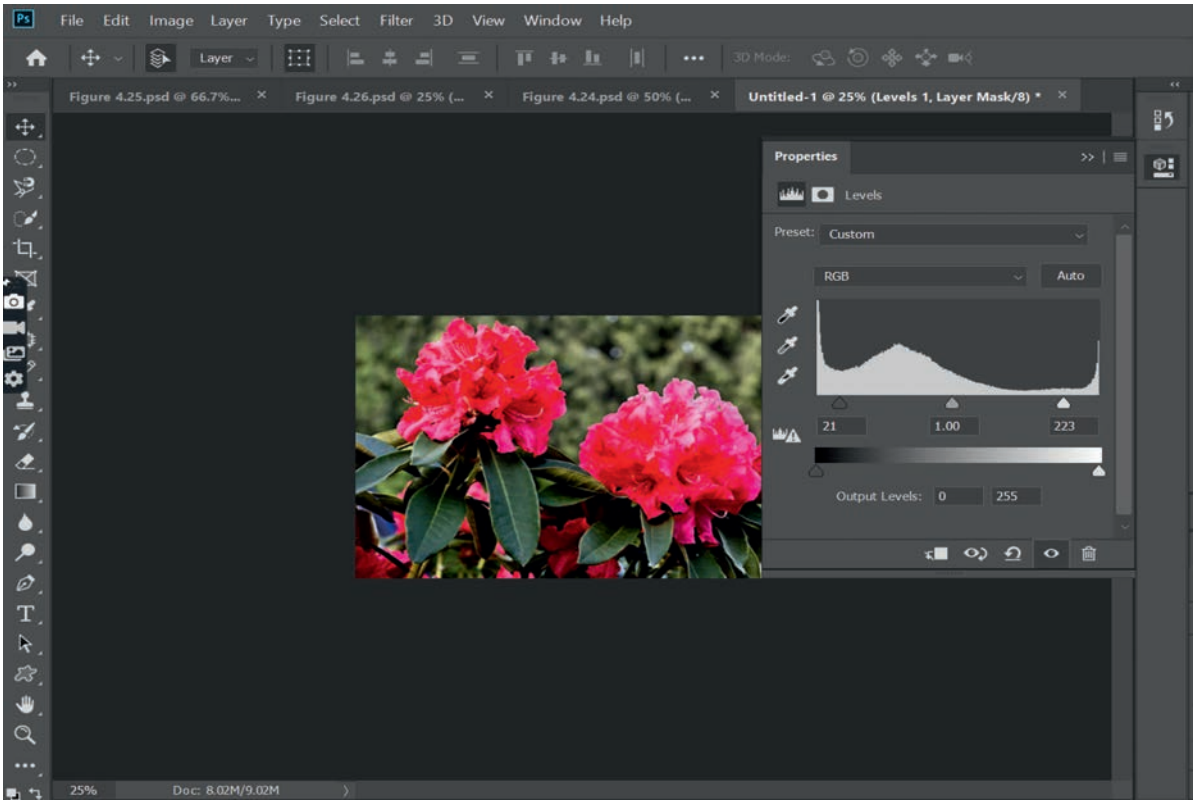


Figure 4.27 Color corrected image

Curves

The Curves tool is similar to levels, but it gives you more power to control shadows, highlights, and midtones separately. Because it's a more advanced tool, you'll need to be careful when using it to adjust your images.

Increasing contrast

One of the simplest adjustments you can make with curves is to increase the contrast. To do this, drag the curve down in the shadows on the left to make them darker and up in the highlights on the right to make them brighter.

Decreasing contrast

In this particular image, it might be better to decrease the contrast. To do this, drag the curve up in the shadows on the left to make them brighter and down in the highlights. To adjust image's colors using curves in Adobe Photoshop, follow the steps below:

1. Open image to be color corrected
2. Add curve adjustment layer

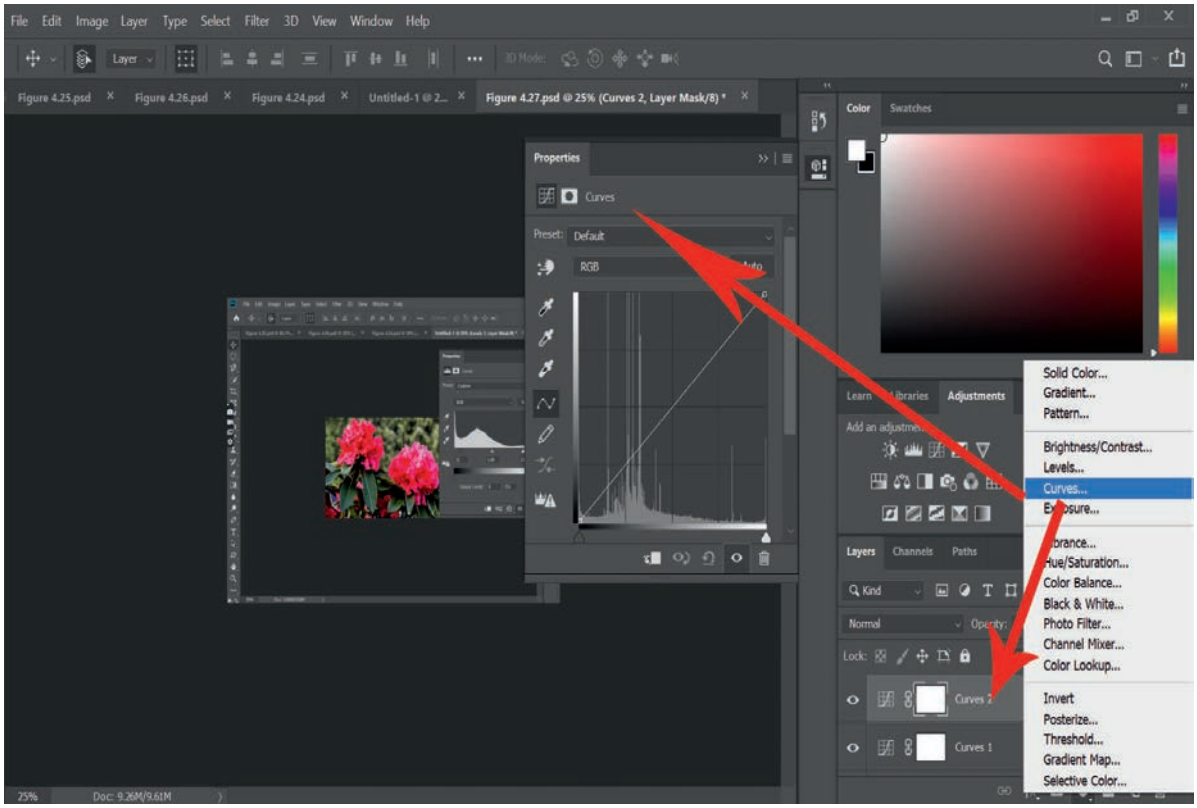


Figure 4.28 Add curve adjustment layer

3. Click anywhere on the line in the Properties panel to create a new point; then click and drag the point to adjust the curve. Note: Be careful not to move the two points in the lower-left and upper-right corners. It is possible to adjust these, but it is recommended to keep them in the corners until you gain more experience with curves.
4. Continue to adjust the points until you are satisfied with the result. You can also press the Delete key or click and drag a point off the line to remove it.
5. When you finish compare with original image by hiding the adjustment layer, and finally save your work.

NOTE

Note that, you can get Curves under the Color Menu in Gimp.

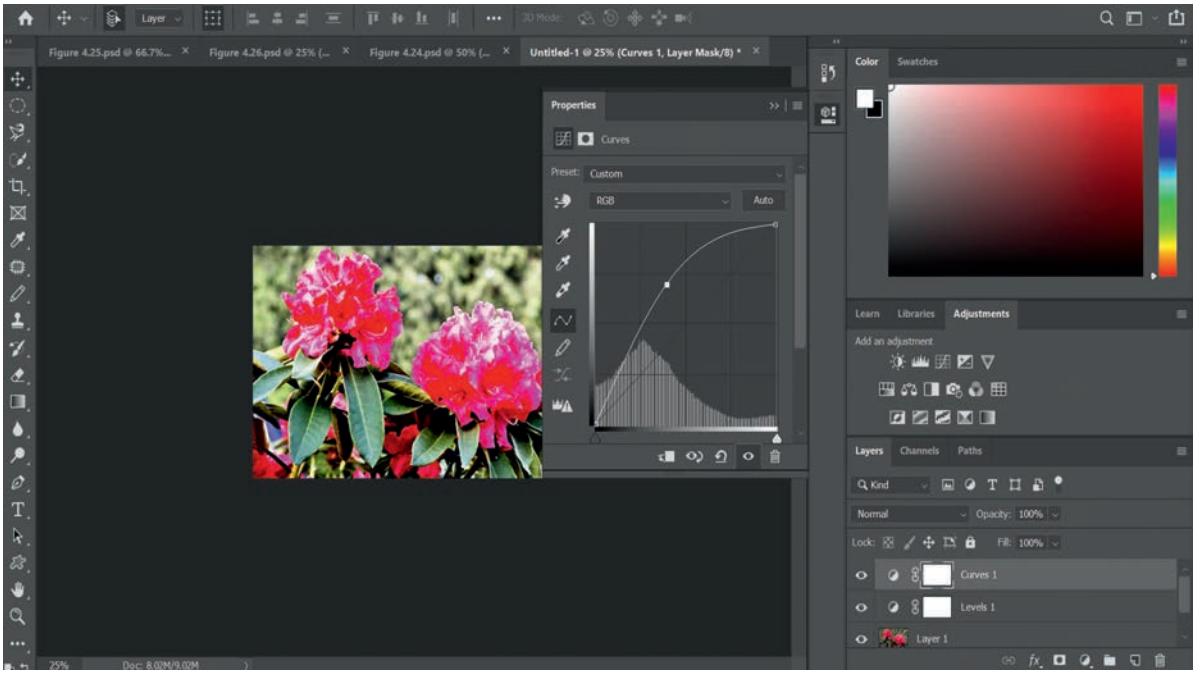


Figure 4.29 Color adjustment using curves

Tip

If you are new to curves, you may want to select one of the Preset options and make small adjustments to the curve as needed. If you need to start over, you can select Default from the Preset menu.

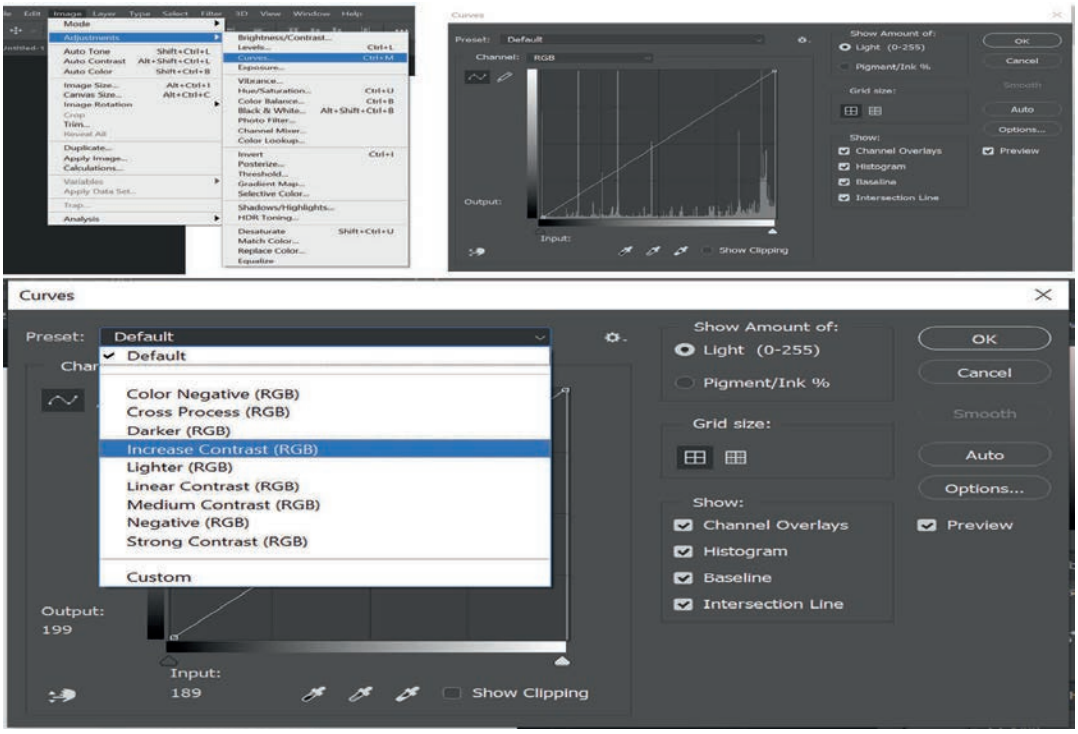


Figure 4.30 Preset curve color adjustment

b. Saturation

If the colors in your image are dull or muted, you can increase the saturation to make them look brighter or vivid. On the other hand, you can reduce the saturation to make the colors less vivid. If you remove the saturation completely, it will produce a black-and-white, or gray-scale, image. You can see an example of this in the images below.

To adjust saturation, add the Hue/Saturation adjustment layer. Then click and drag the Saturation slider in the Properties panel to increase or decrease the saturation. Follow the following steps to correct the image having color problem using saturation method.

1. Load/Open a digital photo you want to correct to the Photoshop.
2. In layer panel, add a Hue/Saturation adjustment layer (See Figure 4.31).

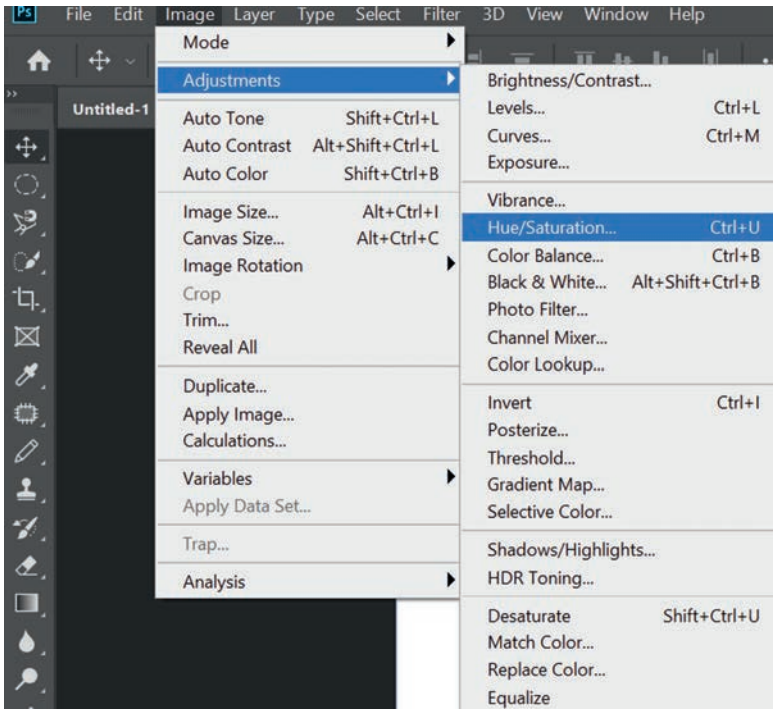


Figure 4.31 Add Hue/Saturation Adjustment layer

3. Then click and drag the Saturation slider in the Properties panel to increase or decrease the saturation. Figure 4.32 seems more natural than original image (See Figure 4.31).
4. Remember to save your work.

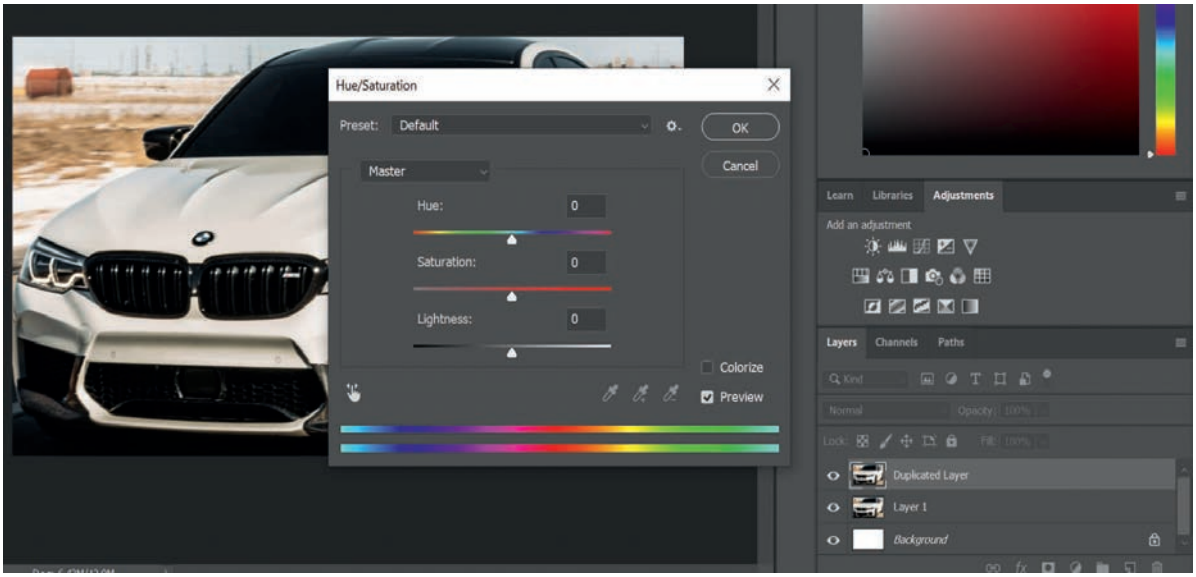


Figure 4.32 Corrected image with changing saturation level

Saturation Adjustment Tip

Be careful not to increase the saturation too much. This can cause the colors to look unnatural, as shown in the example below.

c. Auto-adjustment Tools

Some images may require more specialized corrections. There are several automatic adjustment tools you can use to improve your images. You will find a few auto-correction tools, including Auto Color, in the Image menu (See Figure 4.33).

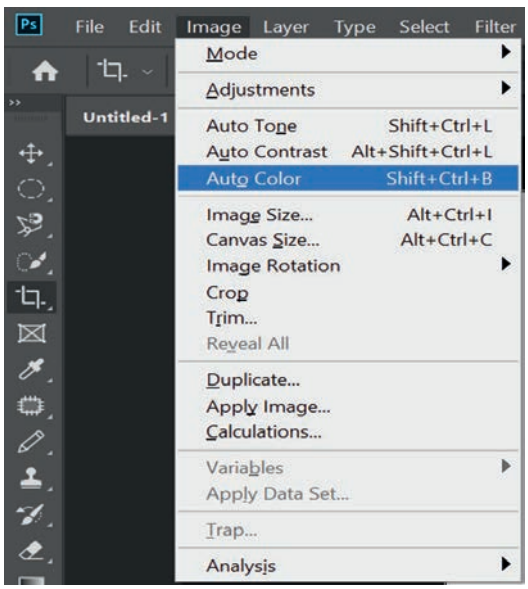


Figure 4.33 Auto color adjustment

Practical Exercise 4.4

Color Adjustment

1. Select an image(s) with color problems among the images you captured during Activity 4.1 above, or download such images from Internet and use any image processing software available to you to correct the color problems.
2. Save both original and corrected image in a folder called Image Processing Practice under Documents folder.

4.3.7 Image Sharpening

Sometimes an image may not be as clear as you would like it to be. Sharpening can help you make it look crisp and clear by enhancing the edges of objects in the image - increasing the contrast of the edges within your photo, which brings more definition to the details in your photo. However, adding too much sharpness can actually make an image look worse, or it can lead to a loss in image detail. To sharpen image in Adobe Photoshop, we can use either of the following options.

- Unsharp Mask
- Smart Sharpen
- High Pass

The Unsharp mask filter is a common way to sharpen images in Photoshop. The name 'Unsharp' is derives from the fact that the technique uses a negative blurry image, which creates a mask for the original photo. This mask is subtracted from the original to detect the presence of edges. After all this, contrast is selectively increased along those edges using this mask. The final result is a sharper image. When you use this tool, you will be able to control several settings like amount, radius and threshold.

Amount: The amount determines how much sharpness will be applied. The amount you will need depends on several factors including the overall image size, so it is good to experiment with this setting.

Radius: The radius controls the size of the details that will be sharpened, so it is generally best to use a very low value for this setting. We recommend a radius

between 0.3 and 0.5 for most images although you may find it useful to use a slightly larger radius (between 1 and 1.5) for higher-resolution images.

Threshold: Sharpening tends to make image noise more visible. Increasing the threshold can help you reduce this by telling the unsharp mask to ignore certain parts of the image. However, this can also mean that different parts of the image are not sharpened consistently. This is why we recommend keeping this setting at 0 most of the times unless the sharpening is creating a lot of extra noise.

Figure 4.34 Correct sharpening

a. Using Unsharp Mask

It is one of the methods used to sharpen our image. Just look at the following steps.

1. Open the Photo and Duplicate the Background

   Open the photo you want to make sharper ➔ Right-click on the background layer and select 'Duplicate Layer…'

   A new window will pop up. After you click OK, the new layer will appear at top of the Background layer and rename it to Sharpen Layer.

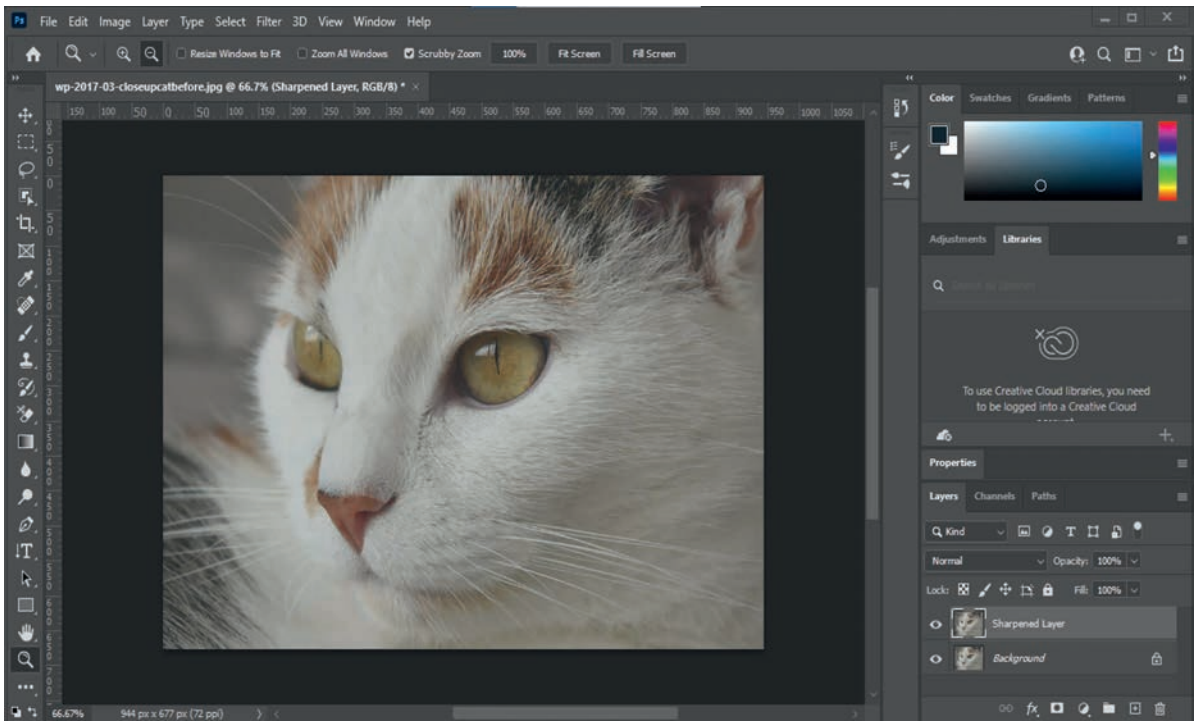


Figure 4.35 Duplicate background layer

2. With new layer Sharpen layer selected, Zoom in to 100 %.➔ Go to Filter ➔ Sharpen and select Unsharp Mask… filter (See Figure 4.36).

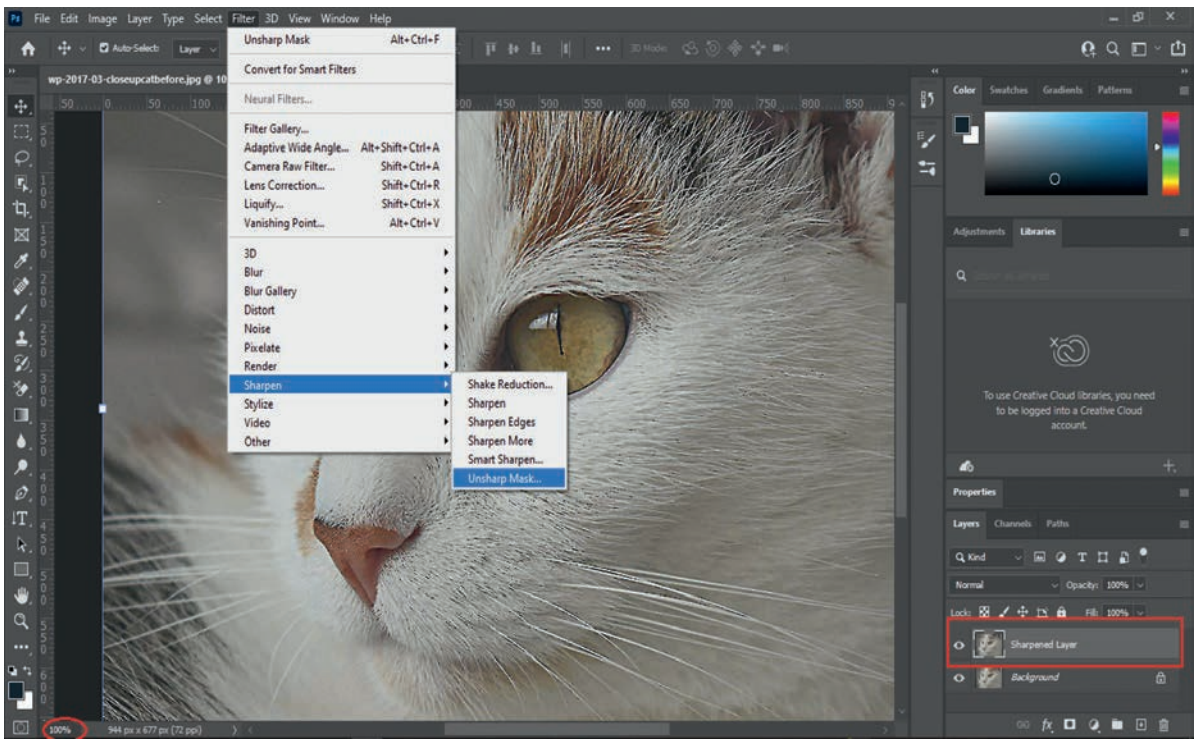


Figure 4.36 Select Unsharp Mask

3. A dialog box will appear. Set the desired radius size, and then choose the amount of sharpness to add. We recommend experimenting with different amounts of sharpening to see what looks best. You can look at the preview window above the sliders to see how sharpening is affecting the image (See Figure 4.33).

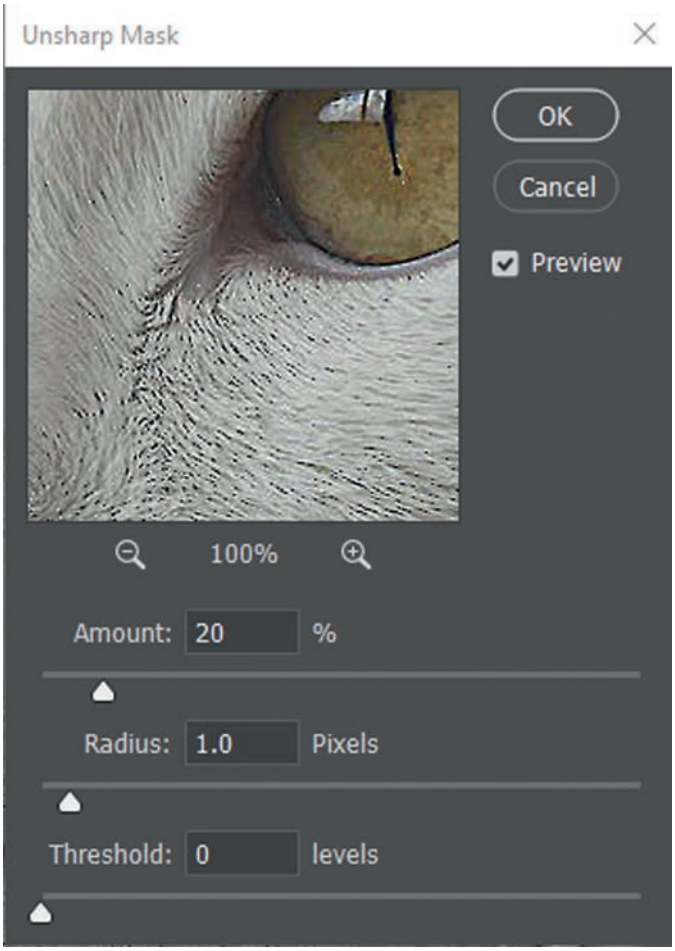


Figure 4.37 Unsharp Mask dialog box

4. Click the preview window to toggle the preview off and on. This is an easy way to compare the sharpened version with the original. To view the different parts of the image, click and drag within the preview window. Note that you will also see the preview in the main document window.
5. Continue adjusting the settings until you arre satisfied with result, then click OK. The Unsharp mask will be applied.
6. Save your work.

b. Using the Smart Sharpen

You can access the Smart Sharpen menu from the Filter menu, and you will want to start by setting the Amount slider to 150%. The radius will stay around 1 or 2, and it is a good idea to always try 1 first. Smart Sharpen has noise reduction, which lacks the Unsharp Mask, and you can use this to reduce the noise that comes along with sharpening (See Figure 4.38).

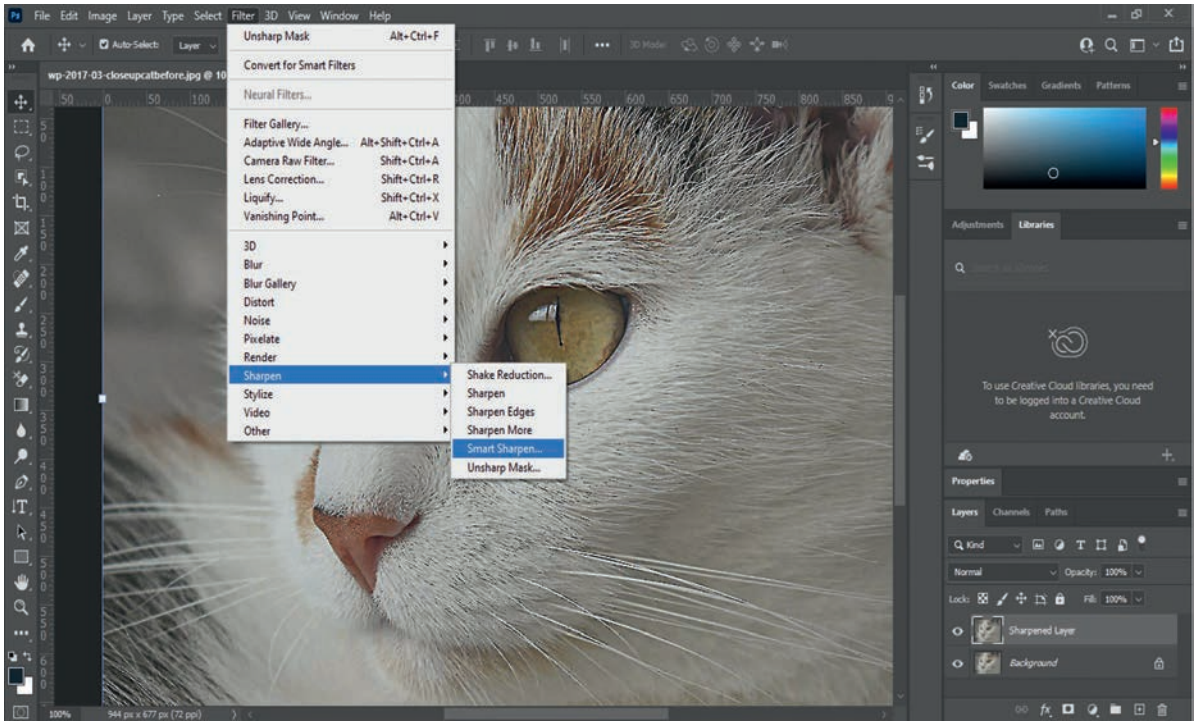


Figure 4.38: Using Smart Sharpen

c. Sharpening an Image in Photoshop Using High Pass

1. Open an image to be sharpened in Photoshop.
2. Convert the background layer into a smart object to protect the original image (See Figure 4.39).

The Layers panel shows the unsharpened image. To convert the layer to a smart object, click the **menu icon** in the top right corner of the Layers panel and choose **Convert to Smart Object** from the menu.

Any sharpening we add with the High Pass filter will now be applied to the smart object itself, leaving the original image unharmed: the smart object icon.

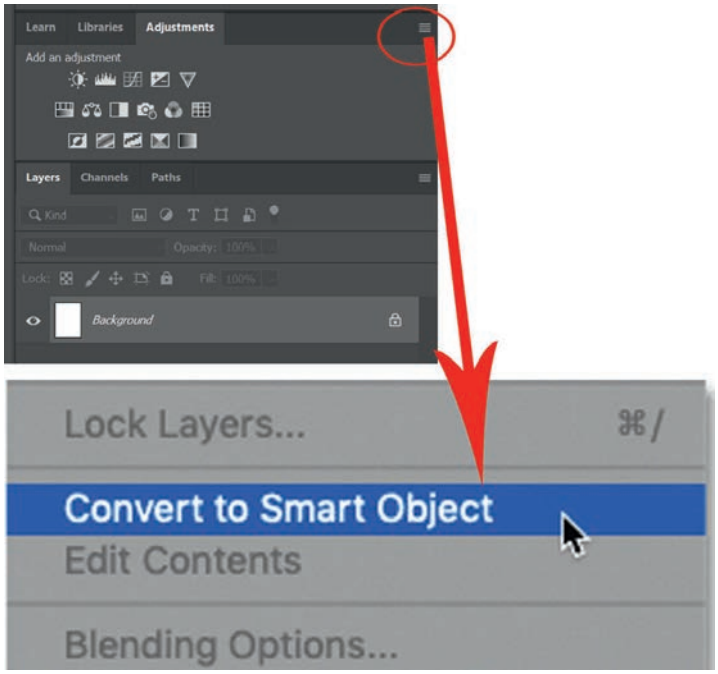


Figure 4.39 Convert background layer to smart object

3. Select the High Pass filter.

   Going to Filter ➜ Other ➜ High Pass. As soon as you select High Pass, your image will turn gray.

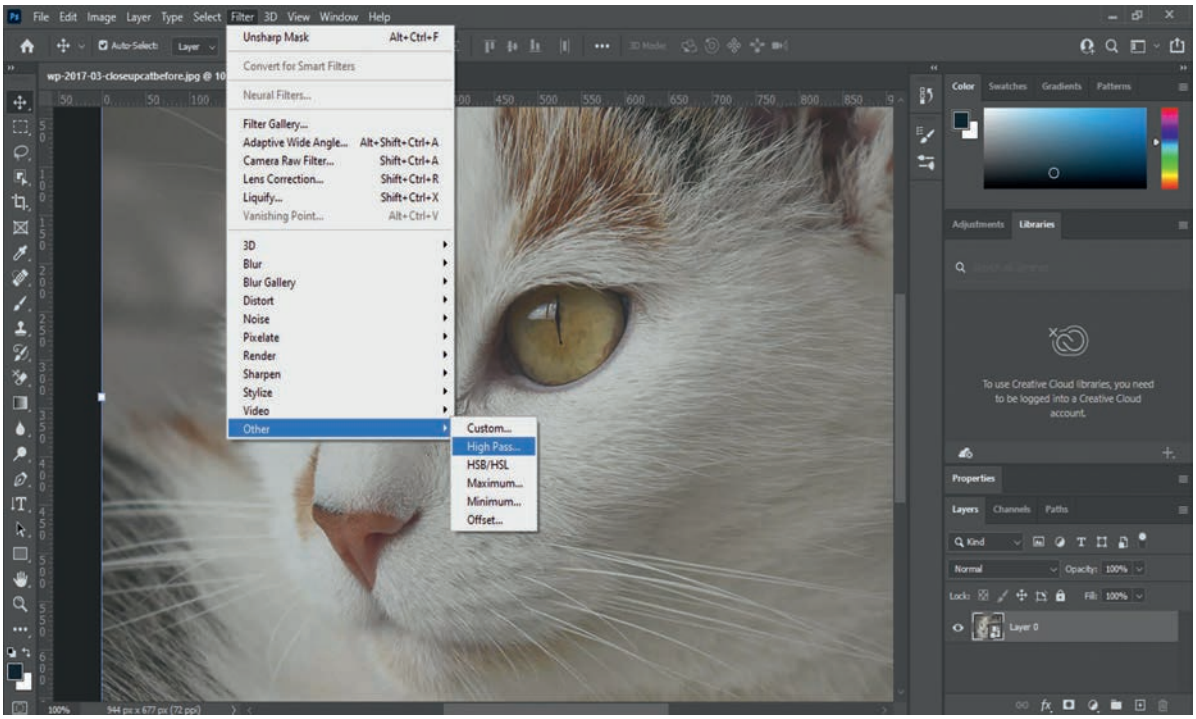


Figure 4.40 Selecting the High Pass filter.

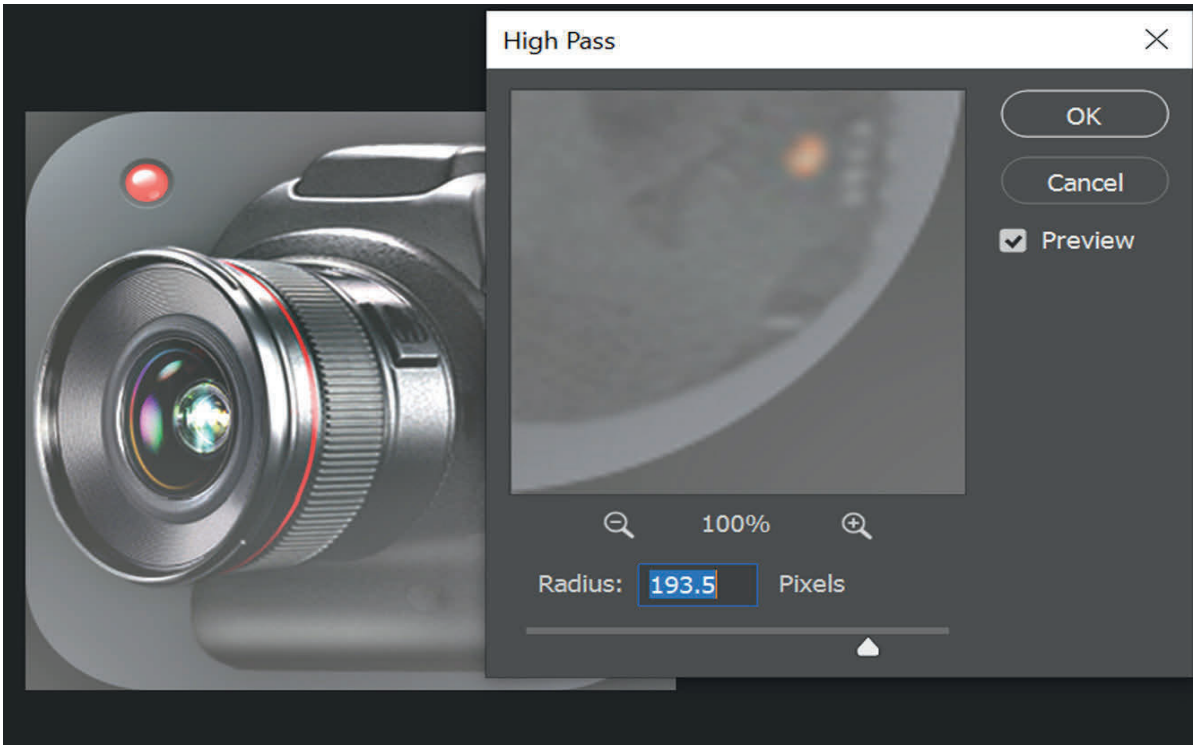


Figure 4.41 Adjusting Radius to highlight the edges

4. Adjust the radius value to highlight the edges by starting with the lowest value first in which the entire image is filled with solid grey and no edges are visible (See Figure 4.41).
5. Close the High Pass filter as the radius setting gets ideally set between 2 and 5.
6. Sharpen the image by changing the filter's blend mode.

With the edges highlighted, we can now sharpen the image just by changing the High Pass filter's mode. Double-click on the **Blending Options** icon to the right of the filter's name opening the smart filter's Blending Options.

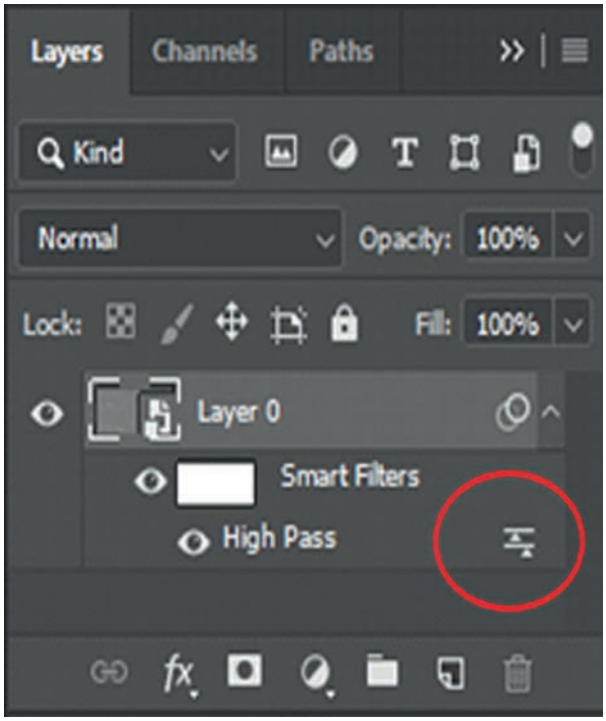


Figure 4.42 Opening Filter's Blending options

Then in the Blending Options dialog box, change the **Mode** (short for Blend Mode) to one of Photoshop›s contrast-boosting blend modes. The blend modes you want to try are **Overlay**, **Soft Light**, **Hard Light** and **Linear Light.**

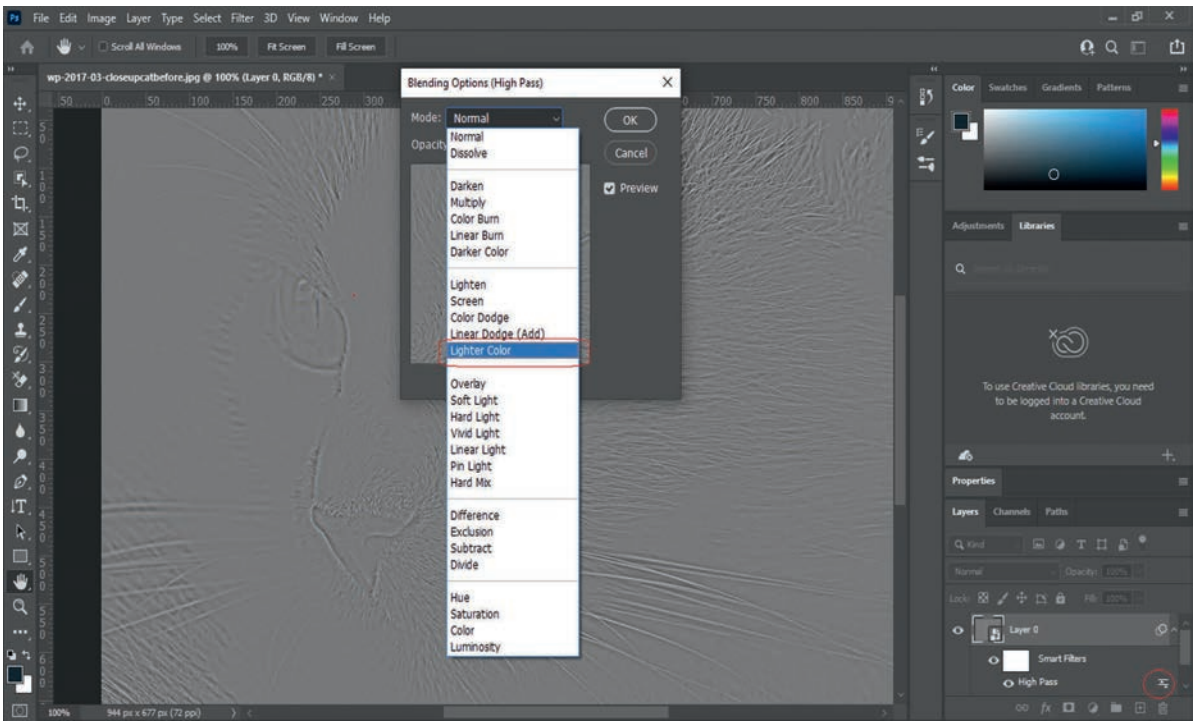


Figure 4.43 Blending Option dialog box

The two most commonly-used blend modes for sharpening images with **High Pass** are **Overlay and Soft Light**. Overlay produces a higher contrast effect, resulting in a stronger amount of sharpening, while Soft Light gives you lower contrast and more subtle sharpening.

On the left is the result using Overlay, and on the right is the sharpening with Soft Light. Keep in mind that the differences in sharpness are not as noticeable in these smaller screenshots as they will be with your own larger images.

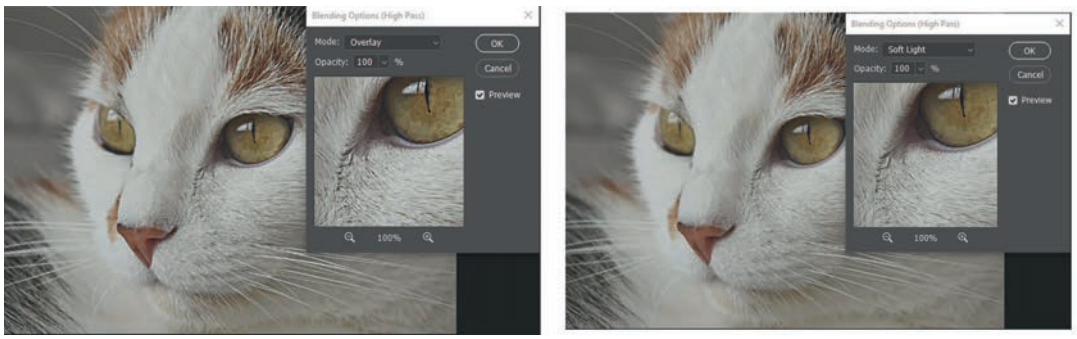


Figure 4.44 Sharpening result

7. Fine-tune the sharpening by lowering the filter's opacity.

Once you have chosen a blend mode, you can then fine-tune the amount of sharpening by adjusting the **Opacity** of the High Pass filter. The more you lower the opacity, the more you will reduce the sharpening effect.

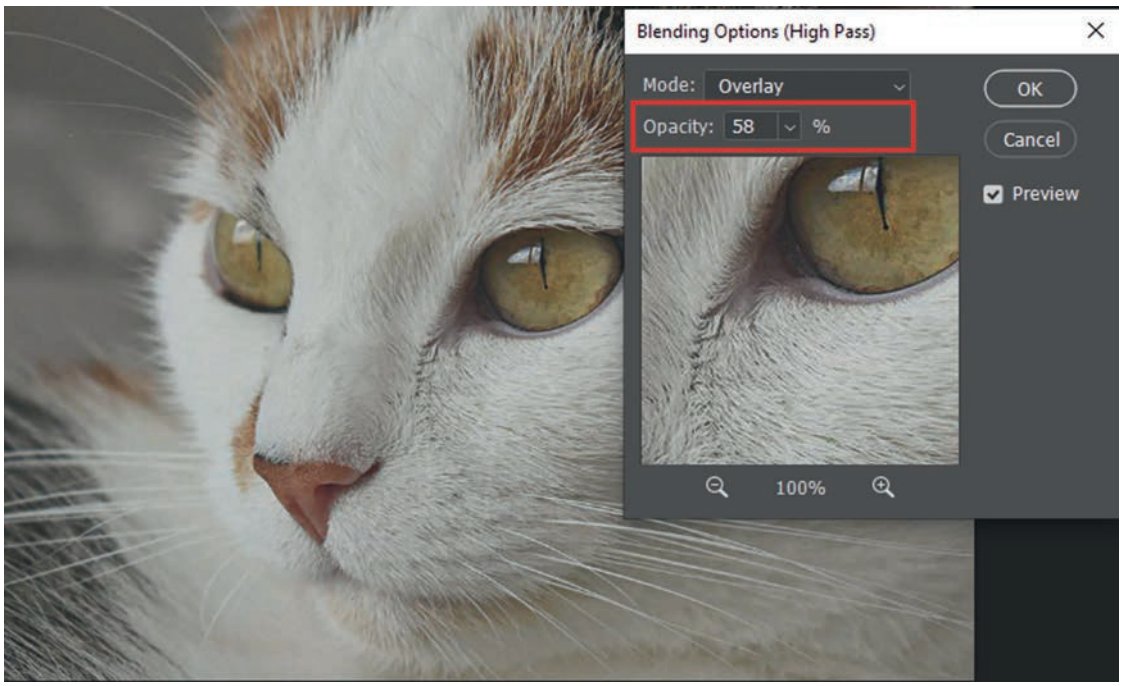


Figure 4.45 Adjusting the Opacity of the High Pass filter

8. Close the Blending Options dialog box.

Finally, click OK to close the Blending Options dialog box,

Practical Exercise 4.5

Image Sharpening

1. Select the image with clarity problems among the ones you captured during Activity 4.1 or download image from Internet and use any image processing software available to you to correct clarity problems in the image.
2. Save both original and corrected image in a folder called Image Processing Practice under Documents folder.

Mini Project

Develop a business card for yourself using Photoshop application that contains your image, your business logo, business name, contact information, etc.

KEY CONCEPTS

- Multimedia is derived from the words *multi* and *media*. Multi means many, multiple, and media is a tool that is used to represent or do certain things, delivery medium, a form of mass communication – newspaper, magazine or TV which contain text, graphic, voice, images, music and the like.
- Multimedia production passes through complex stages and it needs planning strategies, which include defining the goals and objectives of the multimedia, describing the content, developing application script, outline, translate outline into logic flow chart and story boarding.
- Image is a visual representation of something.
- Since images coming out of a camera are not always best, we need image processing.
- Photoshop is one of the best image processing software available today. To crop unwanted part of image, you can use three techniques: crop tool, specifying size, and marquee tool.
- To adjust the colour of an image in Adobe Photoshop, you can use level and curves, saturation and auto adjustment.

- Image sharpening is the process of making the image clear and look crisp by enhancing the edges of objects in the image.
- To sharpen the image you can use Unsharp Mask, Smart sharpen or High pass methodologies in Photoshop.

4.4 Unit Summary

In this unit you have learnt image processing and multimedia. Multimedia comes from two words, multi, which means multiple, and media, which is a way of conveying message. Hence, multimedia means multiple way of representing or conveying information. Multimedia can contain text, image, still images (videos) and etc. Image processing is a method to perform some operations on an image in order to get an enhanced image or extract some useful information from it. The unit discussed basic operations on an image such as image capturing, cropping, resizing, correction and sharpening with Adobe Photoshop software. The basic concepts of this unit are listed below.

- One of the components of multimedia that is used to convey information is image, which represents something or someone visually.
- Every information stored in a computer is processed in 0s and 1s format. Therefore, an image is stored in a computer as 0's and 1's called digits.
- A pixel is a single dot on the screen in digital image, and it is picture element that collectively makes up a picture as a whole.
- Story boarding is a multimedia production planning strategy, which is used to tell one multimedia sequence of story from the beginning to end diagrammatically.
- Adobe Photoshop is one of the popular tools that are used to process a digital image.
- To crop unnecessary part of an image using Adobe Photoshop, you can use crop tool, marque tool or you can specify the width and height specifically.
- There is always no perfect camera shooting that produces perfect image, so we need to correct the color and the tone of an image.

- When we use flash to capture a photo at dark place, we may get an image having red eye, and these has to be corrected.
- When we do not use flash, every detail of the image will not be visible and becomes dark; this also has to be corrected.
- Every image has a mix of **shadows**, **highlights** and **midtones**. Shadows are the darkest parts of the image, highlights are the brightest parts, and midtones are everything in between.
- Color adjustment can be done using levels, curves, saturation or auto-adjustment tools.
- Image sharpening is the process of making a picture or image crisper and clearer to see. For example, the eye of the image may not be visible; the detail part of the image may not be visible and etc.
- To sharpen images, we can use Unsharp Mask, Smart Sharpen or High Pass.

4.5 Unit Review Exercise

Part I: Write whether the following statements are true or false.

1. Images coming out of camera are always correct, and there is no need for further refinement.
2. Unsharp mask method is used to sharpen an image.
3. Editing is the process of changing a photo to make it most effective for its purpose.
4. Pixels are small dots on the computer screen to reflect the colors red, green and blue.
5. Layers are viewed from top to bottom.
6. Digital image is an image combination of 0's and 1's.
7. Lasso tool is used to make free hand selection.

Part II: Choose the correct answer among the alternatives provided.

1. Which of the following options is used to create a new file in Photoshop?

   A. File ➔ New

   B. File ➔ Open

   C. Create ➔ New

   D. Start ➔ New File

2. What is the shortcut key used to create a new file in Photoshop?

   A. File, new

   B. Ctrl + N

   C. Ctrl + Shift + N

   D. Shift + N

3. Which short cut key is used to duplicate layers?

   A. Ctrl + J

   B. Ctrl + T

   C. Ctrl + N

   D. Ctrl + D

4. PPI represents _____.

   A. Point presentation interface

   B. Pixel per inch

   C. Power point index

   D. None of the above.

5. Which one of the following image errors can exist due to not using flash during imaging?

   A. Hot spot

   B. Dark image

   C. Red eye

   D. A and B are correct.

6. _____is the process of removing portions of a photo to create focus or strengthen the composition.

   A. Image sharpening
   B. Image cropping
   C. Image editing
   D. Image selection

7. Which one of the following is used to crop an image in Adobe Photoshop?

   A. Using Crop tool
   B. Specifying size
   C. Using Marque tool
   D. All of the above.

8. _____is the process of making an image clear and look crisp by enhancing the edges of objects in the image.

   A. Image cropping
   B. Image resizing
   C. Image sharpening
   D. All of the above.

9. Which one of the following is used to correct color?

   A. Levels
   B. Curves
   C. Saturation
   D. All of the above.

10. Which one of the following is used to sharpen an image in Adobe Photoshop?

    A. Unsharp Mask
    B. Smart Sharpen
    C. High Pass
    D. All of the above.

Part III: Fill in the blank spaces.

1. _____ refers to technology that presents information in more than one medium— such as text, picture, video, sound and animation in a single integrated communication.
2. _____ is located on the left side of the interface and houses many tools.
3. The right side of the Adobe Photoshop is occupied by _____.
4. To change the name of the layer, you can _____on the words on the layer.
5. _____ describes the purity of a color.
6. The common color adjustment methods used in Photoshop are _____, _____, and_____.

Part IV: Provide clear and precise responses to the following questions.

1. What is Adobe Photoshop?
2. How can re-size you the image in Photoshop?
3. Explain the Rectangular Marquee and Red-eye tools.
4. What are Lasso tools and name them?
5. What is healing tool?

Part V: Project Work

Develop a promotional card for your place of birth using Photoshop application that contains image of known buildings, common animal or renowned person with brief textual information.

UNIT 5 INFORMATION AND COMPUTER SECURITY

UNIT OUTCOMES

At the end of this unit, learners will be able to:

- Explain computer and information security.
- Explain confidentiality, availability and integrity of information system.
- Discuss computer security threats.
- Explain basic security threats and prevention strategies.
- Evaluate confidentiality, availability and integrity of a school-based information system.

UNIT OVERVIEW

As you learned in unit 2, computer network and Internet has transformed our life in many good ways. Unfortunately, these vast network and associated technologies have also brought increasing number of security threats. This unit introduces what computer security attacks you could encounter in your life in the connected world, what type of impacts these security attacks could cause and what action you can take to avoid or minimizing the impact of the attacks.

Brainstorming

1. What threats and risks do you remember in the area of computer network, utilization of smart phones and information and computer misuse from grade 8 IT subject?
2. You learned about Internet and Internet services including social media in grade 8. Besides their wide benefits, what challenges may you encounter through the Internet?

5.1 Definition of Security

What is the meaning of the term *security*? Security has diverse definitions, which vary significantly depending on what is to keep secured. In general, security is the quality or state of being secure. It can be a freedom from danger (which is related to *safety*) or a freedom from fear or anxiety. Security also means *protection* and measures taken to guard against sabotage, crime, attack or escape. This, the latter, definition is a more proper one from institutional and business perspectives. Do you know that Ethiopia has a federal institution called Information Network Security Agency (INSA)? INSA was established for protecting the country's national interest by building a capability to make information and information infrastructures in the country safeguarded. Thus, INSA is a national security agency with a mission on cyber security, which we shall cover this unit.

The focus of this unit is on computer security. Computer security is the protection of computer systems and information from harm, theft and unauthorized use. What is an unauthorized use? For example, you can use this textbook when you are learning in a classroom or when you study at school or at home. Can you use it during examination? Of course, not! Thus, we may say that it is illegal or you are unauthorized to access and use textbook during examinations. Computer security is also the process of preventing and detecting unauthorized use of your computer system. There are various types of computer security, which is widely used to protect personal and organizational valuable information. Depending on what to secure, we can identify the following types of computer security (See Figure 5.1).

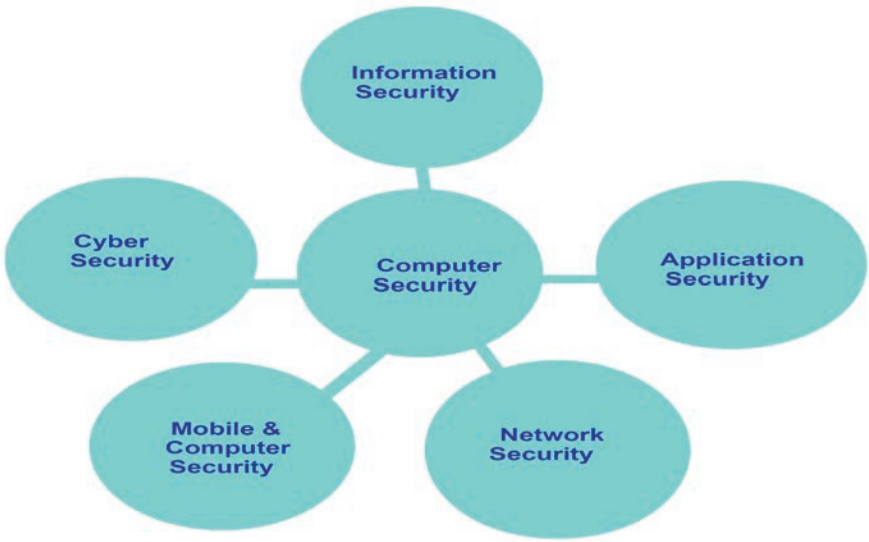


Figure 5.1 Types of computer security

- *Information security:* is securing information from unauthorized access, modification and deletion. For example, do you want your marks reduced or changed by someone who has access to your homeroom teacher's laptop?
- *Application security*: is securing an application by building security features to prevent from cyber threats. Most people use spreadsheet software like Microsoft Excel to store huge data such as payroll or students' marks. What would happen if another person gets access to these data through the network? Such access to application software is dangerous threat for the information security.
- *Mobile and computer security* means securing a handheld devices and standalone machine by keeping it updated and patched.
- *Network security* is done by securing both the software and hardware technologies. Do you know a firewall software or hardware? Read about firewall from the Internet. Firewall protects networks from Internet-based attacks. Related security types are cloud security for internet-based services and Internet of things (IoT) security that are to be covered in grade 12.
- *Cyber security*: means protecting computer systems which communicate over the computer networks.

Note that computer security involves both technological and managerial issues and solutions. Do you know the 90/10 rule? This customary rule states that 10% of your security countermeasures are technical, and 90% of security defenses rely on you to follow good computer practices. The rule emphasis on the importance of security awareness and necessity for students, teachers, employees, merchants and all the citizens adhere to good computing practices. These good computer practices are covered later in this unit.

Activity 5.1

1. **Small group task:** With the increase access to smart phones and use of social media, such as Facebook, TikTok and the like, students of your age upload and share their personal information such as photos and videos online. Develop a small list of questions (not more than five) and ask students outside of your class. Prepare a slide presentation on the benefits that students gain from their sharing of personal information online and potential security risks that students raise in your survey.
2. **Individual work:** if you or your parents have a phone or a computer, consider how many other persons know the password, code or security patters of those devises. Do not worry if you do not have no a phone or a computer. Just, consider that you are the last person to lock your house and you want to put the key somewhere for your brother, sister or parents to fetch it and enter to the house. In both cases, what risks do you anticipate

KEY CONCEPTS

- Being connected is beneficial, but it could also make you victim of security treats.
- Security means protection and measures taken to guard against espionage or sabotage, crime, attack or escape.
- Computer security is the protection of computer systems and information from harm, theft and unauthorized use.
- Good security standards follow the "90 / 10" rule. That is 90% of security safeguards rely on an individual ("you") to adhere to good computing practices. Ten percent (10%) of security safeguards are technical.

5.2 Principles of Computer Security

Brainstorming

What do you wish to see or get from your school computer laboratory or Internet connectivity in terms of quality, reach and your usage desires?

You learned the definition of computer security in section 5.1. Here, you will learn about basic attributes that a computer security system should possess. The concept you learn here helps you, for example, to compare two computer security systems or specify the requirements to establish a particular computer security system.

Computer security is mainly concerned with three main areas. These are *confidentiality*, *integrity* and *availability*, which are abbreviated as CIA. Sometimes CIA is also called as the security requirements triad. Let us see the three components of CIA in detail.

- *Confidentiality* is ensuring that information is available only to the intended audience. This often means that only authorized users and processes should be able to access or modify data. In other words, this involves protecting the information from a third party having unauthorized access. A concept related to this is *privacy*, which focuses on protecting personal data.
- *Integrity* means that data can be trusted. It should be maintained in a correct state, kept so that it may not be wrongly changed and should be correct, authentic and reliable.
- *Availability* is ensuring that the information is available to authorized users whenever they require it. This means keeping systems, networks and devices up and running.

Figure 5.2 shows the confidentiality, integrity and availability as a computer security triangle. Even though the source is unclear, the CIA model in Figure 5.2 shows the three principles as triple constraints of computer security.

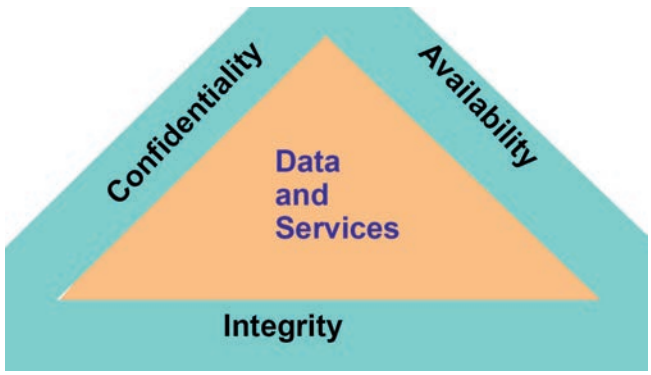


Figure 5.2 CIA model

Such a triangular representation is used to show that computer security (data and services) can be constrained by the three features represented in the three sides of the triangle. Usually, achieving the three of them (CIA) at the same time can be costly and organizations often decide their focuses based on their priorities. For example, schools usually focus on making trustworthy knowledge resources available to wider student community by focusing on integrity and availability. On the other hand, military institutions might focus on confidentiality and integrity.

Activity 5.2

Small group task: In your group activity in question 1 of Activity 5.1, you made a presentation on students' opinion of your school focusing the benefits and risks associated with uploading and sharing personal information such as photos and videos online. You are also introduced to the 90/10 rule of computer security. Improve your slide presentation by discussing first on:

1. Confidential issues related to your examination results - Who can see them, modify them and should not see it?
2. Integrity issue: Can you, as a student, change your result? Ask one of your teachers about whether your school director can make changes on your results? Ask also what your homeroom teacher can do with your marks.
3. Availability: In terms of your school ICT services, ask the IT coordinator to teach students with disability about supports or benefits they could get from the Internet and electronic services of the school.

KEY CONCEPTS

- Confidentiality, integrity and availability, also known as the CIA triad, is a model designed to guide policies for information security within an organization.

5.3 Computer Security Threats

Brainstorming

Ethiopia has become a more connected country. With your mobile phone and mobile data connectivity, you are, of course, part of this interconnected world. What specific threats can affect you through this interconnection?

You learned about the principles of computer security in section 3.2 above, together with the three principles form the cornerstone of any organization's security infrastructure. In fact, they should function as goals and objectives for every security program. The focus of this section shifts on describing the different types of computer security threats. You are living in an interconnected world and it is essential that you develop a clear understanding about the risks of the interconnection and their protection mechanisms.

There are both natural and manmade (artificial) threats to our computers and computer systems. As shown in Figure 5.3, computer security threats can come both from internal and external sources. Internal threats are those threats emerging within an institution, company or business while external threats are from outside. Both internal and external factors can be caused by environmental (i.e. natural) as well as human and technical (i.e. manmade/artificial) factors.

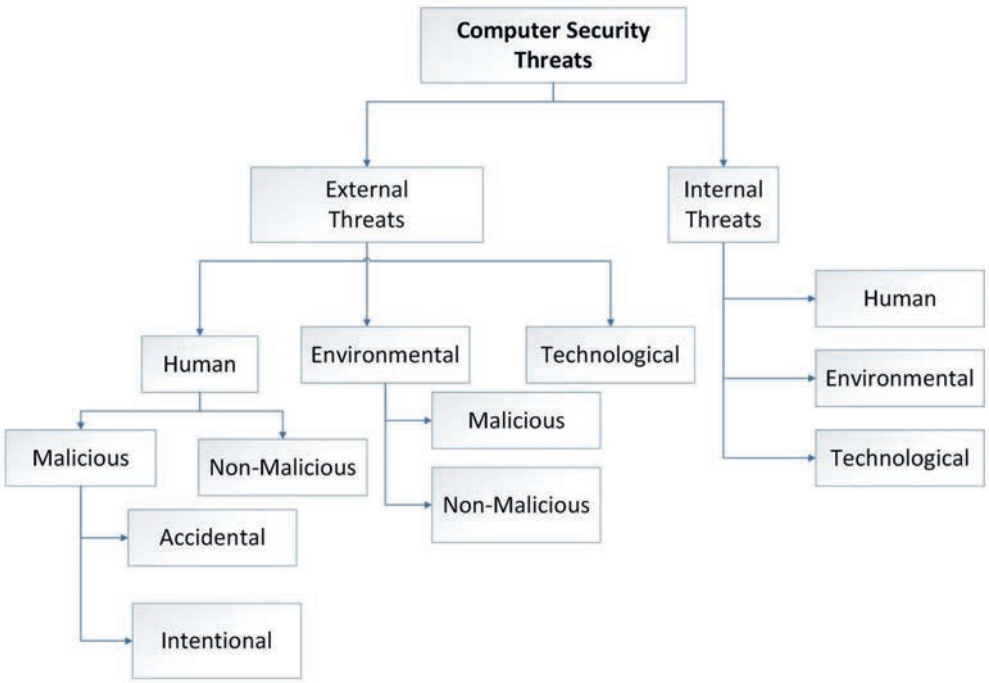


Figure 5.3 Types of computer security threats

Computer security attacks can also be ***malicious***, which are harmful or ***non-malicious*** or have no damaging effect. The attack can also be ***accidental*** that is committed due to mistake or an unintended action or ***intentional***, which means the attacker commits the attack with a deliberate intention. The following two sections (5.2.1 and 5.2.2) present natural and artificial threats for computer security.

5.3.1 Natural Threats in Computer Security

There are many computer security threats happening due to natural causes. Natural hazards such as **earthquakes**, **flooding** or **lightning storms** can lead to **fires**, **extreme temperatures** and even **electric shocks** to your computer, causing potential physical damage and loss of data. These are discussed one by one below.

Fire

Fire can be devastating to your computer. Beyond direct damage from flames, the heat generated can melt sensitive components within the computer. Smoke can damage the CPU fan which can also cause over-heating. In case of a fire, always get yourself to a safe place before trying to rescue your computer.

Extreme temperature

Generally, computers are designed to function within a moderate temperature range. Excessive heat or cold can cause important components to malfunction or break. In cases of drastic temperature changes, it is best to allow the computer to return to room temperature before using it.

Lightning strikes

Lightning strikes are a huge threat to your computer, even if they never actually touche your hardware. Sometimes, a lightning strike will create an electric surge (or spike) that amplifies the voltage to your computer through the power supply. This sudden surge of electricity can destroy crucial components of your computer including your motherboard.

Activity 5.3

1. Discuss with your classmate about the fire burn and property damages of any one of the classed encountered the burning, and what could be done with fire-related emergencies in computer laboratories and data centres.

2. List three components of a computer hardware that a power surge can destroy.

5.3.2 Artificial threats to computer security

The vast majority of computer security threats are manmade and happening through the devices and networks that we are using. Computer security threats change their nature and methods with a change in the technology. With the recent development on Internet-based services, the majority of manmade security threats come through the Internet as a platform, i.e. they come through network connectivity. Hence, the term cyber security is used interchangeably with computer security. The attack on computer security is also widely referred as *cyber-attack*. The prefix *cyber*, both in cyber-security and cyber-attack and as well cyberspace refers to computers and computer networks. Cyber-attacks are classified in different ways. You can consider the following as the main types of cyber-attacks.

1. Denial of service (DoS)
2. Malware attack
3. Man in the middle
4. Phishing
5. Eavesdropping
6. SQL injection
7. Password attack
8. Social engineering

Table 5.1 below describes different types of computer security attacks. Malware attacks such as Trojan horses, worms and virus were in existence since the era of file sharing through portable file sharing. Denial of services (DoS), phishing, SQL injections and password attacks are popularized with the dominance of the Internet as a service platform. Malware stands for malicious software. Cyber-attacks can also combine psychological and technological attacks particularly in the case of man-in-the-middle, eavesdropping and social engineering attacks.

Table 5.1 Types of cyber-attacks

Type	Variety and description
Denial of service (DoS)	DoS attacks hurt computer systems by flooding targets with requests – stopping regular users from connecting to the service. This means the regular network- based services cannot be provided on timely manner. DoS attacks on bank IT infrastructure, for example, could stop the bank services such as ATM and CBE Birr services. Such attacks disappoint customers and the service providers, such as the banks, may encounter reputation damage as a result.
Malware Attack	**Trojan horse**: A code that takes over the system to steal and damage everything on the system. Trojan horse is the type of malware that downloads onto a computer being disguised or masked as a legitimate program.
	Virus: A malicious code that gets into the computer program by replicating to change its functioning. Melisa virus is a common one that spreads itself in the system without acknowledging the user. Some people also refer to it as rootkit.
	Key logger: They work by recording the movement on the keyboards and mostly steal passwords and accounts' details.
	Worms: An independent program that infects the computer system through network devices
	Adware: Advertising software to spread malware. Adware (or advertising software) are various pop-up advertisements that show up on your computer or mobile device. Adware has the potential to become malicious and harm your device by slowing it down, hijacking your browser and installing viruses and/or spyware.
	Botnets: The word botnet is formed from the words robot and network. Cyber criminals use special Trojan viruses to breach the security of several users' computers, take control of each computer and organize all the infected machines into a network of bots that the criminal can remotely manage.

	Spyware: A secret program that tracks all the movements of the user secretly and then uses that information against them.
	Ransomware: This malware locks the files and data on the system and threatens to delete them if not paid the ransom.
Man in the middle	This type of attack includes intercepting communication between the people and then stealing data from their conversation. Open Wi-Fi networks are the most common place where this kind of attack takes place.
Phishing	Phishing attacks are the practice of sending fraudulent communications that appear to come from a reputable source. It is usually performed through email. The goal is to steal sensitive data like credit card and login information or to install malware on the victim's machine. Phishing is a common type of cyber-attack that everyone should learn about in order to protect him/herself.
Eavesdropping	An eavesdropping attack occurs when a hacker intercepts, deletes or modifies data that is transmitted between two devices. Eavesdropping is also known as sniffing or snooping. It relies on unsecured network communications to access data in transit. It typically occurs when a user connects to a network in which traffic is not secured or encrypted and sends sensitive business data to a colleague. The data is transmitted across an open network, which gives an attacker the opportunity to exploit vulnerability and intercept it via various methods. Eavesdropping attacks can often be difficult to spot. Unlike other forms of cyber-attacks, the presence of a bug or listening device may not adversely affect the performance of devices and networks.
SQL injection	This is when an attacker injects an unauthorized input into the SQL statement. However, this is only possible on websites where hackers can access the database using your ID and password.

Password attack	Many hackers try to get your password by using different methods such as dictionary attack where they try different possible passwords from the dictionary; brute force where they do trial and error to decode the password, but it is time-consuming; Key-logger or tracking movements on the keyboard to get passwords; shoulder surfing, which is a physical observation that people do by looking over the user's shoulders; the rainbow table, which has pre-computed hash values to find passwords.
Social engineering	Social engineering refers to creating a social situation to get information from the user like getting a call from the mobile company saying, "Your device is in danger". You blindly trust and give out all the information without any verification.

The Internet has also brought peculiar challenges for kids and youth of your ages. Religious fundamentalists, radical political or tribal extremists, terrorist and sex traffickers and abusers have found the Internet as safe zone for their illegal attraction towards kids and youth to their extreme views and activities. The following are such dangerous Internet-based cyber security attacks which obstacle your safe use of the Internet.

1. *Cyber bullying* - This is ridiculing or humiliating young kids in such places as social media and online game platforms. Cyber bullying is bullying that takes place over digital devices like cell phones, computers and tablets. Cyber bullying can occur through SMS, text and apps, or online in social media, forums, or gaming where people can view, participate in, or share content. Cyber bullying includes sending, posting or sharing negative, harmful, false or mean content about someone else. It can include sharing personal or private information about someone else causing embarrassment or humiliation. Some cyber bullying crosses the line into unlawful or criminal behavior.

2. *Cyber predators:* Cyber predators are people who use the Internet to exploit usually younger people for sexual and other purposes. Many cyber predators pretend to be someone else or lie about details about themselves to gain trust of their victims.

3. *Posting private information*: You may not yet understand social boundaries. Thus, you may post personally identifiable information online, for example in your social media profiles that should not be out in public.

5.3.3 Who is behind cyber attacks?

The following parties play roles behind cyber-attacks.

1. *Online criminals*: These people are good at identifying what can be appropriated, for example stealing and selling sensitive data or holding systems and information to ransom.
2. *Hackers*: Individuals with varying degrees of expertise, often acting in an untargeted way, perhaps to test their own skills or cause disruption for the sake of it.
3. *Malicious insiders*: use their access to an organization's data or networks to conduct malicious activity such as stealing sensitive information to share with competitors.
4. *Honest mistakes*: Sometimes persons like you or staff with the best intentions just make a mistake, for example by emailing something sensitive to the wrong email address.
5. *School pupils or students*: Some students simply enjoy the challenge of putting their cyber skills to the test.

KEY CONCEPTS

- You have a lot to gain from the Internet and Internet-based services. However, Internet could also be a backdoor to allow hackers and other cyber attackers to enter into and abuse your privacy and your school's system. You need to develop safe internet use practices.

Activity 5.4

1. What can do you as a student to protect yourself from the many types of manmade cyber- attack?
2. What can your parents and school can do to assist you to have secure and safe use of Internet and online services?

3. Ask your school's IT coordinator about availability of acceptable use policy that governs how the Internet and computers should be used in the school compound. Read this use policy and discuss its role in protecting you from

5.4 Potential Losses Due to Security Attacks

Brainstorming
What personal, social, economic and political impacts do we incur computer due to computer security threats?

Whether the security threat originates within or outside of your home, your school or somewhere else or happened due to natural or manmade causes, it will have psychological, financial, legal or political impacts of varying levels of severity. The popular impacts of computer security threats are the following.

1. *Destruction or loss of information*: such as destruction of system components or loss of data due to failure of a hard disk.
2. *Corruption of information*: like unauthorized alteration of files stored such as adding or reducing student marks stored in a school database or in a computer used by your homeroom teacher. Posting documents that the school considers as illegal or unacceptable onto your or the school's social media channels (e.g. Telegram or Facebook) is example of corruption of information.
3. *Theft of services:* is an unauthorized use of computer or network services. Consider, for example, that you have access privilege to the school Internet service for educational purposes. If you use this privilege for unrelated purposes such as for online marketing (for promoting goods), then, it becomes a theft of services.
4. *Illegal usage*: uses the normal function of the system to achieve the attacker's behavior for other purpose. For example, dispatching texts of videos that promote inter-conflict or inter-religious conflict by using school internet services is an illegal usage, which can be a criminal act.

5. *Disclosure of information*: This is dissemination of information to anyone who is not authorized. For example, schools put warning or letter of appreciation on noticeboard inside the school to make the case known to the school community. Taking a picture of such information and posting it on social media is an unethical disclosure of private information. Figure 5.3 shows an increase of cyber-disclosure in American secondary schools. Even though it does not show the cases in Ethiopia, it shows the severity of the situation in the developed world and suggestive to the emerging situation in our country and the rest of the developing world.

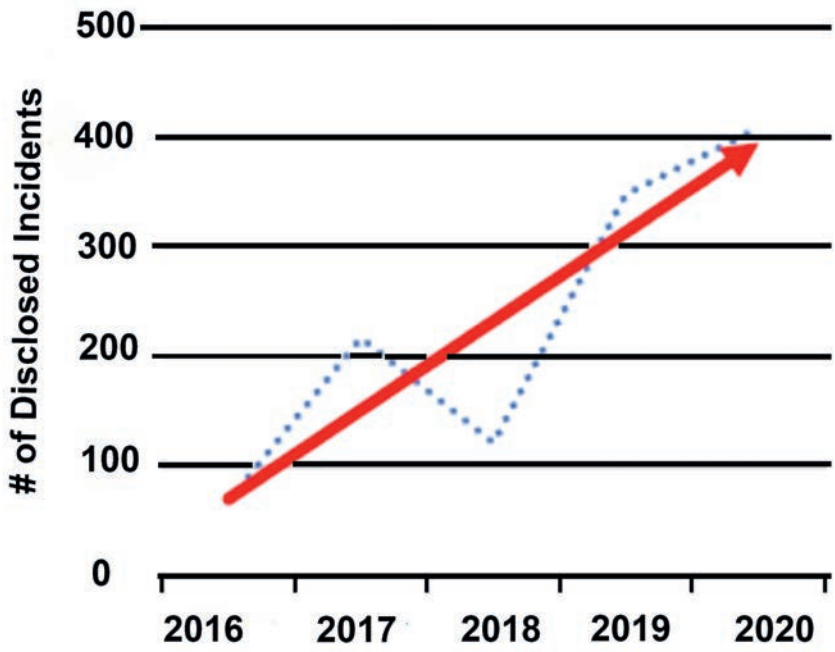


Figure 5.3 cyber-attacks against public schools in the United States

6. *Denial of use:* This is covered above as DOS, in section 5.3.2. DoS is an intentional degradation or blocking of computer or network resources, making it inaccessible to its intended users.

7. *Elevation of privilege*: uses the weakness of the system to access the target system. An elevation-of-privilege occurs when an application gains rights or privileges that should not be available to them. Let as assume both a teacher and a student have privileges to access to academic record systems where students marks are registered. The access privilege for the teacher is higher because he or she registers marks and works on some administrative tasks. Elevation of privilege occurs when a student manages to enter with the

account of the teacher. Such a risk occurs, among others, for example when we use easily guessable passwords, heft or hijacking and due to keystroke logging. Keystroke logging (or capturing) happens due to the action of recording (logging) the keys struck on a keyboard.

Activity 5.4

1. List threat types that could cause each of the seven categories of threat impacts.
2. Try to understand the following case and answer the questions that follow it based on it.

Student Halima, who loves shopping online, is an Ethiopian. She surfs the internet every week and purchases something new. One day, she realized that there were purchases made that she did not make herself and a price twice the cost of the purchase is paid from her mobile banking.

a. Explain how student Halima is benefited from ICT in this context.
b. List two negative impacts she encountered from ICT usage in this context.
c. Briefly explain why Halima could possibly be the victim.
d. Suggest what she can do to protect herself from such situations in the future. Ask an IT expert for further information.

5.5 How to Secure yourself and your Computer Systems

The threats that you learn in section 5.3 can cause unprecedented danger. Consider, for example, what would happen if the computer that keeps the entire result of students from grade 9 to 12 was stolen or failed beyond repair. From where can you get your transcripts? Banks, insurance companies, hospitals and many other institutions store their valuable information in computer systems in spite the fact that the risks of computer security (both natural and manmade) are eminent. Thus, precaution is extremely important.

Here, it is important to employ the customary 90/10 rule of computer security – 90% of good computer and 10% of technical practices. The good computer practices start with having sufficient level of security awareness. A book on Internet safety for schools put forwards the following for students to know.

- The Internet is a powerful tool that should be used wisely.
    - It allows students to access to a vast library of previously unavailable resources.
    - It also enables students to communicate with people around the world.
    - It also provides creative outlet for students skilled in writing, art, music, science, mathematics and other topics.
- Know also that not all Internet information is valid or appropriate.
    - Sexually explicit materials or violent images can affect students negatively.
    - Sexual predators will try to convince students to trust them.
    - Internet information may promote negative attitudes such as hatred or intolerance and dangerous or illegal activities, such as self-injuring behavior, gambling and illegal drug use.
- Internet messages and the people who send them are not always what or who they seem.
    - People in chat rooms, instant message "buddies" or those who visit a blog may not be who they appear to be.
    - E-mail can cause malicious code infection problems for a computer or network.
    - Students need to know which information is safe to share with others online, which should never be shared and why sharing it could put them at risk.
    - Students should never reveal online any information about where they live or attend school.
    - Students need to be aware of their electronic messages, even those with known friends, can leave electronic footprints that can be misused by others.
- Predators and cyber bullies hide themselves and use the Internet to manipulate students and kids. Students must learn how to avoid dangerous situations and get adult help.

- Sexual predators deceive students by pretending to be students themselves. They sometimes lure young people into a false sense of security or blind trust and try to alienate them from their families.
- Bullies use Internet tools such as instant messaging and the Web to harass or spread false rumors about students.
- Students need to know that posting personal information and pictures can allow predators to contact and begin grooming them for illegal meetings and actions. Personal photos can be easily misused or altered when posted on the Internet.

- Internet activities such as playing games and downloading music or video files can be enjoyable. Students need to know which activities are safe and legal.
  - Gaming sites can attract sexual predators and/or cyber bullies.
  - Some games may contain pornographic and/or violent images. Students need to talk to their parents about what is acceptable.
  - Students need to know how to detect whether a specific file download is legal and/or free of malicious code.

Besides having essential security awareness, it is important that you take preventive steps for having secure computer system and safe internet use. These include:

- Secure your computer physically by:
  - Installing reliable, reputable security and anti-virus software.
  - Activating your firewall, because a firewall acts as a security guard between the internet and your local area network.
- Stay up-to-date on the latest software and news surrounding your devices and perform software updates as soon as they become available.
- Avoid clicking on email attachments unless you know the source.
- Change passwords regularly, using a unique combination of numbers and letters, combining the capital and small letters. It is good for you to have at least 15 characters. If you have more than one account (for example, for e-mail, e-learning or Facebook), try to have different

passwords for different accounts.

- Use the Internet with caution and ignore pop-ups, drive-by downloads while surfing.
- Perform daily full system scans and create a periodic system backup schedule to ensure your data is retrievable when something happens to your computer.

KEY CONCEPTS

- Computer security is the protection of computer systems (including hardware, software, firmware and information being processed, stored and communicated) and information from harm, theft and unauthorized use.
- Computer security treats can be internal to an information system or external. The cause could be environmental (or natural) in which natural hazards such as earthquakes, flooding or lightning storms lead to fires, extreme temperatures and even electric shocks to your computer, causing potential physical damage and loss of data.
- Computer security can also be artificial (or human errors or technological) and could happen accidentally in which attackers affect the information and computer system.
- Broadly, there are seven categories of malicious impact that information and computer security threats can course.

5.6 Unit Summary

- Although network allows us to share resource easily, one of the disadvantages of being connected is vulnerability to different security threats.
- Computer security is the protection of computer systems (including hardware, software, firmware and information being processed, stored and communicated) and information from harm, theft and unauthorized use.
- Information security is the protection of information and information

systems from unauthorized access, use, disclosure, disruption, modification or destruction in order to provide confidentiality, integrity and availability.

- Confidentiality ensures that information is available only to the intended audience.
- Integrity protects information from being modified by unauthorized parties.
- Availability ensures that information should be consistently and readily accessible for authorized parties timely.
- Computer security threats can be caused by natural in which natural hazards such as earthquakes, flooding or lightning storms leads to fires, extreme temperatures and even electric shocks to your computer, causing potential physical damage and loss of data.
- Computer security can be artificial or manmade in which hackers and crackers will affect the information and computer system.
- The broad majority of computer security threats come from the manner that computer users practice (90%) and, thus safe use of computer systems and the Internet helps us to avoid the major security risks associated.
- Threats on the Internet can come from hackers, cyber bullies and predators using the Internet and computer networks. Internal malicious actors (like students and teachers) and your trusted persons can make cyber-attacks by mistake.
- The major types of cyber-attacks are denial of services (DoDs), malware attacks, man-in-the-middle, phishing, eavesdropping, SQL injection, password attack and social engineering.
- You can minimize the risks of cyber security risks by building your awareness level and applying good Internet and computer use practices as well as by implementing technical protective measures.

5.7 Unit Review Exercise

Part I: Write whether the following statements are true or false.

1. Bing connected does not introduce security vulnerabilities or threats.
2. Ensuring availability means making service accessible at the time of need.
3. There is little or no danger coming from the Internet.
4. Identity theft is natural security treat.
5. Confidentiality, integrity and availability are principles of a computer security.

Part II: Choose the correct answer among the alternatives provided.

1. _____ ensures that information is available only to the intended audience.
   A. Confidentiality
   B. Availability
   C. Integrity
   D. All of the above.
2. Identify the term which denotes that only authorized users are capable of accessing a given information.
   A. Confidentiality
   B. Integrity
   C. Availability
   D. Authenticity
3. Which one is different from the others?
   A. Fire
   B. Identity theft
   C. Computer crime
   D. Information theft
4. The security of a system can be improved by _____.
   A. Audit log
   B. Threat monitoring
   C. Both A and B above
   D. None of the above.

5. Which one of the following replicates and spreads itself?

   A. Encryption

   B. Worm

   C. VoIP

   D. Spyware

6. Sahlu used his social skills in tricking Jundi into revealing access code. This would be called _____.

   A. Social engineering

   B. Social media

   C. Social viruses

   D. Social processes

7. Which one can be a good password for you online account?

   A. A text that combines your name and telephone number

   B. A text that combines your date of birth with your father's name.

   C. A randomly generated long combination of capital and small letters and digits.

   D. All of the above.

8. Which one of the following can be a potential source of a cyber-attack?

   A. Your father

   B. Online criminal

   C. School boys and girls

   D. All of the above.

9. Use the normal function of a given networked computer system to achieve some unrelated other purpose is _____.

   A. disclosure of information

   B. denial of service

   C. phishing

   D. illegal Usage

10. Which one of the following is a good practice of computer security?
    A. Keeping critical personal information private
    B. Playing games freely available on the Internet
    C. Opening all email attachment instantly out of curiosity to see their contents
    D. Sharing passwords for close friends and family members
11. What is an Internet monitoring technique that captures keystrokes on their journey from the keyboard to the motherboard called?
    A. Spyware
    B. Web log
    C. Adware
    D. Key logger
12. Imagine that you purchase a book from an online company. Three months later, you might receive an email asking you to log in to the system to update your Telebirr information. Of course, this email is not actually from Ethio-telecom, which runs Telebirr, and as soon as you log in, your information will be stolen. What type of information security breach would you consider this to be?
    A. Insider attack
    B. Phishing
    C. DoDs
    D. Eavesdropping
13. Malware stands for?
    A. Multipurpose software
    B. Malfunctioned software
    C. Malicious software
    D. Malfunctioning of security

14. Which of the following usually observes each activity on the Internet of the victim, gather all information in the background and send it to someone else?

    A. Malware

    B. Spyware

    C. Adware

    D. All of the above.

15. When a person is harassed repeatedly by being followed, called or written is a target of _____.

    A. bullying

    B. stalking

    C. identity theft

    D. phishing

16. Unsolicited commercial email is known as _____.

    A. Spam

    B. Malware

    C. Virus

    D. Spyware

17. Among the following, identify the element which is not considered in the triad, according to the CIA.

    A. Confidentiality

    B. Integrity

    C. Availability

    D. Authenticity

18. Why should you be careful about what you open and download on the Internet?

    A. Because it could be something inappropriate.

    B. Because it could steal information from your computer.

    C. Because it could have a virus that harms your computer.

    D. All of the above.

19. What should you do to create a positive digital footprint?

    A. Create a username that does not reveal your identity.

    B. Post photos and comments about every funny thing you do.

    C. Share your full name and private information like your birthdate.

    D. Lie in your profile to make yourself sound more impressive.

20. Hanna is playing an online role play game when another player starts following her around in the game and asking for her personal information. What should Hanna do?

    A. Turn it into a game and run away from the other player for as long as possible.

    B. Tell an adult about what is happening, then report and block the other player.

    C. Message some of her friends and start spamming the other player with messages in return

    D. None of the above.

UNIT 6 FUNDAMENTALS OF PROGRAMMING

UNIT OUTCOMES

At the end of this unit, learners will be able to:

- Describe problem solving techniques.
- Compare and contrast steps of problem solving techniques.
- Use top-down and bottom-up problem solving techniques.
- Evaluate simple algorithms represented in flowcharts and pseudocodes.

UNIT OVERVIEW

Have you ever encountered a problem? For sure you faced many challenges almost every day! All living organisms encounter numerous kinds of problems and attempt to solve them instinctively. We, humankinds, go many steps ahead and try to solve problems applying tools and methods. Do you remember the recent problem that you run into and how did you solve it? You might have done it by asking someone else or by applying a technique that you had known beforehand. You might also use tools such as a calculator for mathematical problems or machineries of some sorts. This can be what a problem solving is.

This unit focuses on enabling you develop problem solving skills with a focus on computational problems. You can consider a computational problem as a problem that is solvable applying computers. You will learn the common steps of problem solving and the top-down and bottom-up approaches of solving computational problems. This will enable you to develop your skills in *computational thinking*. Computational thinking involves skills in formulating and solving problems by breaking them down into simple steps as well as synthesizing simple steps into bigger solutions. You will also be familiar with representation of a solution or steps in solving a given problem using graphic tool called flowchart, and visualize how a computer follows them to perform the task associated.

Brainstorming

1. What types of problems have you solved using computer software (applications) you learned in the previous units?
2. Which types of card games are you familiar with? What are the steps and the rules of the games that you played? What would happen if you miss one of the steps or interchange two of the steps in finding solution for a mathematical problem, e.g. polynomial equations?

6.1 Defining a Problem and Computational Problem

You have used application software in units 3 and 4 to handle tasks that we usually do in our everyday business and personal activities. Imagine how challenging those activities would be in the absence of these software! We call challenges that we encounter in our day-to-day life a problem. In non-technical terms, a problem is a difficulty to understand something, or a matter that is difficult to solve/settle, a doubtful case or a complex task involving doubt and uncertainty.

Activity 6.1

Form a small group of three to five students and discuss on one of the following questions.

1. Is climate change causing a problem to your town or village? If yes, how does it affect your community? What should be done to address the challenges and minimize adverse impacts?
2. Do you know that traffic accident is a major challenge in Ethiopia? What are the common problems in your community with regard to safe road use? Discuss the steps you need to take to cross a street in urban centers.
3. What are the positive and negative impacts of social media on students? Discuss on what actions you can take to strengthen the positive impacts and controlling the negative impacts.

Do you consider that the questions in Activity 6.1 are easily solvable by using computers or other kinds of electronic device? Of course, they cannot be easily and directly resolved using a computer system. The issues raised need the engagement of individual persons in the community and the leadership roles of local government bodies, religious and community leaders.

There are other classes of problems that are called computational problems. What is a computational problem? A computational problem is a problem that can be solved systematically (step-by-step) with a computer. These problems usually have a well-defined inputs, constraints and conditions that the output must satisfy. You will learn about these requirements for a computational problem later in sections 6.2 and 6.3. Here are some types of computational problems:

- A *decision problem* is one where the answer is *Yes* or *No*. For instance, "given an Integer **n**, is **n** even?" is a decision problem.
- A *search problem* is the one where the solution consists of one or more values that satisfy a given condition. For instance, we may want to compute a path from one geographical location to another on a map. Another instance, we may want to get a name from a list of names in a spreadsheet column.
- A *counting problem* is the one where the answer is a number of solutions to a search problem. For instance, counting the number of female students from Grade 9 students' list.
- An *optimization problem* is the one where the solution is the "best" possible solution, where the "best" can be defined in a different way. For instance, we may want to compute the fastest route from one location to another. Note that you learned about router in unit 2, which is an intermediary device to find the best route to send message or packet. This device, thus, handles optimization problem in network traffic management.

A **computational problem** is the problem that can be solved step-by-step with a computer. This problem usually has a well-defined inputs, constraints and conditions that the output must satisfy.

6.2 Steps in Problem Solving

Brainstorming

Have you ever heard about the 21st century skills? Is problem solving one of the skills required in the 21st century?

Life in the 21st century demands you to be a good problem solver, which requires related skills in critical thinking, communication, collaboration, creativity and innovation. A closely related concept is a computational thinking. Computational thinking is the thought process that involves formulating a problem and expressing its solution(s) in such a way that a computer, human or a machine can effectively carry out. You will develop your computational thinking skills through practicing problem solving strategies.

Practical Exercise 6.1

Form a group of two to three students and work on the following activities.

1. Search the Internet for "21st century skills" and discuss the skills related to problem solving in your group using the description in the paragraph above as a guide.
2. Search the Internet for George Polya's Problem Solving Method published in his book, "How to Solve It" and discuss the four basic principles of problem solving.

George Polya, a mathematician, designed a four-step method to solve all kinds of problems. Because the method is simple and generalizes well, it has become a classic method for solving computational problems. The four steps of problem solving that Polya suggested are:

1. Understand the problem.
2. Make a plan.
3. Execute the plan.
4. Review and extend.

Although the method appears to be a straightforward method where you start at step 1, go through steps 2, 3 and 4; the reality is that you will often need to go

back and forth through the four steps until you have solved and reflected on a problem. The four steps are elaborated in Table 6.1 below.

Table 6.1 Polya's four steps of problem solving methods

Step Number	Description of Step
1. Understand the problem.	Figure out what is being asked. What is known? What is not known? What type of answer is required? Is the problem similar to other problems you have seen? Are there any important terms for which you should look up definitions?
2. Make a plan.	Come up with some strategies for solving the problem. Common strategies include making a list, drawing a picture, eliminating possibilities, using a formula, guessing and checking, and solving a simpler, related problem.
3. Execute the plan.	Use the strategy chosen in step 2 to solve the problem. If you encounter difficulties using the strategy, you may want to use resources such as the textbook to help. If the strategy itself appears not to be working, return to 2tep 2 and select a different strategy.
4. Review and Extend.	Part of step 4 is to find a way to check your answer, preferably using a different method than what you used to solve the problem. Another part of step 4 is to evaluate the method you used to solve the problem. Was it effective? Are there ways you could have made it more effective? Are there other types of problems with which you might be able to use this type of solution method?

Polya's four stage of problem solving is adjusted into the following in computer science and information technology:

1. Understand the problem.
2. Develop an algorithm.
3. Write the program.
4. Test the program.

As you can see, steps 2 to 4 are replaced with the concepts that are used in information technology. The "make a plan" in step 2 is represented as *develop an algorithm*. An algorithm is the plan for a solution for a computational problem.

Technically, an algorithm is a sequence of clearly defined steps that describe a process to follow a finite set of unambiguous instructions with a clear start and end points. In short, an algorithm is a precise sequence of instructions for solving a problem. Algorithms are a way of specifying a multistep task, and are especially useful when we wish to explain to another person or machine how to carry out steps. For example, what steps do you follow to calculate the average of 10 numbers? The following sequence of activities should be performed to get the average in the order they are presented.

Step 1. If you do not know the numbers, get the 10 numbers.
Step 2. Get SUM by adding the 10 numbers.
Step 3. Get AVERAGE by dividing SUM by 10.
Step 4. Tell or report AVERAGE as a result.

Algorithm: is a precise sequence of instructions for solving a problem represented in human-understandable format.

An algorithm written needs to be transformed into a computer program to be executed by a computer or any other digital devices. This transformation is required because computers do not understand instructions written in English, Amharic, Afan Oromo or other languages that we humans speak. Instead, computers have their own special language known as a *programming language*. A computer program or *program* in short is a sequence of instructions written using a programming language. The program is executed by a computer to solve problem or perform a specified task.

A **program**: is a sequence of instructions written using programming language and can be executed by a computer to solve a given problem or perform a specified task.

You will learn about steps 3 and 4 of problem solving in grade 10 through grade 12. The next section (section 6.3) will focus on development and representation of algorithms and their steps of execution. Since algorithms for computational problems are developed for execution by computer systems, it is important to understand information-processing model by computers. A typical and simplified single-CPU information-processing model is shown in Figure 6.1 below.

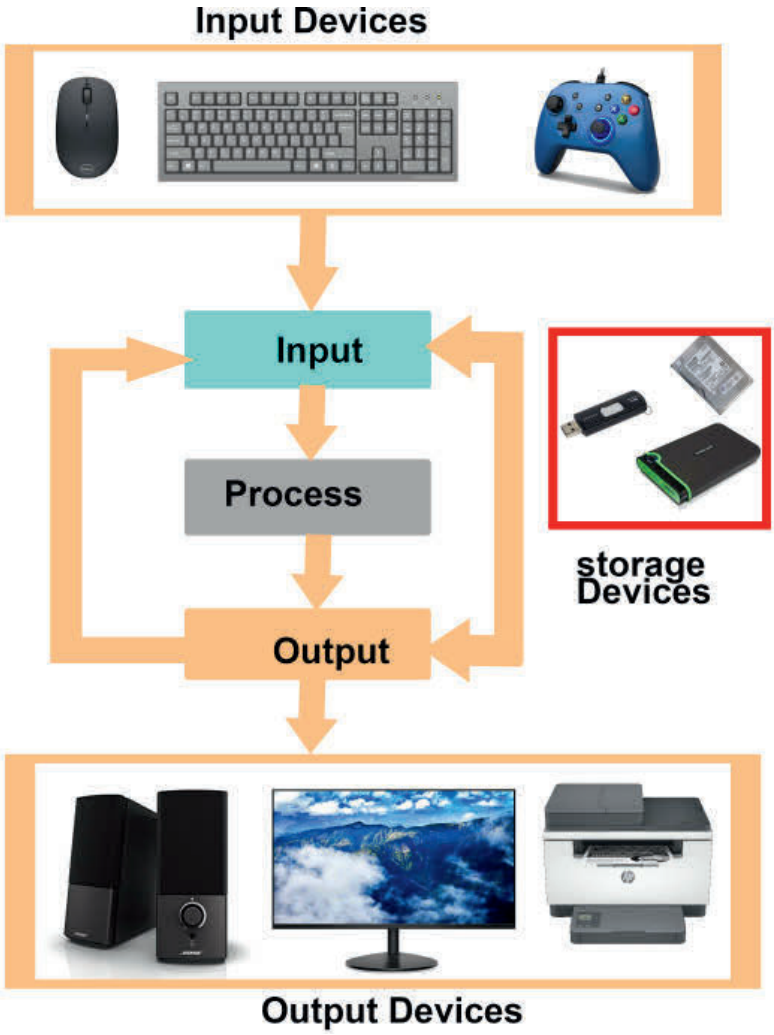


Figure 6.1 A simplified single CPU information processing model

Problems are solved using a computer by obtaining some kind of user input (e.g. keyboard/mouse information or game control movements), then processing the input and producing some kind of output (e.g. images, text and sound). Sometimes the incoming and outgoing data may be in the form of secondary memories or network devices. With regard to problem solving, we will apply the above model in that we will assume that we are given some kind of input information that we need to work with in order to produce some desired output solution.

In the example about finding the average of 10 numbers above, step 1 (get the 10 numbers) is an *input*, which you might get it from a keyboard entry. Steps 2 and 3 that calculate the sum and average of the ten numbers is a *process*. Reporting the result is an *output*, which can be a display on the screen.

6.3 Working with Pseudocode, Flowcharts and Block Programming

Brainstorming

You learned about different symbols (or notations) that you use to represent different networking devices in unit 2. What would happen if different symbols are used to represent a particular device type?

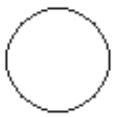
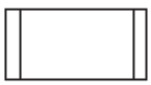
Flowcharts and pseudocodes are two such standard mechanisms used for development of algorithms. Flowcharts use special shapes to represent different types of actions or steps in a process. Lines and arrows show the sequence of the steps, and the relationships among them. A pseudocode is a simple and concise sequence of English-like instructions to solve a problem.

Flowchart: represents an algorithm graphically using boxes of various kinds, ellipses and arrows as connectors.

Pseudocode: represents algorithm with a simple and concise sequence of English-like instructions.

Whereas flowcharts are visually appealing and can be easier to understand, pseudocodes are closer to instructions used in a program. With usage of standardized symbols and pseudocode structures, it is also possible to convert algorithm represented in flowchart into pseudocode and vice versa. You can also draw your own flowchart on paper using the standardized graphical symbols shown in Table 6.2. Table 6.2 does not include all flowchart symbols available. It includes only those which are most frequently used to draw simple flowcharts.

Table 6.2 Basic flowcharting shapes and symbols

Symbol	Representation
	**Start/End** The terminator symbol marks the starting or ending point of the system. It usually contains the word Start or End.
	**Action or Process** A box can represent a single step (add two cups of flour), or an entire sub-process (make bread) within a larger process.
	**Decision** A decision or branching point. Lines representing different decisions emerge from different points of the diamond.
	**Input/Output** Represents material or information entering or leaving the system such as customer order (input) or a product (output).
	**Connector** Indicates that the flow continues where a matching symbol (containing the same letter) has been placed.
	**Flow Line** Lines indicate the sequence of steps and the direction of flow.
	**Subroutine (or module)** Indicates a sequence of actions that perform a specific task embedded within a larger process. This sequence of actions could be described on a separate flowchart in more detail.

Terminal or start/end is always used at the beginning and end of an algorithm. A parallelogram (or input/output) indicates that information is required at this point in the flow. The information can be accepted into (i.e. input) or released from (i.e. output) the computer system. Information processing such as arithmetic operations like adding two numbers or getting average of the two numbers added is represented with a rectangle (process). Process designates specific action or work within the flow. Decision (or diamond shape) indicates a choice that must be made or a question that needs to be answered. The result determines the next step in the flow. Flow lines (arrows) show the direction and order of the flow. Small circle (connector) is used to connect a flowchart placed in a different place or page. Larger flowcharts usually have subroutines to handle a specific task. It is also called *predefined process* and shows that additional information for *predefined processes* is provided elsewhere.

6.3.1 Developing Flowcharts

Flowcharts can be used to represent both computational and non-computational activities. Let us start with non-computational activities (i.e. a process to be handled by a human or a manual machine). For example, one of the peace building activities in school is maintaining a peaceful school environment. This can be done through reducing students' absenteeism and late coming, avoiding sexual abuse and harassment inside and outside of school compound, and strengthening collaborative atmosphere in student-to-student and teacher-to-students engagement.

Assume that your Woreda Education Department has the following Environmental Protection Policy on school gardens. In school where there is a school garden, students and teachers cultivate the garden as part of their Nature study work. However, a new school garden is prepared with the participation of parents. The following flowchart in Figure 6.2 is the algorithm for this policy. Figure 6.2 presents a flowchart for this school policy. The diagram uses two terminals for the start and end. A decision (diamond symbol) for the rule which have a "Yes" and a "No" arrows show the flow direction based on the condition in the diamond.

Practical Exercise 6.2

Draw flowcharts for the following two diagrams.

1. Write an algorithm that accepts a driving speed in kilometer and displays "reasonable speed" if the speed is not exceeding 40 km per hour. The display is "Excessive speed, you are at high risk for traffic accident" if it exceeds 60 km per hour. If the speed is between 40 and 60 km per hour, display "You are in medium speed limit. Be careful!".
2. Draw a flowchart for an algorithm that accepts two numbers and displays the sum and product of the two numbers.

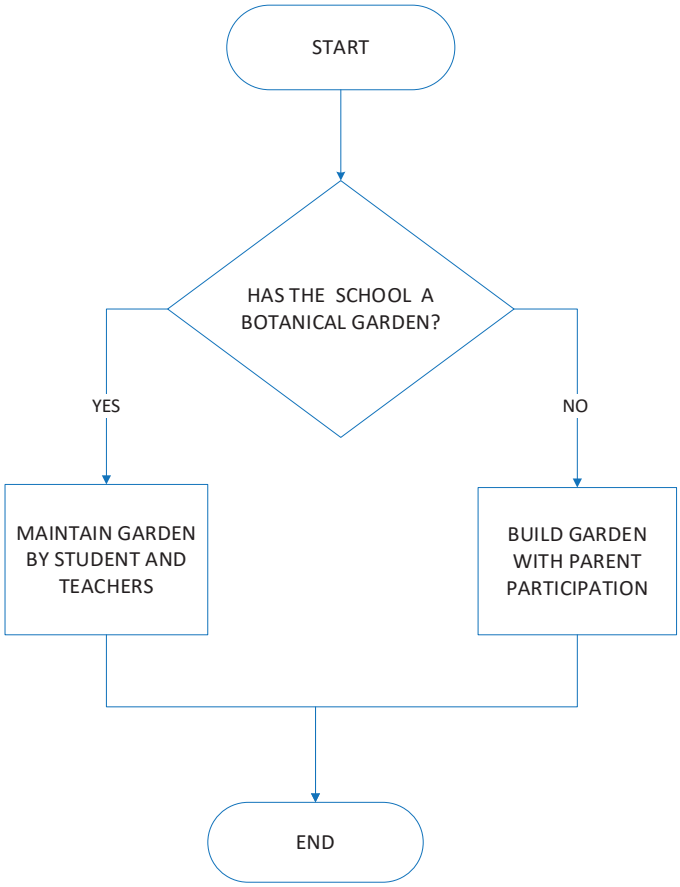


Figure 6.2 Flowchart of environmental protection policy in a school garden

6.3.2 Working with Decisions and Repetitions

Brainstorming

1. Are there some activities that you do repetitively before completing the work? For example, how do you add a long list of numbers, say for exampling adding 100 different numbers?
2. Are there some other activities that you can perform only when a certain condition(s) is met? For example, when do you open your umbrella – is it when you are inside a house or when you are outside? Or, can you become grade 10 student if your average mark of grade 9 is a failure (<50%)?

In this section, you will develop a simple flowchart for certain activities that will be done repetitively or selectively. In general, there are three types of flow of instruction processing in a computer system.

These are:

- **Sequence**: execute instruction top down in the order they are placed in the algorithm.
- **Selection or condition**: execute or jump instruction(s) depending on the outcome of the decision.
- **Repetition**: repeatedly execute instruction(s) for a fixed number of times or until some condition occurs.

Flowchart and block programming tool

There are recent development in learning to programing graphically to make programming accessible and faster to do. These two trends are:

1. Flowchart-based programming environment: using software tool to develop algorithm automatically as flowchart. These tools can help learners to learn the step of execution visually. Additional capacity is auto-creation of program codes from the flowchart. The following are freely available software in this category include
   a. Flowgorithm (http://www.flowgorithm.org)
   b. Raptor (https:// raptor.martincarlisle.com/)
   c. SFC - A Structured Flow Chart Editor (http://watts.cs.sonoma.edu/SFC/)
2. Block-based Programming Environment: The block-based approach of visual programming allows learners to reuse pre-developed graphic object for development of a program through a drag and drop manipulations. The following are two popular free block-based programming environments:
   a. Scratch (https://scratch.mit.edu/)
   b. Blockly (https://developers.google.com/blockly)

We use Flowgorithm for flowchart-based programming and Scratch for block-based programming. Flogorithm is a free beginner's programming language that is based on simple graphical flowcharts. Figure 6.3 shows the flowchart symbols. Flowgorithm combines classic flowchart symbols you have known from Section 6.3.1 above and a few more to represent common repetition flows of in- struction. You can also run your programs directly in Flowgorithm. You can learn more about how to learn programming with Flowgorithm from YouTube videos and notes available at https://en.wikiversity.org/wiki/Flowgorithm and www.flow-

gorithm.org/resources/index.html. You can learn programming through creating stories, games and animations in Scratch.

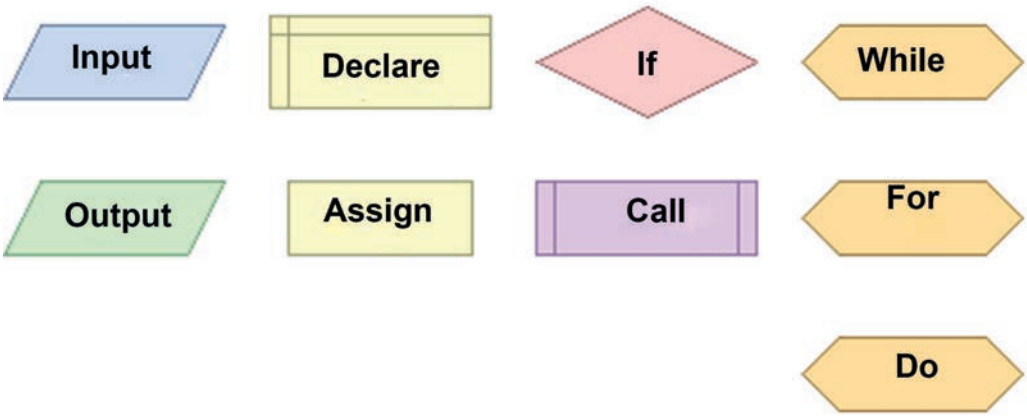
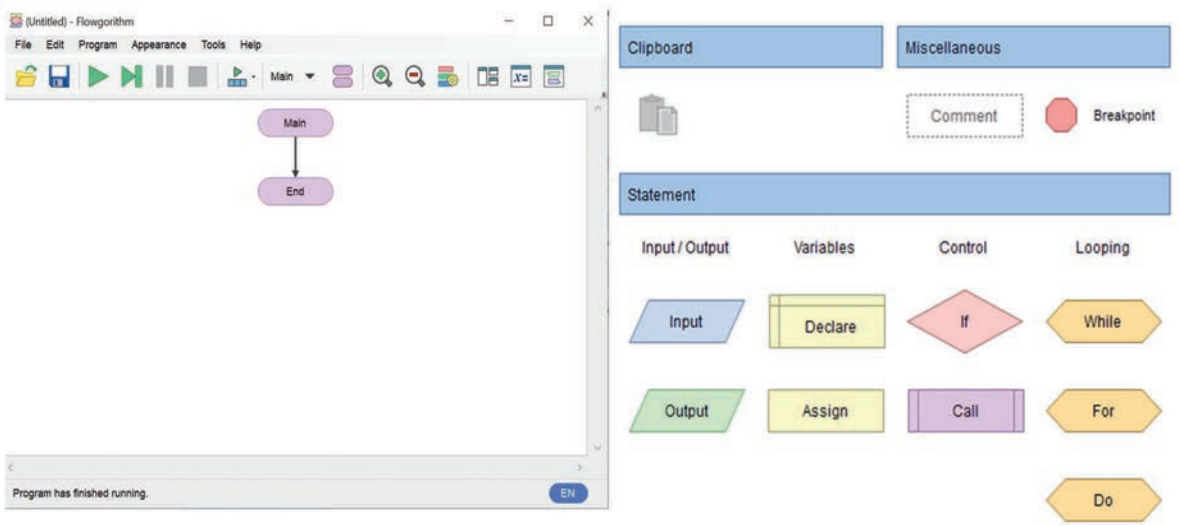


Figure 6.3 Flowgorithm flowchart symbols

You can draw flowcharts in Flowgorithm. Figure 6.4 shows how you can do this. You see a window as shown in Figure 6.4 (A) when you open Flowgorithm. You get a start (or main) and end symbols created automatically with an arrow connection. Figure 6.4 (B) is a pop-up window that you get when you right-click the **arrow** connector. To draw a flowchart with a "Welcome!" message output, you select the **Output** symbol from the pop-up window with which the symbol is added into your flowchart between the start and end. Double click on the output symbol on your flowchart and add the text "Welcome!" in the textbox with instruction *Enter an Expression Below.* Figure 6.5 shows the flowchart produced. To see the output, simply click the RUN icon on the toolbar (See Figure 6.4 (A)).

a) b)



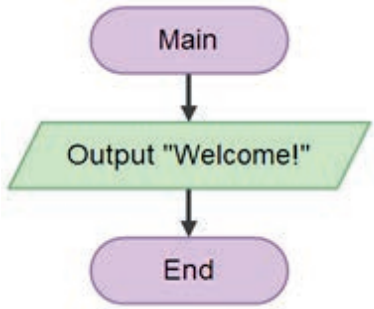


Figure 6.5 Displaying "Welcome"

Practical Exercise 6.3

Draw flowcharts for the following two diagrams.

1. Draw a flowgorithm flowchart with your name and the name of your school in a single line. Hint: Put your name in a double quotation, like "Challa" and your school's name again inside double quotation and connect them together with the & operator, which is a string connector in flowgorithm. Run the flowchart. Are your name and the name of your school combined together without space? Put a space at the beginning of your school's name after opening the quotation and run it. How is it displayed now?
2. Draw a flowchart for an algorithm that displays the name of three neighbouring countries to Ethiopia in three different lines. Hint: Use three output symbols. Note that, instruction presented with one flowchart symbol can be referred to as a statement.
3. Draw a flowchart that adds two numbers, num1 and num2, accepted from a keyboard. Note, now you need to use a variable declaration symbol and the input symbols. Declaration is used to name a variable where a data accepted from a keyboard is going to be placed. Declaration always comes before input. You can also declare more than one variable with one declaration symbol by separating them with comma (,). Hint: You will have important lesson from this activity. One of them is about computer-human interaction. To accept some data from a keyboard, an alerting message must be given with output symbol.

For example, you have to display, "Please enter two numbers" as a prompt for the person to enter them. Then you can accept the numbers the person is supposed to enter with two input symbols declared as num1 and num2. After drawing the complete flowchart, do the following to learn more about how the computer executes long flowcharts. (1) Click the Layout Windows… from the toolbar and select Variables & Consoles from the pop-up windows. Now, you see two more flowgorithm windows. Now, use the Step icon from the toolbar to see how the flowchart performs at each level. Observe the changes in the variable and consoles (or output) windows and responding to prompts given to you.

4. See the pseudocode equivalent of your flowchart. To see the pseudocode version of your flowchart in question number 5, select Source code viewer from Tools menu. Make sure that auto Pseudocode is selected for the source code. If it is not selected, select it by choosing it from the Language combo box in the toolbar of the code viewer.
5. Draw two flowcharts that calculate (1) area of a circle (2) area of a triangle. Note that 62 is written as 6^2 in flowgorithm. Thus, area of a circle with a radius of 6 cm can be calculated in llowgorithm as 3.142 * 6 ^2.
6. Simple wage calculation. Draw a flowchart that accepts hours worked and hourly rate and displays net pays. If total pay exceeds 5,000, tax is calculated for 50% of the total pay. The tax rate is 5%. Net pay is calculated by deducting tax from the total pay. Hint: Use decision or IF symbol.

Working with Scratch

Scratch is a high-level block-based visual programming language designed as an educational tool for programming. Scratch helps you to code simple stories, animations and games. It is freely downloadable from https://scratch.mit.edu/. In this unit, you will use it to build your skills in the use of selection and repetitions with visual coding. Note that it is not a flowcharting tool, instead it is a programming language specifically designed for children.

Figure 6.6 shows the Scratch's first window. At the top right, you get a **stage** with a **sprite,** a **cat** by default. The sprites are the actors or main characters of the project. Sprites are programmed to do something in scratch. The window has four

main elements. The stage and the sprite are the first two. The other two are the **programming pallet** and the **script.** The scrip tells the actors what to say or do. In version 3 of scratch, the programming pallet is at the left side of the windows and labeled as **code.** A script is developed by taking graphic objects from the pallet. The pallet has categories named as *Motion, Looks, Sounds, Events, Control, Sensing, Operators,* and *variables.* The **script** is the area for your block programming of the sprite.

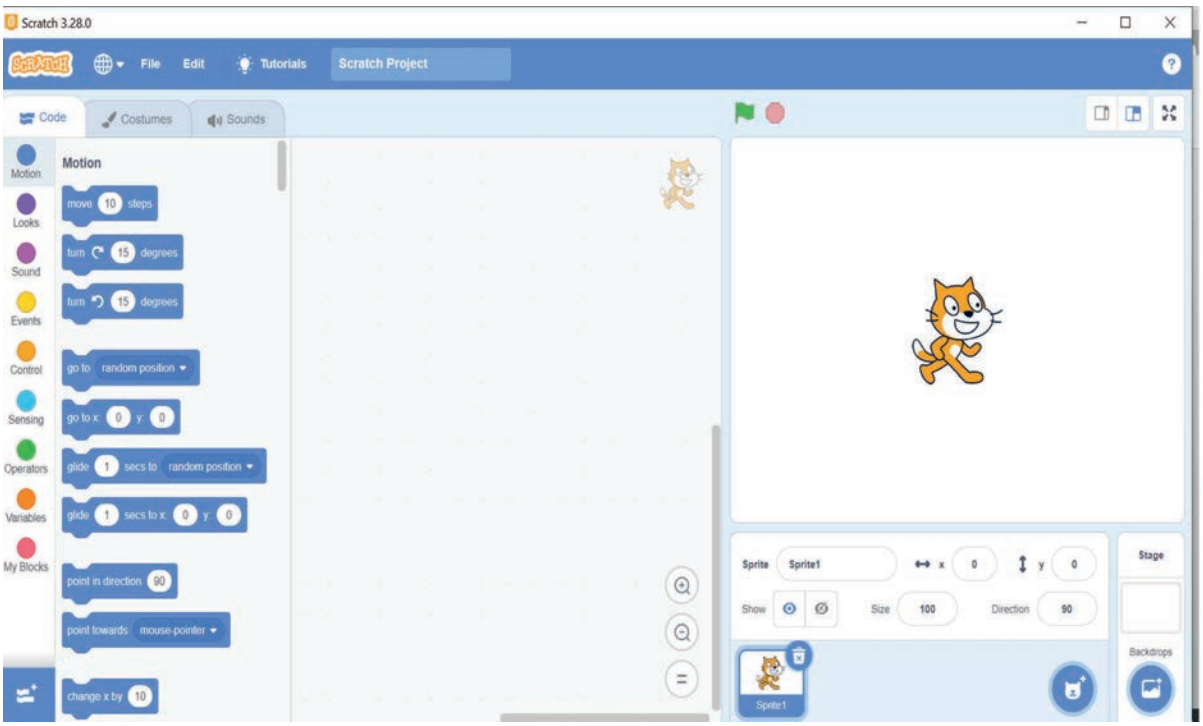


Figure 6.6 Scratch visual programming tool

For example, do the following to move the sprite 10 steps each time **Go** flag (Green) at the top of the window get clicked.

1. From *Events,* drag the **Move** **Clicked** block to the script area.
2. Drag **Move** **10** **Steps** from *Move* and attach it with the **Move** **Clicked** block in the script area.

The script that you developed looks like the following (Figure 6.7).

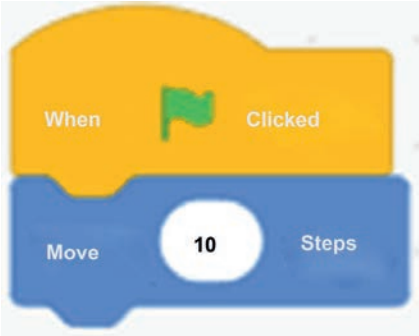


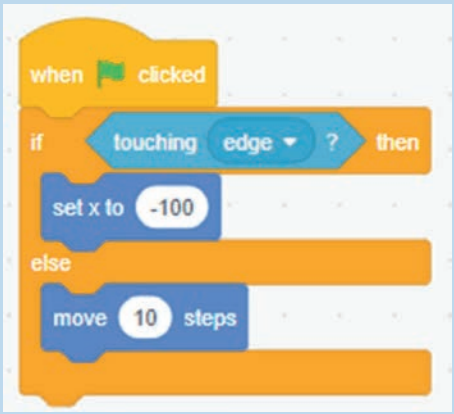
Figure 6.7 A scratch script that moves a sprite 10 steps

After this, click the on the window or the script, what happens? The cat sprite moves 10 steps to the right. That is, with a clip event of the flag, the sprite goes 10 steps horizontally. Try it with several clicks. Now, lets the sprite say hello in addition to a 10 steps move. How can you do that? Look the right block from the *Looks* palette and drag it to the script.

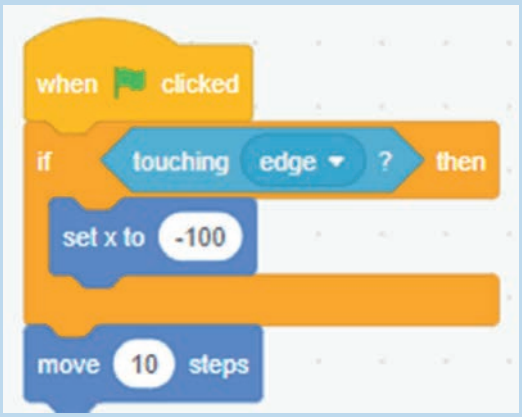
Practical Exercise 6.4

Draw Scratch script for the following questions.

1. Modify your script by changing the Motion, Looks, or adding Sound that you choose. Each time you add any action/look to the Script, (1) discuss with your friends on what you have added and what changes the new script element brought to the sprite.
2. Change the Move 10 Steps in the script into Move 100 steps. What happens after 5 or 6 clicks? Is the sprint inside the stage? Actually, if the sprite goes outside of the stage, it stops near the edge. In this case, it most likely stops in the right edge of the x-axis.
3. Use the if block from the control category with the Touching 'mouse pointing' from the Sensing control. Use the following to control the movement of the sprite within the stage. See the if …. else block. By running the script several times. At what point does the sprite go back to the left? The if script reads: if the script touches the rightmost edge, the x position is adjusted to -100 positions. Otherwise, the sprite moves 10 steps to the right. Note that the stage has a coordinate system with X in the range of -240 and 240 and Y in the range of -180 and 180.



4. Is there any difference between the scripts in question 3 with the one shown below? Which one is better?



5. Write a script to move 10 steps to the left, right, up or down depending on which arrow key on the keyboard is pressed. Hint: Use the key ….. pressed from the Sensing pallets. Also, think how to use the When Clicked together with the forever loop, change x by …, and change y by …. Pallets.
6. Use the repeat N loop, example repeat 10 to force the cat sprite to repeat meows 10 times. Hint: Select the appropriate block from Sound and Use wait … seconds to listen to each meow with clarity.
7. Use the repeat until to repeat the meow sounds until a condition is met. Example, if a counter variable is set to 0 at the beginning, this is to repeat the meow until counter reaches 12 by adding 1 to the counter after each meow. Hint: Add a variable count, set count to 0 before the repeat until … block, add operator as a condition for repeat until block and increment count by 1 inside the repeat until… block.
8. Discuss in group how the if …, if… else, forever, repeat …., repeat until…. Control pallets work.

You have done a good job with scratch! It is time now to draw flowcharts for selection and looping controls. For example, how do you determine whether a given number is even or odd? You divide the number by two and if the remained is not 0, then you say the number is odd. Which flowchart symbol is more appropriate – decision (or if) or looping such as while? The answer is the *if* structure. See the flowgorithm flowchart shown in Figure 6.8 (A). As you can see in the flowchart, a variable *number* is declared and an integer is accepted into it with an input symbol. There is a prompt "Enter an integer: " as output before the input to alert the person to key in the number. The next symbol is the diamond/decision with a condition *number % 2 = 0*. Flowgorithm uses % as a special operator called *modulo-divide*, which gives the remainder of an integer division. For example, 14%3 is 2, which is the remainder. This operator (%) is the same as *mode* in Excel. Check *=Mode(14, 3)* in an Excel cell. Then the condition checks whether the remainder is equal to 0 or not. The flow to output *" number is even"* goes only if the remainder equals to 0; otherwise, the flow moves towards the "number is odd" direction.

Figure 6.8 (B) represents a flowgorithm flowchart that displays all positive integers less than 10. The numbers are 2, 4, 6 and 8. To display these step-by-step, the flowchart begins with declaring **num** as a variable to help the computer to store different even integers. Then 2 is assigned to **num**. **Assign** means making a variable to hold a value, which is 2 at the beginning. There is a *while* loop next to the output. The *while* loop checks whether num is less than 10, and if this is true, it goes inside the loop. The loop outputs or prints the num value and adds 2 to the existing value of num. It goes back to the condition checking and the cycle continues until the condition num < 10 becomes FALSE, in which cases the flow goes out of the *while* loop to finish the task.

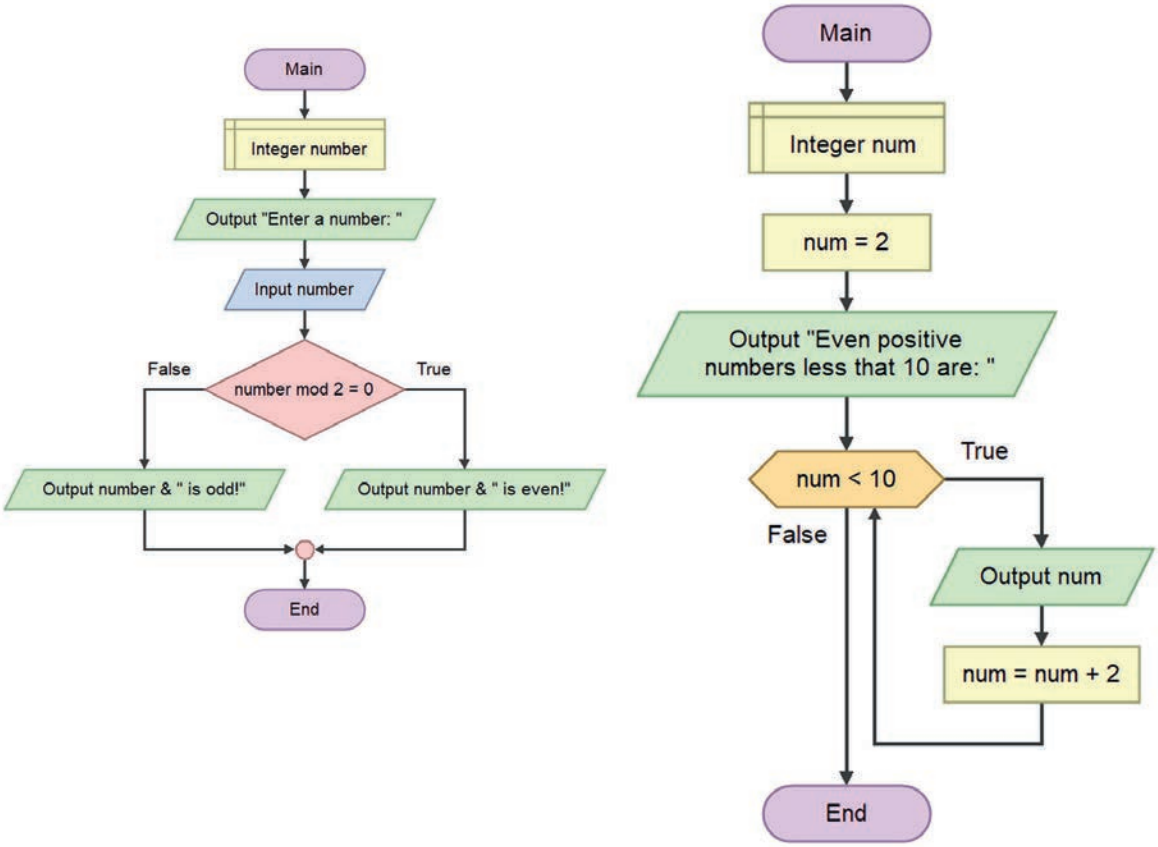


Figure 6.8 If and while loop control flowcharts

Practical Exercise 6.5

Draw flowcharts for the following.

1. Draw a flowgorithm flowchart that calculates wages of 10 labourers by improving the flowchart that you developed for question number 6 of Practical Exercise 6.2.
2. Draw a flowgorithm flowchart that adds all the positive multiples of 3 less than 100.
3. Draw a flowgorithm flowchart that counts the number of failed and passed marks out of 100 for 60 students in the classroom. Mark less than 50% is a failure.

6.4 Problem Solving Approaches

Brainstorming
What problem-solving strategies have you used in solving mathematical problems?

You developed some basic algorithms in section 6.3 above. It is important that we develop and test algorithm before developing program for a given problem. With an increasing complexity of a problem to solve, there is a need to be systematic and apply appropriate problem solving strategy. Top-down and bottom-up programming refer to two different strategies for developing a computer program for complex problems.

6.4.1 Top-Down Approaches

Top-down approach starts by implementing the most general modules and works toward implementing those that provide specific functionality. The idea behind top-down approach is that a bigger problem is difficult to manage in its entirety. Thus, the problem is decomposed or divided into smaller and manageable sub-problems. These sub-problems are then solved individually and then, later, integrated together to get the complete solution for the bigger problem. The solution developed for a smaller problem is called a module. This process of dividing the problem into smaller problem is known as modularization.

Refer back to question 1 of Practical Exercise 6.4 above. You were asked to draw a flowchart to calculate wages of 10 laborers by improving the flowchart that calculates net-pay for a single laborer for Practical Exercise 6.2. In question 1 of Practical Exercise 6.4, you were expected to integrate a repetition (loop) to calculate 10 wages by repeating a set of instructions to complete a single wage for 10 times. This can be divided into two modules. The first module calculates a wage for one laborer. The second module uses the service of the first module to compute 10 wages. See the flowchart symbol for *subroutine* in section 6.3 above and the *CALL* symbol of flowgorithm.

Figure 6.9 shows the flowchart for wage calculation of 10 laborers. As you can see in Figure 6.9, there are two modules. The first is *CalculateWage*, which calculate net pays with specification given in question 6 of Practical Exercise 6.2.

The second is the *main module*, which calls the *calculateWage* subroutine inside a loop structure to calculate wages repeatedly. Likewise, a program for a large problem can be developed by dividing the problem into smaller problems and building modules for the smaller problems.

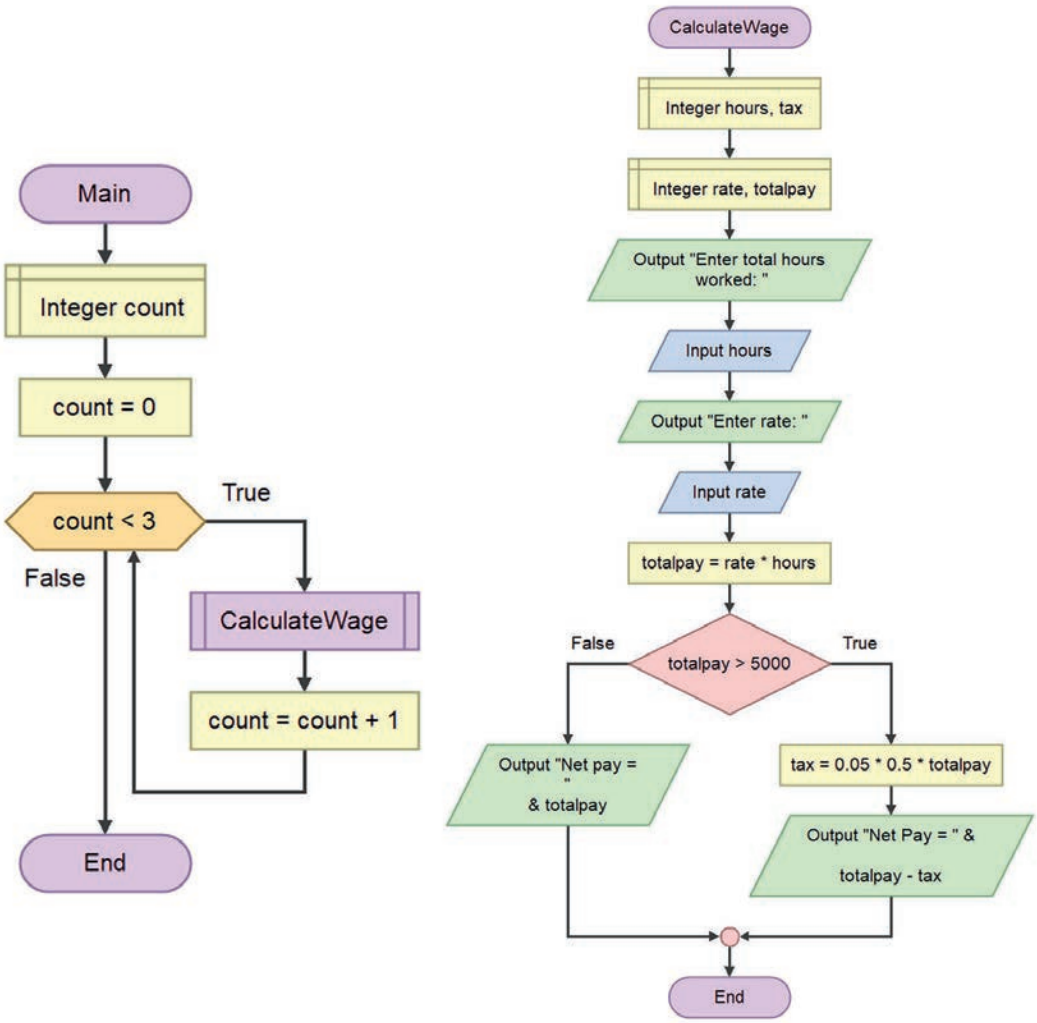


Figure 6.9 A flowchart developed with top-down approach

Practical Exercise 6.6

Draw flowcharts for the following.

1. Draw a flowgorithm flowchart that calculates area and circumference of a circle applying a top-down approach.
2. Draw a flowgorithm flowchart that (1) calculates the hypotenuse of a right-angle triangle using Pythagorean Theorem, and, (2) computes the perimeter of the triangle.

6.4.2 Bottom-up Problem-Solving Approach

Brainstorming

Let us consider a scenario in which you have many modules that are already developed. What will you do if you are given a duty to write a program to which the existing modules are relevant?

This method of solving a problem works exactly opposite of how the top-down approach works. Top-down programming starts by implementing the most general modules and works toward implementing those that provide specific functionality. In bottom-up approach, the most fundamental units, modules and sub-modules are designed and solved individually; these units are then integrated together to get a more concrete base to problem solving.

For example, how can you do if you want to write a program to calculate area and perimeter of different polygons (circle, triangle, rectangle, cube, parallelogram, etc.) applying bottom-up approach. If you have already modules with required functionalities (that is area and perimeter calculation) for each types of polygon, you can bring together those individual components and integrate them. Otherwise, you develop each module first and then incrementally build them up (or synthesize) as a bigger program.

Overall, most programs are developed using a combination of top-down and bottom-up strategies. Both strategies are based on incremental development – the process of building your program piece by piece. Both strategies employ unit testing – testing each individual piece before moving on to the next.

KEY CONCEPTS

- To develop algorithm, we may use bottom-up approach or top-down approach.
- Top-down approach divides the large problem into small chunks called modules and concurs each module individually whereas bottom-up approache starts from individual chunk or module to build up the entire problem solution.

Practical Exercise 6.7

Design Scratch Games. There are many online games that you can play online. You can also design your own games with scratch. Do you know kids' video games such as catch game, Pong, Flappy Bird, PacMan and Mario Bros. You can also develop your own!

1. What is needed? Games have actors – sprites for example apple and a bowl for Catch game. You also need a script, which are actions that a sprite takes during the play. For example, the bowl makes horizontal move to collect the falling apples. You also need stages that change as needed in the game. Read about one of the games and develop a scratch script for the game. Note that you need to apply a careful planning and implementation and teamwork activities.
2. Telling story in scratch. Ethiopia is a historical country with rich cultural diversity and many attractions. What touristic attractions and cultural stories your community has to tell to the world? We have also many issues to tell to your young brothers and sisters, and kids to correct bad habits and unhealthy practices in the country. For example, drug addiction, improper walkway usage in cities and towns, abuses towards child and female students are all common problems in Ethiopia. Scratch helps you build stories and put them online to share your stories for kids or global audiences. Oh, what a golden opportunity! Watch online videos on how to make a story in scratch and build your own story. What you need is determining you characters, scenes and writing dialogues. Using the wait and broadcast makes your story interactive. Remember, this also needs a problem solving strategy that involves proper planning, task division and

6.5 Unit Summary

- Computers and computer applications are meant for solving human problems. Most of our problems are solved using software.
- Software is created through a software development process. The term software and computer program, or simply program, can be used interchangeably.

- A program is a sequence of instructions that can be executed by a computer to solve some problem or perform a specified task.
- A program development passes through a stage or steps to decrease the complexity of the problem.
- The first step in developing a program is to try to understand the problem at hand that needs to be solved using a computer program.
- After clearly identifying the problem, the second step is to develop an algorithm that can be done using flowchart. Another option is a pseudocode.
- An algorithm is a prescribed set of well-defined rules or instructions for the solution of a problem. Algorithms need to be checked for their accuracy. Checking algorithms with paper and pencil is called *desk checking*.
- Pseudocode resembles instructions written using a programming language. We use flowchart for shorter algorithms.
- Problem developers use top-down and bottom-up problem-solving approaches. In top-down, bigger problems and solutions are continually broken down into sub-problems and sub-specifications to get a program's solution by integrating solutions from smaller chunk of problem. Bottom-up starts with solutions from smaller one and builds larger system through integration of pre-developed solutions.

6.6 Unit Review Exercise

Part I: Write whether the following statements are true or false.

1. Program or software is used to solve a problem. .
2. Modularization is a process of decomposing a bigger problem and solving smaller ones.
3. Decision/If is used to control repetitions.
4. A computational problem covers all kinds of problems that human beings may encounter.
5. A computer can solve a problem on its own.

Part II: Choose the correct answer among the alternatives provided.

1. A set of instructions that is developed to solve a given problem using a computer is _____.

   A. hard disk

   B. software

   C. program

   D. B and C are answers.

   E. All of the above

2. An Algorithm can be represented using _____and _____.

   A. software and programs

   B. pseudocodes and flowcharts

   C. A and B are answers.

   D. None of the above .

3. Understanding a problem may include _____.

   A. identifying what is not known

   B. identifying alternative solutions

   C. writing and testing a program

   D. All of the above.

4. Which of the following can be a part of flowcharts?

   A. Input/output

   B. Decision

   C. Loops

   D. All of the above.

5. _____ is a type of diagram that represents algorithm graphically using boxes of various kinds, in an order connected by arrows.

   A. Pseudocode

   B. Algorithm

   C. Flowchart

   D. Top-down and bottom-up approaches

6. Which one is different from others?

   A. if … else

   B. forever

   C. repeat

   D. repeat until

7. _____ is an approach used to build a program by integrating small modules and building them up into a bigger solution.

   A. Bottom-up

   B. Decomposition

   C. Top-down

   D. All of the above.

Part III: Provide clear and precise responses to the following questions.

1. Why is bottom-up better than top-down?
2. What do we mean by top-down problem-solving approaches?
3. What is the advantage of a top-down approach?
4. Write the difference between flowchart and pseudocode. Discuss also how flowgorithm can help you in learning the two?
5. What is a computational thinking?

Annex A: Acronyms

ATM	Automated Teller Machine
CBE	Commercial Bank of Ethiopia
CIA	confidentiality, integrity and availability
CPU	Central Processing Units
DVD	Digital Video Disc or Digital Versatile Disc
HTTP	Hypertext Transfer Protocol
ICT	Information Communication Technology
INSA	Information Network Security Agency

LAN	Local Area Network
MAN	Metropolitan Area Network
NAS	Network-attached storage
NIC	Network Interface Card
PAN	Personal Area Network
PPI	Pixel Per Inch
SQL	Structured Query Language
USB	Universal Serial Bus
UTP	Unshielded Twisted Pair
WAN	Wide Area Network