



Federal Democratic Republic of Ethiopia Ministry of Education



STUDENT'S TEXTBOOK

INFORMATION TECHNOLOGY

GRADE 10



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Federal Democratic Republic of Ethiopia Ministry of Education

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INFORMATION TECHNOLOGY

Grade 10

Student's Textbook

Writers Abdella Kemal (Assistant Professor)
Tegegn Gobana (Assistant Professor)

Content Editor Wogene Alemayehu (MSc)

Instructional Design Editor Jerusalem Yibeltal (PhD)

Language Editor Tagesse Daniel (PhD)

Illustrator Kibrebeal Getinet (MSc)

Book Designer Efrem Yohannes (PhD)



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UNIT

1

ORGANIZATION OF FILES

UNIT OUTCOMES

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

- Explain the file management system.
- Analyze extensions of file types.
- Organize, delete and restore files and folders.
- Summarize file formats.
- Convert a file into different formats.

1.1 Unit Overview

Dear student, in grade 9, you learned about file management and related concepts such as files, folders, file drivers, methods of file creation, naming and renaming files and folders, and ways of accessing drives. In this unit, you are going to learn advanced concepts of file management such as file types, extensions, drivers and paths. You will also learn about methods of file conversion, saving and deleting files, file backup and recovery, storage drive and mechanisms of file importing and exporting.

1.2 File Management

Brainstorming

1. How are files handled at your home?
2. Can you describe ways of managing files in school or other organizations?

Before the introduction of automation system, schools and other societies used to manage and organize their sensitive data in traditional file systems such filing cabinets. Such systems are so traditional and complicated to access files.

Figure 1.1 shows a filing cabinet.

Unit 1 : Organization of Files

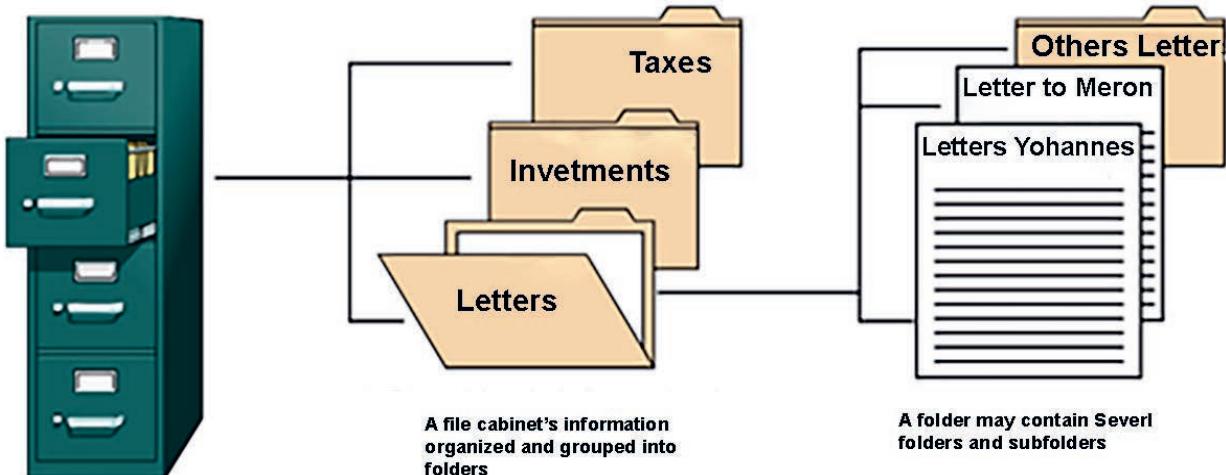


Figure 1.1 Filing cabinet

Nowadays, to recognize file management, you need to understand how your computer stores information. A file is the common storage unit in a computer, and all programs and data are “written” into and “read” from the file.

Computers store information in files that are also organized and grouped in folders and stored on disks, not in big drawers. Computers rely on hard disk drives (HDDs) to store data permanently. They are storage devices used to save and retrieve digital information that will be required for future reference.

NOTE

A **disk drive** is a technology that enables the reading, writing, deleting and modifying of data on a computer storage disk. It is either a built-in or external component of a disk that manages the disk’s input/output (I/O) operations. The most common type of disk drive is a hard disk drive (**HDD**), and the terms *disk drive* and *hard disk drive* are typically used interchangeably. Other types of hard disc include optical drives, storage devices and floppy drives. Figure 1.2 shows a disk drive. Disk drives and other storage devices are discussed in section 1.3.

Activity 1.1

Complete the following activities in a group.

1. Discuss the major types and functions of file management.
2. Try to remember what you learned in grade 9, unit one, and explain the types of files, folders and subfolders.

3. Compare and contrast disks and drives.
4. Briefly explain why file management is so important.

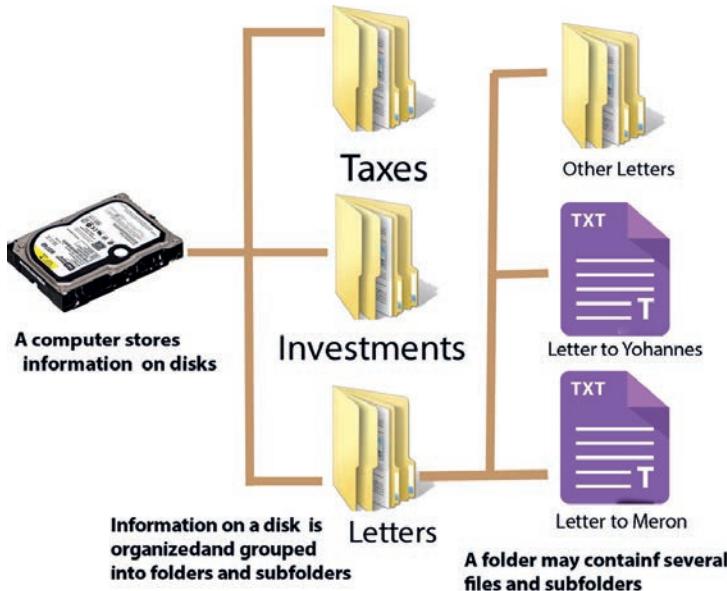


Figure 1.2 Disk drives

A **folder** holds one or more files, and it can be empty until it is filled. A folder can also contain other folders, and there can be many levels of folders within folders. Files are normally organized into directories in schools and other organizations to easily locate and use them. When multiple users have access to files, it may be desirable to control by whom and in what ways the files may be accessed. Therefore, file management is the process of organizing and keeping track of files and folders, helping you stay organized, so information is easily located.

KEY CONCEPTS

- ✍ **File management** is the process and act of creating an organized structure in which you store information for easy retrieval.
- ✍ **Folder (directory)** is a virtual storage space used to store and organize computer files.
- ✍ **A disk drive** is a technology that enables the reading, writing, deleting and modifying of data on a computer storage disk.

1.3 Storage Drives

Brainstorming

1. What do you think a drive is? Why is it used for?
2. How do you identify a drive on your computer?

A computer drive is a piece of hardware that is used to **read** and **store** information on the computer and that is usually not as easily removed as a disk. For example, in **Microsoft windows**, users can identify the drives windows has detected by opening file explorer (right-clicking on windows icon on the taskbar), opening *This PC* icon on the desktop, or pressing the **windows key + E**.

Whenever someone saves his/her file on the computer, it simply means that the file is stored on the hard disk. Currently, there are other ways of saving files using **cloud-based drives**. **OneDrive** and **google drive** are examples of cloud-based drives on which files are stored. You should consider the following important points about drives.

- Each drive is assigned a letter to identify it.
- The letter identifies the root of the file where it is originated from (this means, the location where the file was saved in).

Drives and Drive Letters

A drive is alternatively referred to as a device letter. A drive letter is a single alphabetic character A through Z that is assigned to a physical computer drive or drive partition. For example, a computer with a 3 1/2" floppy diskette drive has a drive letter of **A:** assigned to the drive. Computers containing a hard drive always have that default hard drive assigned to **C:** drive letter, and **CD-ROM** or another disc drive, which is the last drive letter (**For example E:)**. Figure 1.3 shows devices and drives.



1. A cloud drive is a web-based service that provides storage space on a remote server. Cloud drives, which are accessed over the Internet with client-side software, are useful for backing up files. Figure 1.4 shows cloud drive icon.

2. Some people may be confused with “drive” and “driver”. These are separate terms. If you are looking for help with installing or updating the software related to hardware, driver is a group of files that enable one or more hardware devices to communicate with the computer’s operating system. Without drivers, the computer could not send and receive data correctly to hardware devices such as a printer.

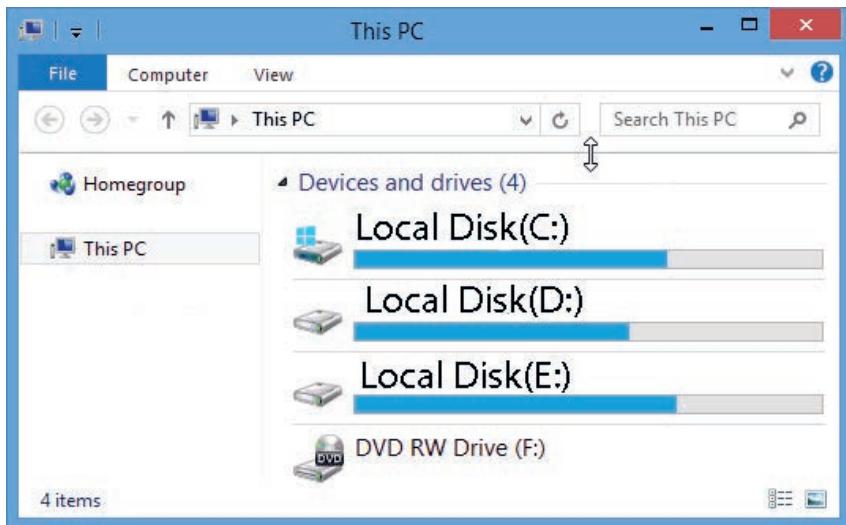


Figure 1.3 Devices and drives



Figure 1.4 Cloud drive icon

Activity 1.2

Perform the following activity and express what you observed.

1. On the desktop of your computer, perform the following steps:
 - Step 1. Right Click on the Start Menu.
 - Step 2. Click on Windows Explorer.
2. What have you observed on the screen? Can you identify the drive letters?

Unit 1 : Organization of Files

After doing the above activity, you will see the following in the folder list.

►  **System (C:)** This is known as a hard drive and is found inside your computer. This drive is where all your program software is installed, for example, Microsoft Word, Excel, etc.

►  **Storage (D:)** This is another hard drive in your computer into which you can save data.

►  **CD Drive (E:)** This is a CD drive where you can read CD data disks and listen to audio disks. Without a special CD drive (CD burner), you cannot save data to this drive. However, in some computers, the above derive letters and drive names might not appear or have different names or letters based on the partition of the computer disk.

►  **Removable Disk (F:)**

If you plug in a USB drive on any operating system, it will recognize the plugged-in or inserted device and automatically gives the plugged-in drive a letter of its own. Usually, the next available letter that is not being used by another drive will be assigned.

KEY CONCEPTS

► A **computer drive** is a piece of hardware that is used to **read** and **store** information on the computer and it is usually not easily removed as a disk.

► **OneDrive** and **Google drive** are cloud-based drives on which files are stored.

1.4 File Name Extension

Brainstorming

1. How do you identify a word file from an excel file?
2. What do you understand by the term *filename extension*?

A computer has many different types of files on it, and each one has its own **file extension**. A **file extension** is a three- or four-letter identifier found at the end of a file name being followed by a period. The extension tells you about the characteristics of a file and its use. Examples of file extensions are:

- An image uses the **.jpg** or **.jpeg** extension (for example, **image.jpg**).

- A Word document uses the **.docx** extension, or **.doc** for older versions (for example, **CoverLetter.docx**).
- An audio file uses the **.mp3** extension (for example, **song.mp3**).
- An Excel spreadsheet uses the **.xlsx** extension, or **.xls** for older versions (for example, **budget.xls**).

File extensions are used by an operating system to identify what applications are associated with a particular file type. In other words, a file extension specifies an application that opens the file when you double-click on it.

For example, a file named “awesome_picture.jpg” has the “jpg” file extension. When you open that file in Windows, for example, the operating system looks for whatever application is associated with JPG files, opens that application, and loads the file.

An operating system is a software program required to manage and operate computing devices like smartphones, tablets, computers and supercomputers. The operating system eliminates the need-to-know coding language to interact with computing devices. Table 1.1 shows examples of operating system.

Table 1.1 Operating systems

Operating System	Description
Windows	Windows is developed by Microsoft Corporation to run personal computers (PCs). It featured the first graphical user interface (GUI) for IBM-compatible PCs.
Unix	Unix is a multitasking, multiuser computer operating system. A command-based computer operation has been constantly updated since the invention of Unix.
Linux	Linux is an open-source operating system (OS).
DOS	DOS is the part of a computer operating system that controls and manages files and programs stored on a disk. DOS is an abbreviation for ‘disk operating system’.
Android	Android is a mobile operating system based on a modified version of the Linux kernel and other open-source software, designed primarily for touch screen mobile devices such as smart phones and tablets.

Unit 1 : Organization of Files

Filename extension and length vary according to the type of operating system (OS) we use. For instance, in Unix operating system, which is a command-based OS, a file extension is optional; in Linux and Windows operating systems a file extension is a requirement. However, Disk Operating System (DOS) limits the length of the file extension. For example, DOS uses three characters; Windows uses three or four characters while Unix-based OS uses unlimited characters.

A filename extension is a suffix added to the name of a computer file to indicate the encoding, convention or file format of its contents. Table 1.2 shows different types of file extension.

Table 1.2 Different types of file extensions

File Type Extension	Content	Application
.txt	Simple text file	Any word processing application
.doc, docx	Word processing file	Microsoft Word file(doc,docx)
.rtf	Rich Text Format	Any word processing application
.pdf	Portable Document Format	Document presentation format
.ppt	Presentation file for slide show	Microsoft PowerPoint file
.xls,xlsx	Spreadsheet files	Any spreadsheet file
.mdb	A database file	Microsoft Access database file
.zip, .Rar	Compression format for PC	WinZip, WinRar
.exe	Dos/Windows self-extracting format	Downloads and launches it in its own temporary directory
.mp3	Audio file on Windows	Window Media Player
.wav	Audio Files on PC	Real Player

Activity 1.3

Answer the following accordingly.

1. Discuss the various types of file extension and their applications.
2. Discuss file extension types that indicate audio and video formats.
3. Mention the operating system that uses three characters for file extension.
4. Identify the application file names in Figure 1.5 below.



Figure 1.5 Application files

KEY CONCEPTS

- ✍ Operating system (OS) is a program that manages a computer's resources, especially the allocation of those resources among other programs. Typical resources include the central processing unit (CPU), computer memory, file storage, input/output (I/O) devices and network connections.
- ✍ A **filename extension** is a suffix added to the name of a computer file to indicate the encoding convention or file format of its contents.
- ✍ In Unix operating system, file extension is optional while in Windows it is mandatory.
- ✍ DOS uses three characters, Windows uses three or four characters and Unix uses unlimited characters as a file extension.

1.5 File Directory Structure

Brainstorming

1. Can you define file directory?
2. Describe a file directory structure in a computer?
3. What is a file path?

Unit 1 : Organization of Files

The **directory structure** is the way an operating system shows its system and other types of files to the computer user. Files are typically displayed in a hierarchical tree structure. When you see the structure, it looks like a tree; hence, the term *hierarchical tree structure* is used to describe it. The first or the top folder (directory) in the structure is called the **root directory**. A directory contained inside another directory is called a **subdirectory**. The terms *parent* and *child* are often used to describe the relationship between the directory and the subdirectory.

The root directory contains all other folders or files in the drive. For Example, the root directory of the main partition on a computer is usually C:\. The root folder of a DVD or CD drive might be D:\.

A **folder** is a virtual location where programs, files and other **folders** can be located. A folder is also called a directory. It is a tool for arranging files on a disk. Files are organized by storing related files in the same directory. Folders which hold files or other folders on the computer are called sub-folders or sub-directories. Figure 1.5 shows simple directory structure.

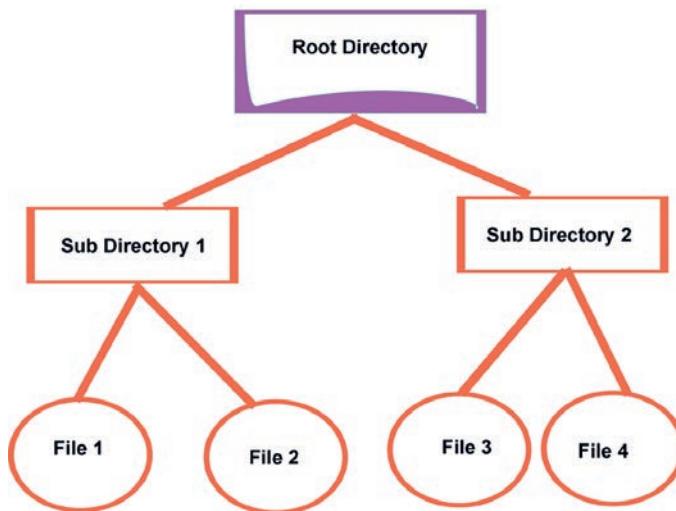


Figure 1.6 Simple directory structure

1.5.1 Directory Path or File Path

A path is a list beginning with a drive letter that tells which folders to open so that you can find a file or another folder. When a file system is organized as a directory tree, somehow is needed to specify the filenames. The use of a tree-structured directory minimizes the difficulty of assigning unique names. Any file in the system can be located by following a path from the root or master directory down to various branches until the file is reached.

The series of directory names, culminating in the file name itself, constitutes a **pathname** for the file. Figure 1.7 shows a file path from the directory structure in which the file *Click.mp3* is shown.

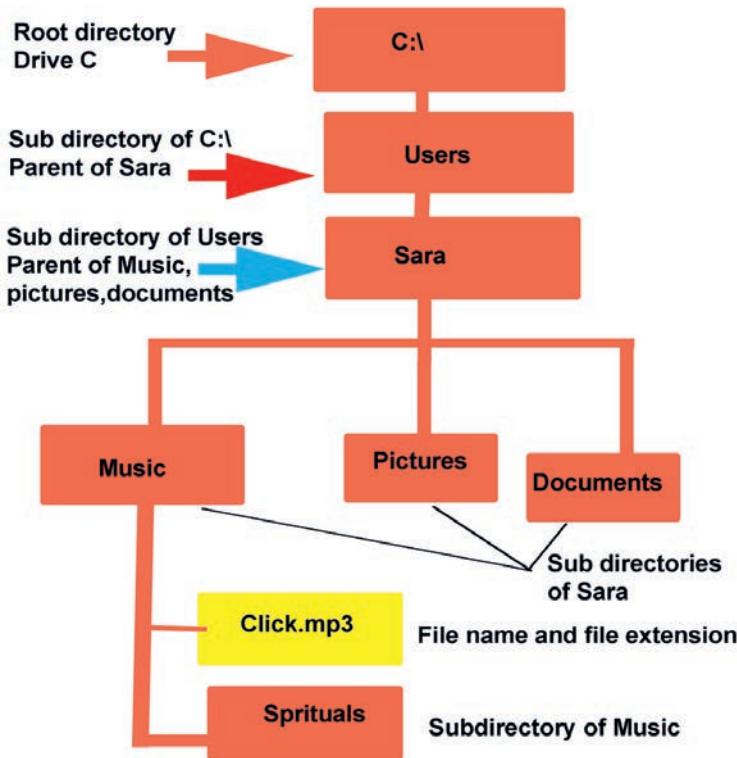


Figure 1.7 Directory structure of a file

To access the file **Click.mp3**, you need to follow the steps stated below.

1. Open the C:/ drive on your computer.
2. Select the user folder from the drive.
3. Select the *Sarah* folder.
4. Select the music folder and then you will see the file in the folder.
5. Check that the file *Click.mp3* exists in the music folder.

Types of Directory Paths

The two different methods commonly used to indicate the path of a file are absolute pathname and relative pathname.

a. Absolute Pathname

An absolute pathname represents the complete name of a directory or file from the /(root) directory downward. Regardless of where you are working in the file

Unit 1 : Organization of Files

system, you can always find a directory or file by specifying its absolute pathname. Figure 1.8 shows an example of absolute pathname.



Figure 1.8 Absolute pathname

The slash (/) is used to delimit names in the sequence. The name of the master directory is implicit because all paths start at that directory.

Note that it is perfectly acceptable to have several files with the same file name, as long as they have unique pathnames. That is, the same file name may be used in different directories. Figure 1.9 shows that there is another file in the system with the file name ABC, but the pathname /User_B/Draw/ADC.

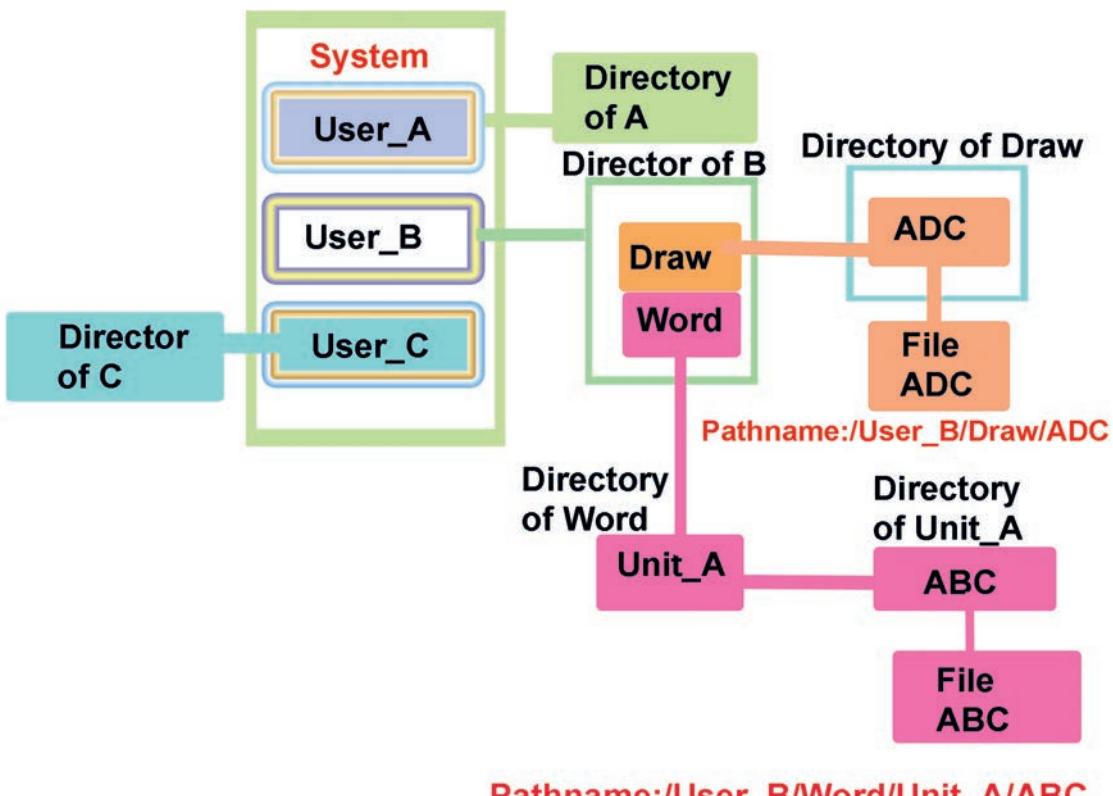


Figure 1.9 Tree structure file directory

b. Relative Pathname

Although the path name facilitates the selection of file names, it would be difficult for a user to have to spell out the entire pathname every time a reference is made to a file. Typically, an interactive user or a process associated with a current directory is often referred to as the working directory or current directory. In this case, the files are referenced relative to the working directory.

Relative pathnames are used to specify the name of a file in the current directory or the pathname of a file or directory above or below the level of the current directory in the file system. If D is the current directory, the relative pathname for accessing 10 is F/10. For example, as you can see in Figure 1.9 above, if the working directory for user B is "Word," then the pathname Unit_A/ABC is sufficient to identify the file.

Activity 1.4

Answer the following accordingly.

1. State the meaning of the term path name.
2. Define absolute pathnames and relative pathnames.
3. Look at the directory structure in Figure 1.10 below and answer the following questions.
 - a. Identify the root directory.
 - b. Identify the name of the drive.
 - c. Identify the subdirectory of the root directory.
 - d. Write the name of the folders in the 'home' directory.
 - e. Identify the parent directory of the user2.
 - f. Identify the child directory of user2.
 - g. Write the path to be used to get to file 'status report (file)'.
 - h. Describe what would happen if the 'home' folder was deleted.

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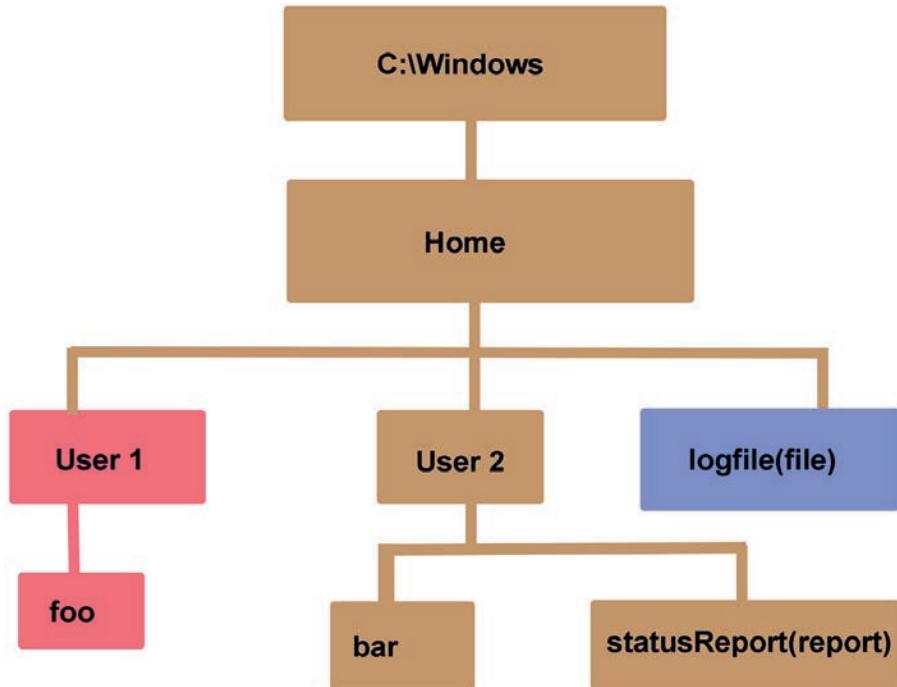


Figure 1.10 Directory structure

KEY CONCEPTS

- ✍ **Directory structure** is the way an operating system shows its system and other types of files to the computer user.
- ✍ A **path** is a list beginning with a drive letter that tells which folders or files to open.
- ✍ **Absolute pathname** is the path given from the root directory to the file.
- ✍ **Relative pathname** is the path referenced relative to the current directory.

1.6 File Conversion

Brainstorming

1. How is a file converted?
2. Why do you think file conversion is so important?

File conversion is the process of taking a file of one format and changing it into another. This is especially handy since you may one day work with files that are not compatible with the different programs you need to use. In Figure 1.11, you will see different types of files. It is possible to convert from one file format to another; for example, you can take a file used in Microsoft Word (.doc) and convert it to the Portable Document Format (PDF) file format.



Figure 1.11 Types of files

There are dozens of file formats for word processing documents, graphics and spreadsheets, and so on. If a file was created in one application and you want to use it in another, you can either import the file or use a conversion program.

File Converter

A file converter is software that converts a document from one file type to another. These solutions offer simple step-by-step processes to perform conversions so that a user simply needs to upload the original document, select which file type they would like the document to be converted to and convert it. Some common file converter soft wares include FoxitPDFEditor, PDF to Word Converter, PDF Convert Free, EliteCloudConvert, PDFShiftPDF and CandySelectPdf.

Activity 1.5

Answer the following items individually.

1. Define the term *file conversion*.
2. Summarize the advantages of file conversion from one format to another.
3. Describe how image and drawing files are converted.
4. Mention the file formats that cannot be converted into drawing or vector graphics formats.

KEY CONCEPTS

- ✍ **File conversion** is the process of taking a file of one format and changing it into another.
- ✍ **File converter** is the software that converts a document from one file type to another.
- ✍ If a file was created in one application and you want to use it in another, you can either import the file or use a conversion program.

1.7 File Importing and Exporting

Brainstorming

1. What do you think is file importing?
2. Would you describe what a file export means?
3. Can you tell the difference between file import and export?

What is a File Import?

File import is the process of moving files or data used in one program to another. As shown in figure 1.12 below, when you import, you are bringing in information from a file into a program. For example, you could import a CSV file you downloaded from the Internet into an Excel spreadsheet.

A comma-separated values (CSV) file is a delimited text file that uses a comma to separate values. Each line of the file is a record of data.

What is a File Export?

A file export is a process of moving information from a program into a file. As seen in figure 1.12, when you are exporting, you are taking information from a program and putting it into a file. For example, you may export a Microsoft Excel spreadsheet to a CSV file.

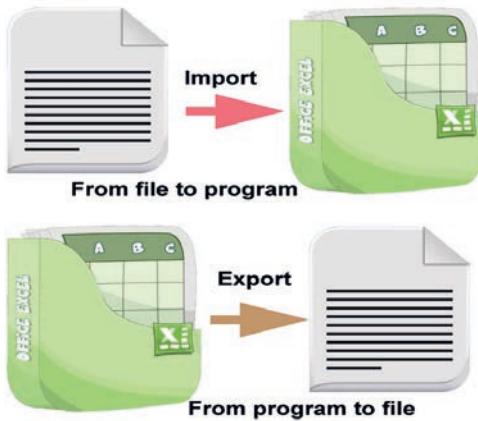


Figure 1.12 File import and export

In programs, you can export data in a format recognized by another program by opening the file menu in that program and selecting **export** (the feature may be located in different menus in different programs). Then you can enter what file format you want the file to be exported in. Some commonly used formats are txt, BMP, jpg, gif and more. Figure 1.13 shows the export window in OneNote application. Here, notes are exported as a *.doc* files, which is commonly used by Microsoft Word and other word processors.

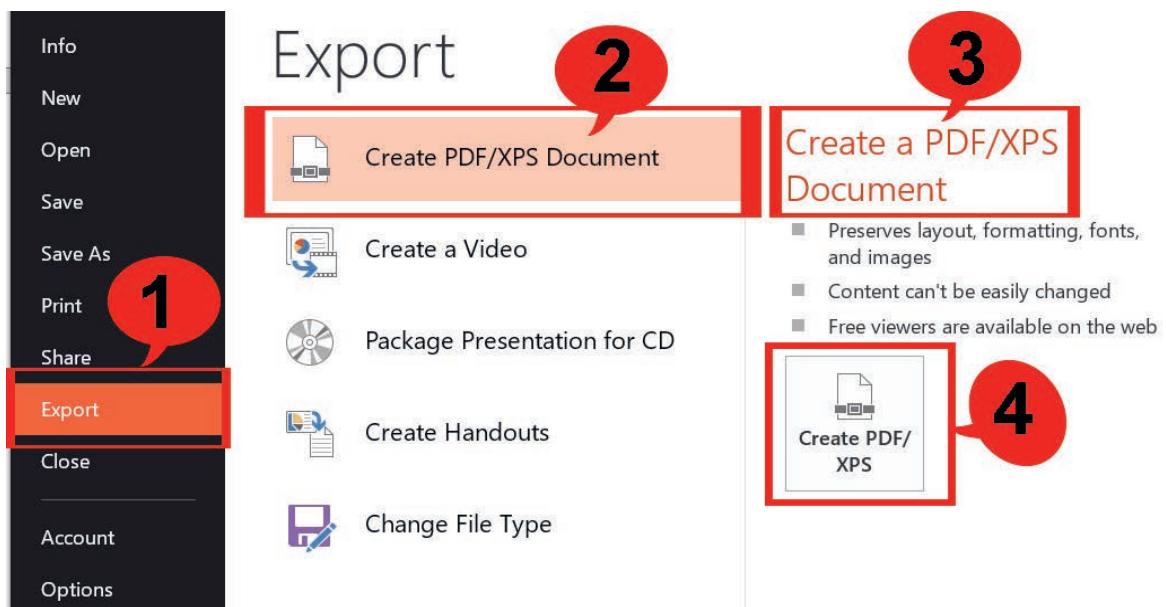


Figure 1.13 Exporting files

Activity 1.6

Work in a small group to answer the following items.

1. Discuss the terms file import and file export.
2. Open any word document and try to convert it into a PDF file using the export method.
3. Open any word document and use save as or export options to convert it into PDF, Plain text, or any other options that appear in the pop-down menu.

KEY CONCEPTS

- ☞ **File import** is the process of moving a file or data used in one program to another. When you import a file, you are bringing in information from a **file** into a **program**.
- ☞ **File export** is the process of moving information from a **program** into a **file**. When you are exporting, you are taking information from a program and putting it into a file.

1.8 Saving and Opening Files

Brainstorming

1. Why do you think we need to open and save files in a different format?
2. Can you mention the steps you follow to open and save files in different formats?

Although it is often a wise decision to **save files using the default file format** of a program (since the program is guaranteed to store all the information correctly then), you can also easily change the file format when saving a file. In most programs, you can change the file format using the following path.

Click on the **File Menu** → click on **Save As** option → click on **Browse** folder → select the file and click on the **Save as type** list in the bottom part of the window that opens and choose the file type you like and then click on the **Save** button.

The list will display the file formats in which you can save your file. Figure 1.14 shows how a *tiff* image is saved as a *jpeg* image.

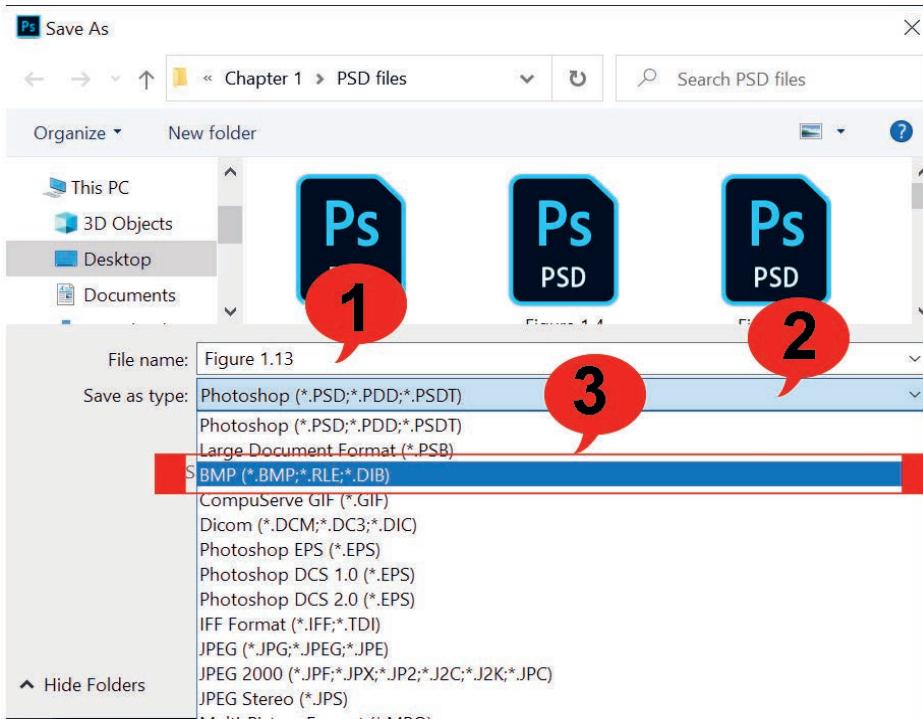


Figure 1.14 Saving files in different formats

When you save a file in another file format, some of the original file's features may not be transferred correctly. Check your new file after saving it and always save the original. To **change the format** of a file you are opening, follow the same principle as saving in a different file format.

When you **open a file in Windows**, it will usually open in **the default application for that type of file**. In Microsoft (MS) Word, you can open documents that are in different formats. You can specify a file format to narrow down your search, or choose the All-Files option and let Word do the work for you.

Practical Exercise 1.1

Complete the following activities.

1. Discuss the importance of saving the files in different formats.
2. Describe the importance of file export and file import.
3. Summarize steps to open different file formats in the Microsoft office application.

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4. In Microsoft word, write one page about the Ethiopian renaissance dam and save it with the name ETHIOPIA. Observe file format.
5. Convert the file ETHIOPIA into PDF file format.

KEY CONCEPTS

- ✍ When you save a file in any application program, the application saves the files using the default file format of a program.
- ✍ When you open a file in Windows, it will usually open in the default application for that type of file.

1.9 File Backup and Recovery

Brainstorming

1. How do you understand file backup?
2. Why do you think it is necessary to take a file backup?

Backup and recovery describe the process of creating and storing copies of data that can be used to protect individuals and organizations against data loss. This is sometimes referred to as operational recovery.

A backup is a digital copy of your most important information such as photos, health records, assignments, academic records and other credentials. It can be saved to an external storage device or the cloud. A proper backup copy is stored in a separate system or medium, such as tape, from the primary data to protect against the possibility of data loss due to primary hardware or software failure.

Backing up is a precautionary measure so that your data is accessible in case it is lost, stolen or damaged.

1.9.1 Steps Followed to Take File Backup

How to Backup Files

You will learn how to take backup using MS Windows operating systems. To take back up of a file, follow each of the following steps carefully.

Grade 10 Information Technology Student's Textbook

The step of Backing up your files using an external storage device in Windows is shown below:

1. Ensure your external storage device is plugged in. Click on **Start**, and then click on the **Settings** icon, or type settings on **Type here to search the textbox**.

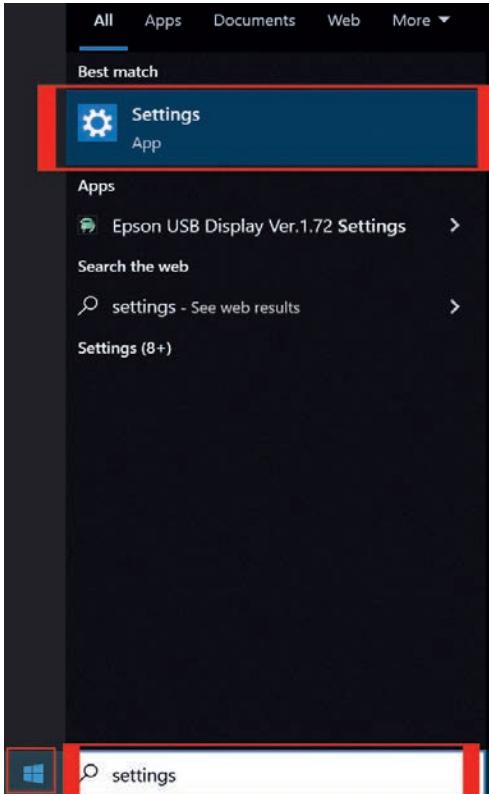


Figure 1.15 Click on start

2. Select **Update and Security** among the options given.

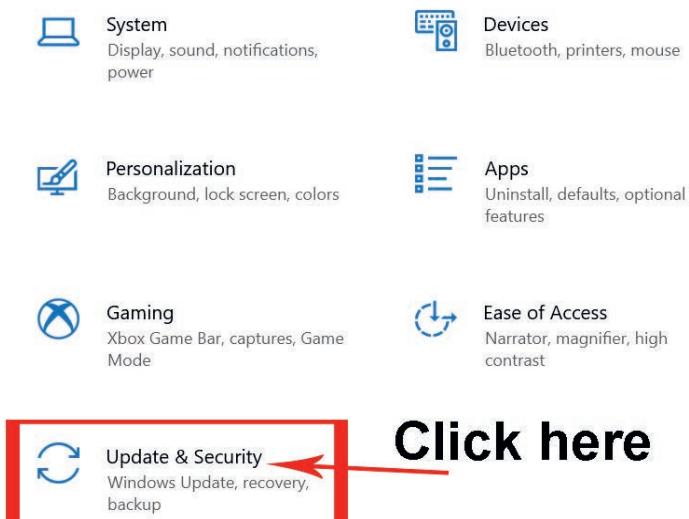


Figure 1.16 Select Update and Security

Unit 1 : Organization of Files

3. Click Backup in the left column.

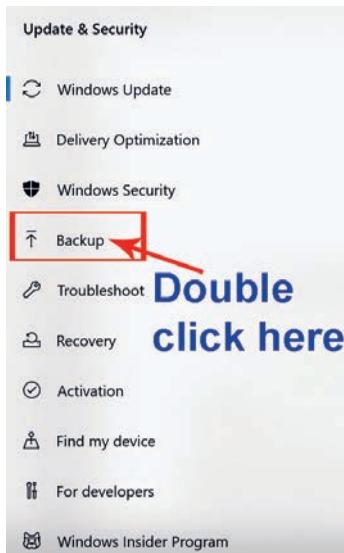


Figure 1.17 Click Backup

4. Select your backup removable drive from your computer.
5. The file will be copied to the specified format.

1.9.2 File Recovery

Restoring is the process of copying backed-up data from a secondary location and restoring it to its original device or a new device. The purpose of the backup is to create a copy of data that we use to recover in the event of a primary data failure. Primary data failures can be the result of hardware or software failure, data corruption or a human-caused event, such as a malicious attack (virus or malware) or accidental deletion of data. Backup copies allow data to be restored from an earlier point in time to help the business recover from an unplanned event.

KEY CONCEPTS

- Backup and recovery describe the process of creating and storing copies of data that can be used to protect individuals and organizations against data loss.
- Restoring is the process of copying backed-up data from a secondary location and restoring it to its original or a new device.
- The purpose of the backup is to create a copy of data that we use to recover in the event of a primary data failure.

Practical Exercise 1.2

Open MS Word document and write a paragraph on the uses of MS word and do the following activities in a group.

1. Click the Save icon. If you have never saved the file before, the Save As dialog box appears.
2. If you are saving a new file or saving the file under a new location, select the drive and folder you want to save the file in from the Save inbox.
3. Type a name for the file in the File name box.
4. Click the Save button.

When you want to work on your previous document next time, first you have to open it. To open the existing file, you have already done in practical exercise 1.2 on your computer, follow practical exercise 1.3.

Practical Exercise 1.3

Complete the following activities using in a group.

1. From the application's file menu, click open or simply click the open () button of the application.
2. Click on Browse, choose the drive and folder you want to look in for the file.
3. Double-click the filename from the list of files.

1.10 File Compression

Brainstorming

1. What does it mean by a file compression?
2. Why is file compression so important during file management?

File compression is a data compression method in which the logical size of a file is reduced to save disk space for easier and faster transmission over a network or the Internet. It enables the creation of a version of one or more files with the same

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data at a size substantially smaller than the original file. File compression is also known as file zipping. Figure 1.18 shows the file compression icon.



Figure 1.18 File compression icon

Zipped (compressed) files occupy less storage space and can be transferred to other computers more quickly than uncompressed files. In Windows, you work with zipped files and folders in the same way that you work with uncompressed files and folders. You need to combine several files into a single zipped folder to share a group of files more easily.

To compress file and folders, we follow the following steps.

To zip (compress) a file or a folder

1. Locate the file or the folder that you want to zip.
2. Press and hold or right-click the file or the folder.
3. Select or point to Send to, and then select Compressed (zipped) folder.

A new zipped folder with the same name is created in the same location. Figure 1.19 shows how to compress a file on the desktop.

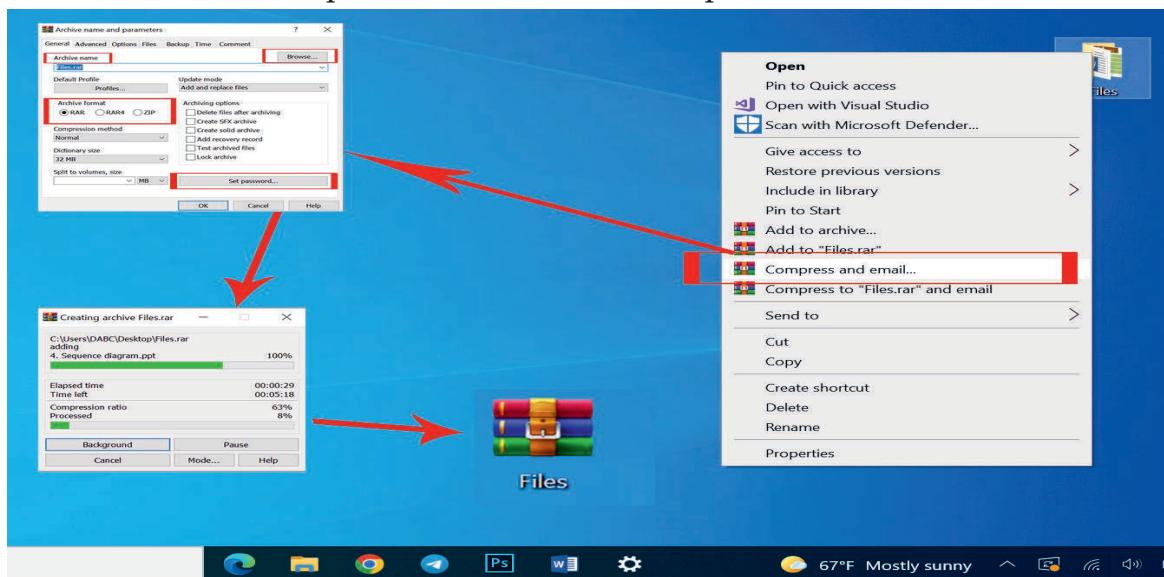


Figure 1.19 Compressing a file

File or Folder Compression Tools

There are a lot of file or folder compression software packages; among them, the most popular compression tools are WinRAR, WinZip and 7zip. Below are steps to unzip compressed files.

To Unzip Files

1. Open File Explorer and find the zipped folder.
2. To unzip the entire folder, right-click to select Extract All, and then follow the instructions.
3. To unzip a single file or folder, double-click the zipped folder to open it. Then, drag or copy the item from the zipped folder to a new location.

Practical Exercise 1.4

Practice the following in a small group.

1. Open Microsoft Word and write a paragraph about the Ethiopian Renaissance Dam and save it at any drive you like in the file name AbayDam.
2. Compress the file in the same location.
3. Unzip the file on the desktop.
4. Insert any file from your computer into the zip folder AbayDam and send it to any external storage device.

1.11 Deleting a File

Brainstorming

1. Do you think that it is important to delete a file? Why?
2. Can you delete a file you have saved into C-drive of your computer?

File deletion is the removal of a file from a computer's file system. The **Recycle Bin** is a location where deleted files or folders are temporarily stored in all versions of Windows operating systems. To delete a file, a folder or multiple selected files, you need to **right-click on the file and select Delete**. Alternatively, you can select

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the file and hit the **Delete** key on the keyboard. When you delete a folder, you delete all its contents as well. You may get a dialog prompt that asks if you want to move the file to the recycling bin. In Windows, Recycle Bin icon is located on the desktop as shown in Figure 1.20 below.



Figure 1.20 Recycle Bin icon

We may need to delete files or folders for various reasons. Some of the reasons are:

- Freeing the disk space.
- Removing duplicated or unnecessary data to avoid confusion.
- Making sensitive information unavailable to others.

The following activity will help you to delete unwanted files from folders of your computer.

Practical Exercise 1.5

Work in a group. Find and open any folder that contains the file you want to delete and follow the steps below.

1. Right-click the file you want to delete. If you need to remove more than one files, select all the files you want to delete.
2. Click Delete; then the Delete File dialog box appears.
3. Click Yes.

Note: Check that the file disappears from its original location.



- Another way to delete a file is to click and drag it to the desktop's Recycle Bin icon.
- You can hold down the shift key and hit the Delete key when you want to delete a file to prevent it from going to the Recycle Bin. This will remove the file totally from your computer.

KEY CONCEPTS

- ✍ **File deletion** is the removal of a file from a computer's file system.
- ✍ **Recycle Bin** is the location where deleted files or folders are temporarily stored in a computer.
- ✍ To delete a file, a folder or multiple selected files, **right-click on the file and select Delete**. You can also select the file and hit the **Delete key** on the keyboard. Deleting a folder deletes all its contents as well.

1.12 Restoring Deleted File

Brainstorming

1. Why do you think restoring a file is required?
2. How could we restore deleted files?

Files deleted from your computer's hard drive will not be removed immediately; they will be automatically moved to the **Recycle Bin**.

It is possible to restore the deleted files. Data restoration is the process of copying backup data from secondary storage and returning it to its original or a new location. Restoration is performed to return the **lost, stolen or damaged data to their original conditions or to move to new locations**. You will practice how to restore a deleted file from your computer in Activity 1.7.

NOTE

1. A deleted file cannot be restored by the following conditions.
 - The file you deleted is not in the Recycle Bin.
 - The Recycle Bin is emptied permanently.
 - The file is deleted using the shift key (shift key + Delete) on the keyboard.
2. To empty the Recycle Bin in Windows:
 - Find the Recycle Bin icon on the desktop.
 - Right-click (or press and hold) and select Empty Recycle Bin.

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Activity 1.7

Work in a group to practice restoring deleted files.

1. Double-click **Recycle Bin** icon in the desktop.
2. The Recycle Bin folder appears. The files currently in the Recycle Bin will be displayed.
3. Right-Click the file you want to restore.
4. Click **Restore this item**, see Figure 1.21.
5. Observe that the file disappears from the recycling bin and will be restored to its original location.

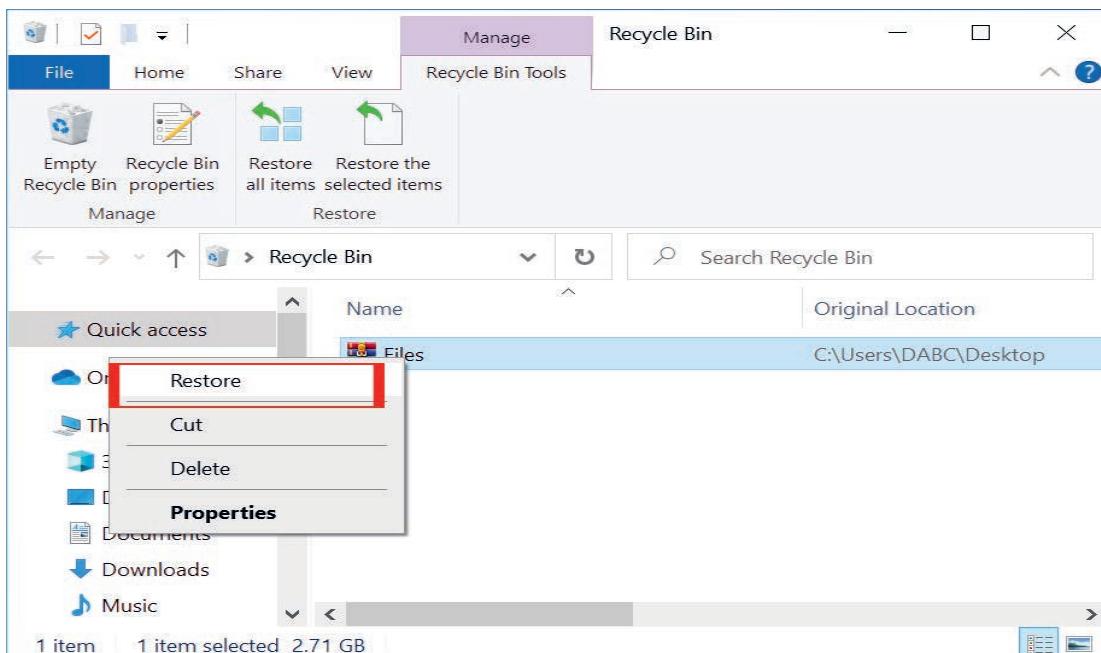


Figure 1.21 File restore

KEY CONCEPTS

 **Data restore** is the process of copying backup data from secondary storage and reinstating it to its original or a new location. Restoration is performed to return data that has been lost, stolen or damaged to its original condition or to move data to a new location.

1.13 Unit Summary

A **file** is the basic unit of storage that enables a computer to distinguish one set of information from another file. It is the common storage unit in computers where all programs and data are “written” into and “read” from. A folder holds one or more files, and it can be empty until it is filled. A folder can also contain other folders, so there can be many levels of folders within it.

Programs, files and folders can be found in a virtual location called **folder**. A folder, which is also called a directory, is a tool for arranging files on a disk. Files are organized by storing related data in the same directory. In naming a file, it would have two parts, with a period separating them. The part on the left side of the period character is called the *main name* while the part on the right side is called the *extension*. File extension shows the file type and the application that the operating system will use when opening it. Any file in the system can be located by following a path from the root or master directory down to various branches until the file is reached.

File import is the process of moving files or data from program to program; **file export** is the process of moving information from program to file; file conversion is the process of changing a file from one format to another.

Restoring is the process of copying backed-up data from a secondary location and returning it to its original device or a new device to create a copy of the data. Backup and recovery describe the process of creating and storing copies of data that can be used to protect individuals and organizations against data loss. This is sometimes referred to as operational recovery.

File compression is a data compression method in which the logical size of a file is reduced to save disk space for easier and faster transmission over a network or the Internet. It enables the creation of a version of one or more files with the same data at a size substantially smaller than the original file.

File deletion is the removal of a file from a computer’s file system. The **Recycle Bin** is the location where deleted files or folders are temporarily stored in all versions of Windows operating systems. Data restoration is the process of copying backup data from secondary storage and returning it to its original or a new location. Restoration is performed to return lost, stolen or damaged data to their original conditions or to move to new locations.

1.14 Unit Review Exercise

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

1. A file is a container in a computer system for storing information.
2. A folder holds one or more files and can be empty until it is filled.
3. The operating system implements the abstract concept of a file by managing mass storage media and the devices.
4. The purpose of backup is to create a copy of data that we use to recover in the event of a secondary data failure.
5. File conversion is the process of taking a file of one format and changing it into another.
6. File compression changes the contents of the original file.
7. Files can be deleted by clicking and dragging them to the desktop's Recycle Bin icon.

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

1. _____ is a self-contained piece of information available to the operating system and its programs.
 - A. Record
 - B. Icon
 - C. File
 - D. Data
2. What do we call the organization of files and folders on a disk?
 - A. Directory or directory tree
 - B. Path
 - C. File management
 - D. Root directory

3. Which one of the following is logical component of a file?
 - A. Field
 - B. Record
 - C. Database
 - D. All of the above.
4. What could be possible to do with a folder created and named?
 - A. Moving it to another location.
 - B. Renaming it.
 - C. Creating other folders inside it.
 - D. All of the above.
5. The process of copying backed-up data from a secondary location and returning it to its original or a new device is called _____.
 - A. recording
 - B. restoring
 - C. duplicating
 - D. resizing
6. Which one of the following is among the fundamental aspects of file management?
 - A. Organizing
 - B. Labeling
 - C. Classifying
 - D. All of the above.
7. _____ is the way an operating system's file system and its files are displayed to the computer user.
 - A. Directory structure
 - B. Directory content
 - C. Directory Name
 - D. Directory folder

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8. Which of the following always start at the root directory and are unique?
 - A. Relative file names
 - B. Directory names
 - C. Absolute file names
 - D. Directory path names
9. _____ is a collection of files typically created for organizational purposes.
 - A. Directory
 - B. File
 - C. Drive
 - D. Folder
10. What do you call the suffix added to the base name of a computer file?
 - A. Operating system identifier
 - B. Program application
 - C. Filename path
 - D. Filename extension
11. Which one is not an extension for an image file?
 - A. BMP
 - B. GIF
 - C. XLS
 - D. JPG
12. _____ is a software program required to manage and operate computing devices.
 - A. Operating system
 - B. File recovery
 - C. File search
 - D. File import and export

Part III: Discuss the following questions.

1. Explain how Operating System differentiates one file from another.

2. What types of file extensions do the following contents have?

- A. A movie on a video CD
- B. A word-processed file
- C. A file in a musical CD
- D. A scanned image
- E. A picture was taken with a digital camera.
- F. A file sent in compressed format

3. Discuss how to name a file and give examples of valid and invalid filenames.

4. Differentiate between absolute and relative path names with appropriate examples.

5. Use Figure 1.22 below to answer the following questions.

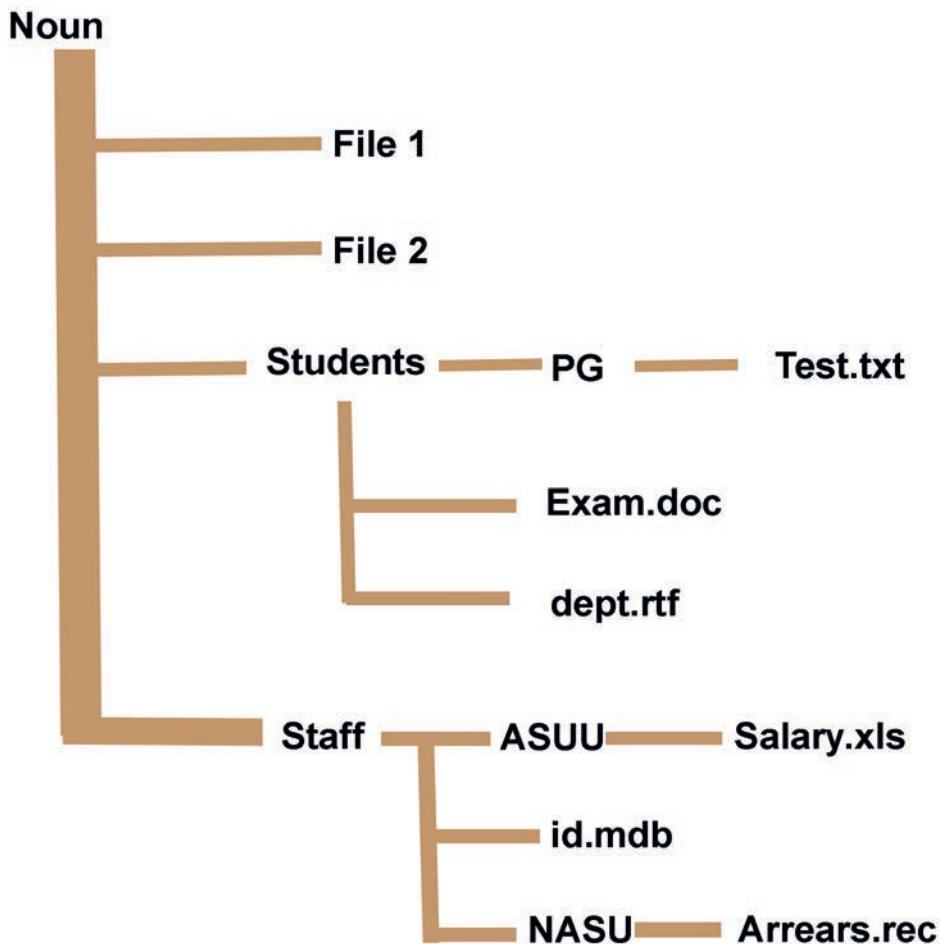


Figure 1.22 File directory

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- a. Write out the absolute pathname for EXAM.DOC, TEST.TXT, SALARY.XLS and ARREARS.REC.
- b. Write out the relative pathname for DEPT.RTF and ID.MDB using STUDENTS and STAFF as the working directory respectively.
6. Ethiopia sends a spreadsheet file called Budget2021 via email to his teacher. His teacher attempted to view the file in his web browser online but was unsuccessful.
 - a. What could be a possible cause of the problem Ethiopia's teacher encountered?
 - b. Suggest one solution that either Ethiopia or his teacher could do to rectify the problem?
 - c. Show the file name that Ethiopia's teacher would see when he opens the email.
7. What is the definition of the term 'drive' as it relates to computing?
8. List at least four types of drives available to store files on the computer system along with their respective drive letters.
9. Describe, using a step-by-step process, how to save a file you prepared in Microsoft Word as PDF.
10. Define the following terms.
 - a. File path
 - b. Disk drive
 - c. Folder
11. Answer the following questions based on the file path below. C:\Documents\School\Maths.Docx
 - a. What is shown in the file path above?
 - b. What does "C:\ " refer to?
12. Using Figure 1.23 below, provide the file path to get to the file: *Communication.pdf*.

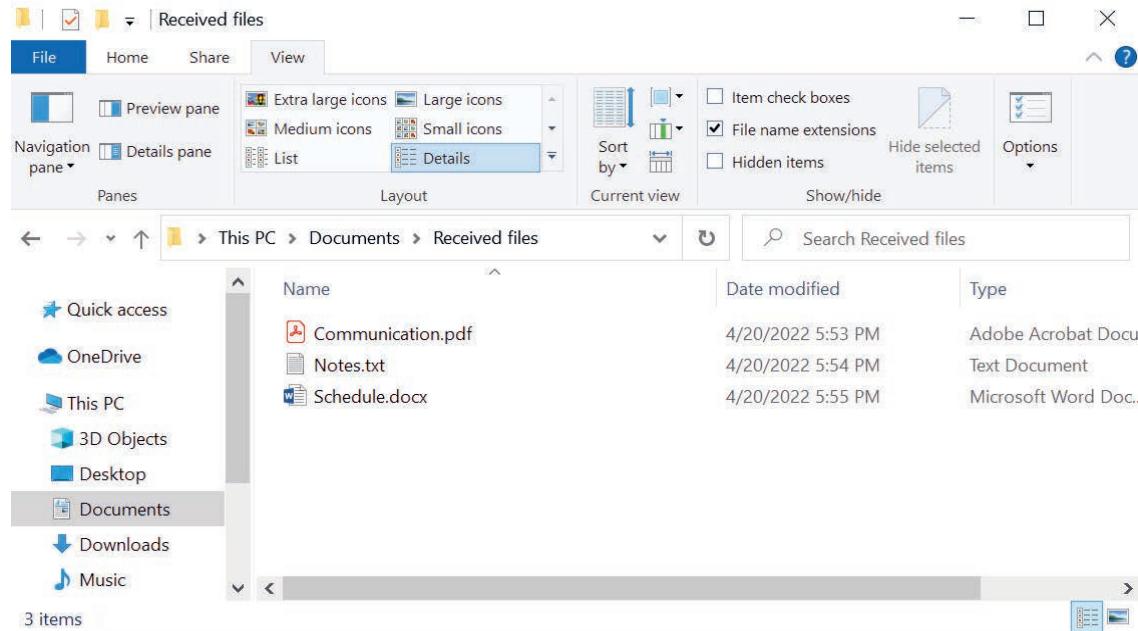


Figure 1.23 Determining the file path for the file, communication.pdf

13. Identify the drive letter, folder, sub-folder, file name and extension in the the following file paths and complete table 1.3.
- c:\Games\Solitaire\Solitaire.exe
 - e:\assignment\IT\hardware, Docx
 - c:\Program Files (x86) \Calculator.exe

Table 1.3 Identifying drive letter, folder, subfolder, filename, and extension

No	Drive Letter	Folder	Sub-folder	File Name	Extension
a					
b					
c					

UNIT OUTCOMES

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

- Explain transmission media.
- Describe telecommunications network.
- Explain mobile and cellular communications.
- Analyze satellite networks.
- Discuss data communication.
- Conceptualize the use of Internet protocols (IP).

2.1 Unit Overview

As it was defined and discussed in grade 9, unit 2, the computer network is the connection of two or more computers or communication devices connected by transmission **media** and guided by a set of rules for communication purposes that allow users to communicate with each other and share applications and data. The fundamental components of a network are devices, media, messages and protocols. Figure 2.1 shows representation of network in a given school.



Figure 2.1 Representation of network in school

In this unit, you are going to learn about network media, telecommunications networks, mobile communications, cellular networks, satellite networks, data communications and internet protocol (IP).

2.2 Network Media (Transmission Media)

Brainstorming

1. What do you think is a transmission medium?
2. How are data transmitted in modern networks?

For data to be transmitted from one location to another, a physical pathway or medium must be used. These pathways are called transmissions media and can be either physical or wireless. The physical transmission use wire, cable, and other tangible materials; wireless transmission media send communications signals through the air or space. The physical transmission media are generally referred to as cable media (example, twisted pair wire, coaxial cable, and fiber optic cable). Wireless media include cellular radio, microwave transmission, satellite transmission, radio and infrared media.

Modern networks primarily use three types of media to interconnect devices and to provide the pathway over which data can be transmitted. These media are:

- Copper cables
- Glass or plastic fibers (fiber optic cable)
- Wireless transmission

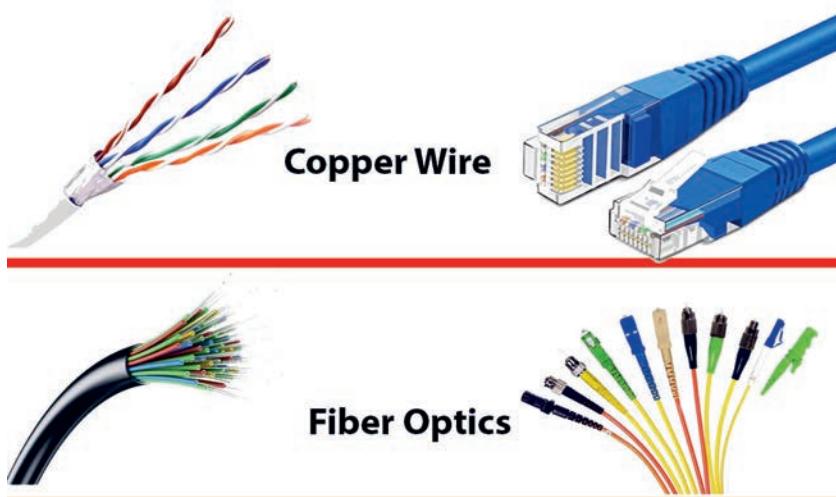




Figure 2.2 Network media

The signal encoding that must occur for the message to be transmitted is different for each media type. On metallic wires, the data is encoded into electrical impulses that match specific patterns. Fiber optic transmissions rely on pulses of light, within either infrared or visible light ranges or in wireless transmission, and patterns of electromagnetic waves depict the various bit values. Different types of network media have different features and benefits. All network media do not have the same characteristics and are appropriate for the same purpose.

Activity 2.1

Discuss the following items in a group.

1. What categories of transmission media could you use to communicate in school and local environment?
2. Analyze characteristics of the signal in each media.
3. Bring some physical media to the class and discuss how they are arranged to be used in the network.
4. Explain factors to be considered while choosing a transmission medium

KEY CONCEPTS

- ✍ Signal is an electric or electromagnetic form of data that passes over transmission media.
- ✍ A wire is a long thin piece of metal that is used to fasten things or to carry electric current.

Categories of Network Media (Transmission Media)

The transmission medium can be divided into two broad categories: **wired or guided media and wireless or unguided media**, as shown in Figure 2.3.

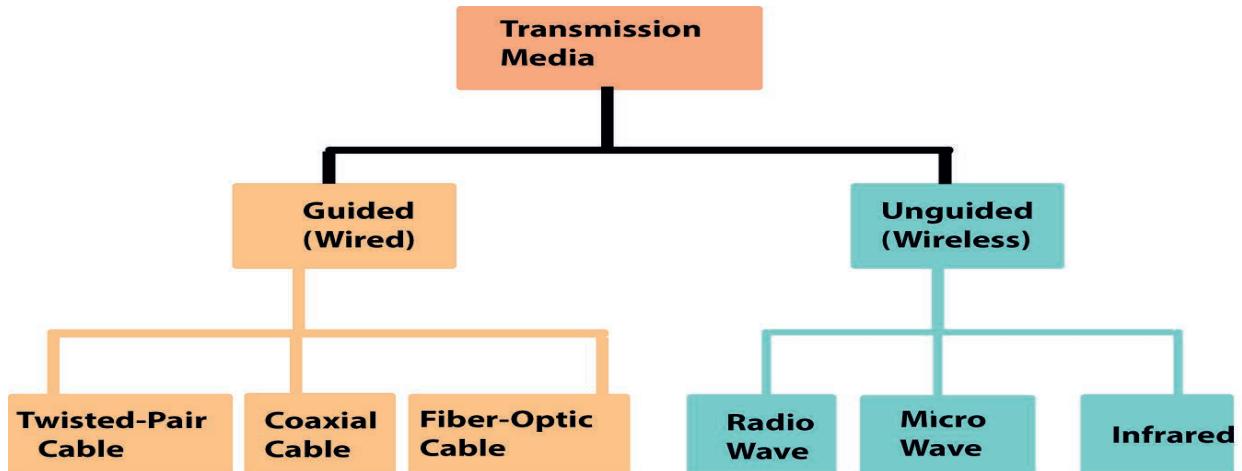


Figure 2.3 Classification of transmission media

2.2.1 Guided (Wired) Media

Guided media are those that provide a conduit from one device to another. These include **twisted-pair cable**, **coaxial cable** and **fiber-optic cable**. A signal traveling along any of these media is directed and contained by the physical limits of the medium. Twisted-pair and coaxial cables use metallic (copper) conductors that accept and transport signals in the form of electric current. Optical fiber is a cable that accepts and transports signals in the form of light.

Twisted-pair Cable

A twisted pair consists of two conductors (normally copper), each with its plastic insulation, twisted together as shown in Figure 2.4. One of the wires is used to carry signals to the receiver and the other is used only as a ground reference.

In addition to the signal sent by the sender on one of the wires, interference (noise) and crosstalk may affect both wires and create unwanted signals.

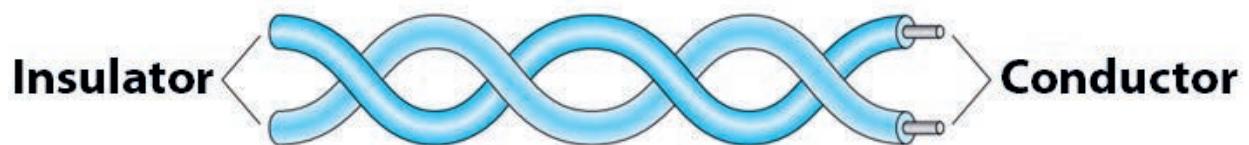


Figure 2.4 Twisted-pair cable

If the two wires are parallel, the effect of these unwanted signals is not the same on both wires because they are at different locations relative to the noise or crosstalk sources (for example, one is closer and the other is farther). This results in a difference at the receiver.

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By twisting the pairs, a balance is maintained. For example, suppose in one twist, one wire is closer to the noise source and the other is farther; in the next twist, the reverse is true. The twisting makes it probable that both wires are equally affected by external influences (noise or crosstalk). Fundamentally, twisted pairs are classified as **unshielded twisted-pair (UTP)** and **shielded twisted-pair (STP)**.

Unshielded Twisted-Pair (UTP)

Unshielded twisted-pair (UTP) is the most common form of network cable. This cable format is used for the Ethernet wiring standards which are managed by the **Institute of Electrical and Electronics Engineers (IEEE)**. These wiring standards are referred by **code 802.3**.

The Ethernet standards include specifications of cable configurations and the types of connectors used to plug cables into devices.

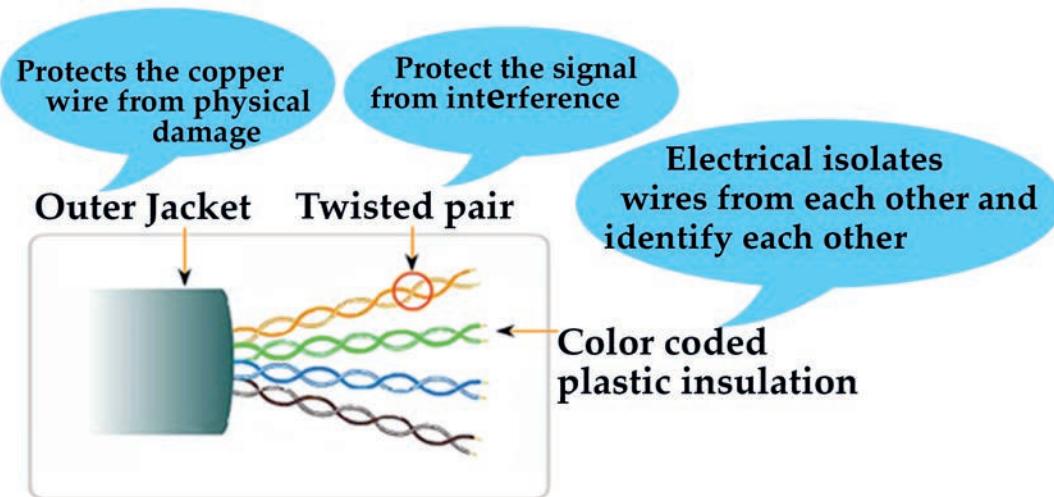


Figure 2.5 UTP cable

What we conventionally know as a network cable is an 802.3 specified cable for Ethernet networks. This type of cable, which is shown in Figure 2.5, can block interference and does not depend on a physical shield for this purpose. In modern networks, UTP cables are considered in different categories starting from cat1 to cat7 and so on.

UTP Cable Connectors

The most common UTP connector is **RJ45**. RJ stands for registered jack, implying that the connector follows a standard borrowed from the telephone industry, as shown in Figure 2.6. The RJ45 is a keyed connector, meaning the connector can be inserted in only one way. UTP cabling, terminated with **RJ45** connectors, is a common copper-based medium for interconnecting network devices such as computers with intermediate devices like routers and network switches.

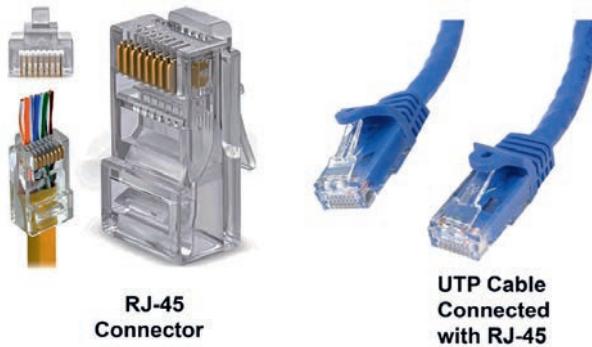
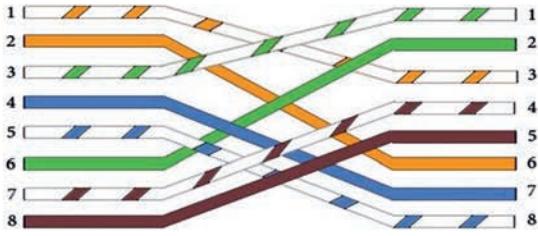


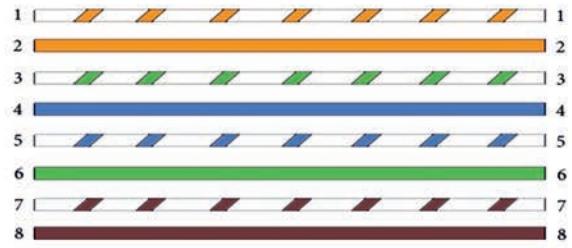
Figure 2.6 UTP connector

UTP cables are wired according to different wiring conventions. The individual wires in the cable have to be connected in different orders to different sets of pins in the RJ45 connectors.

Ethernet straight-through and Ethernet crossover are the main cable types that are obtained by using specific wiring conventions (see Figure 2.7).



a) Cross-over Cable



b) Straight-through Cable

Figure 2.7 Ethernet cable color coding a) cross-over b)Straight-through

The straight-through is the most common type and is used to connect computers to hubs or switches (connect different network devices). They are most likely what you will find when you go to your local computer laboratory. Crossover Ethernet cable is more commonly used to connect a computer to a computer (connect similar network devices) and may be a little harder to find since they are not used nearly as much as a straight-through Ethernet cable.

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When electromagnetic signals are conducted on copper wires that are nearby (such as inside a cable), some electromagnetic interference occurs. This interference is called **crosstalk**. Twisting two wires together as a pair minimizes such interference and also provides some protection against interference from outside sources.

Unshielded twisted pair is subject to external electromagnetic interference, including interference from nearby twisted pairs and noise generated in the environment. In an environment with several sources of potential interference (for example, electric motors, wireless devices and radio frequency (RF) transmitters), a **shielded twisted-pair (STP)** may be a preferred solution.

Practical Exercise 2.1

Do the following exercises in a group.

1. Practice color code arrangements of straight-through and cross-over cables.
2. Practice UTP cabling in your school laboratory.
3. Connect any two computers using UTP cable cat5, cat 6 or cat 7.

Shielded Twisted-Pair (STP)

This type of cable, as shown in Figure 2.8, consists of a special jacket to block external interference. It is used in fast-data-rate Ethernet and voice and data channels of telephone lines.

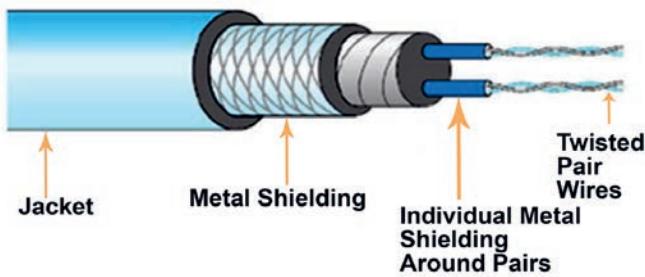


Figure 2.8 Shield twisted-pair

Shielded twisted-pair (STP) cable combines the techniques of cancellation and twisting of wires with shielding. Each pair of wires is wrapped in metallic foil to further shield the wires from noise. The four pairs of wires are then wrapped in an overall metallic braid or foil. STP reduces electrical noise from the cable (crosstalk) and outside the cable (EMI and RFI).

Activity 2.2

Discuss the following points in a group.

1. Discuss the term *signal*.
2. Compare and contrast unshielded twisted-pair (UTP) and shield twisted-pair (STP).

KEY CONCEPTS

- ✍ RJ45 stands for Registered Jack 45.
- ✍ Electromagnetic (EM) waves are waves that are created as a result of vibrations between electric and magnetic fields. In other words, EM waves are composed of oscillating magnetic and electric fields.
- ✍ RF is short for radiofrequency. RF is any frequency within the electromagnetic spectrum which is associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created and then able to travel or propagate through space.

Coaxial Cable

Coaxial cable (or coax), as shown in Figure 2.9, carries signals of higher frequency ranges than those in twisted pair cable in part because the two media are constructed quite differently. Instead of having two wires, coax has a central core conductor of solid or stranded wire (usually copper) enclosed in an insulating sheath which is, in turn, encased in an outer conductor of metal foil, a combination of the two. The outer metallic wrapping serves both as a shield against noise and the second conductor which completes the circuit. This outer conductor is also enclosed in an insulating sheath and the whole cable is protected by a plastic cover.

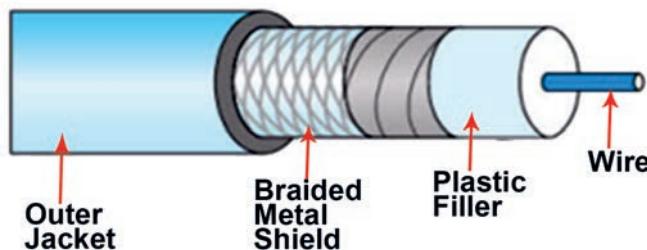


Figure 2.9 Coaxial cable

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Coaxial cables are available in a variety of thicknesses, with two primary physical types: thick coaxial cable and thin coaxial cable, as shown in Figure 2.10. Thick coaxial cable ranges in size from approximately 6 to 18 mm (1/4 to 3/4 inch) in diameter.

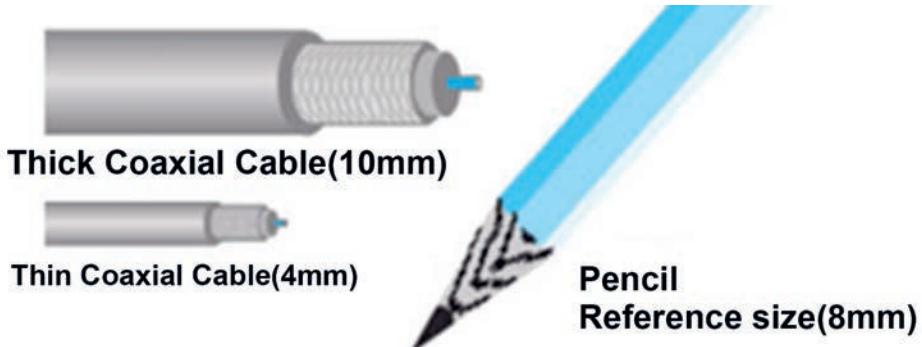


Figure 2.10 Thick and thin coaxial cables

The thin coaxial cable is approximately 4 mm (less than 1/4 inch) in diameter. Compared to a thick coaxial cable which typically carries broadband signals, a thin coaxial cable has limited noise isolation and typically carries baseband signals. Thick coaxial cable has better noise immunity and is generally used for the transmission of analog data such as single or multiple video channels.

Coaxial Cable Connectors

To connect coaxial cables to devices, we need coaxial connectors. The most common type of connector used today is the **Bayonet Neill-Concelman (BNC)** connector. Figure 2.11 shows three popular types of these connectors: the BNC connector, the BNC T connector, and the BNC terminator.

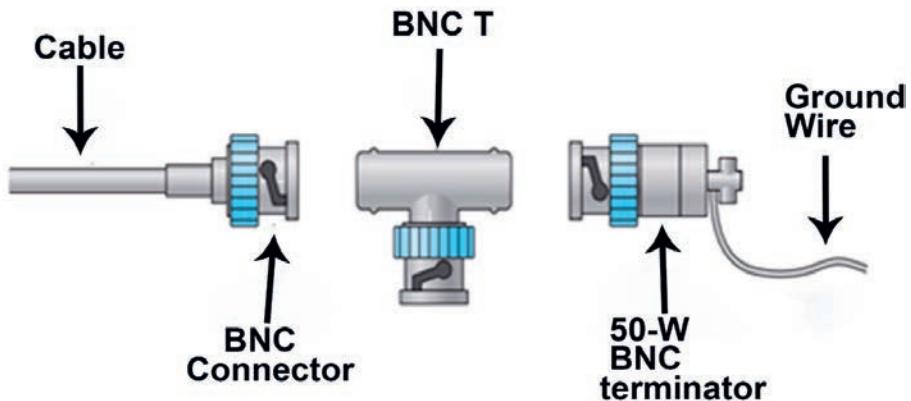


Figure 2.11 BNC connector

Practical Exercise 2.2

Answer the following exercises in a group and demonstrate them to class.

1. Bring some of the coaxial cable and its connector to class and demonstrate their connection.
2. Telecommunications office provides Internet service at home for Individuals' use; explain the technologies used to provide Internet services.

KEY CONCEPTS

- ✍ **Ethernet** is the traditional technology for connecting devices in a wired local area network (LAN) or wide area network (WAN).
- ✍ **Unshielded twisted-pair (UTP)** is a ubiquitous type of copper cabling used in telephone wiring and local area networks (LANs). There are different types of UTP cables - identified with the prefix CAT, as in category - each supporting a different amount of bandwidth.
- ✍ Coax, short for coaxial, is a type of cable used to **transmit data, the internet, video and voice communications**.
- ✍ **Electromagnetic** is used to describe the **electrical and magnetic** forces or effects produced by an electric current.

Fiber-optic Cable

Fiber-optic cabling uses either glass or plastic fibers to guide light impulses, Figure 2.12, from source to destination. The bits are encoded on the fiber as **light impulses**. Fiber optic cabling consists of a center glass core surrounded by several layers of protective materials. It transmits light rather than electronic signals eliminating the problem of electrical interference. This makes it ideal for certain environments that contain a large amount of electrical interference. It has also made it the standard for connecting networks between buildings due to its immunity to the effects of moisture and lighting.

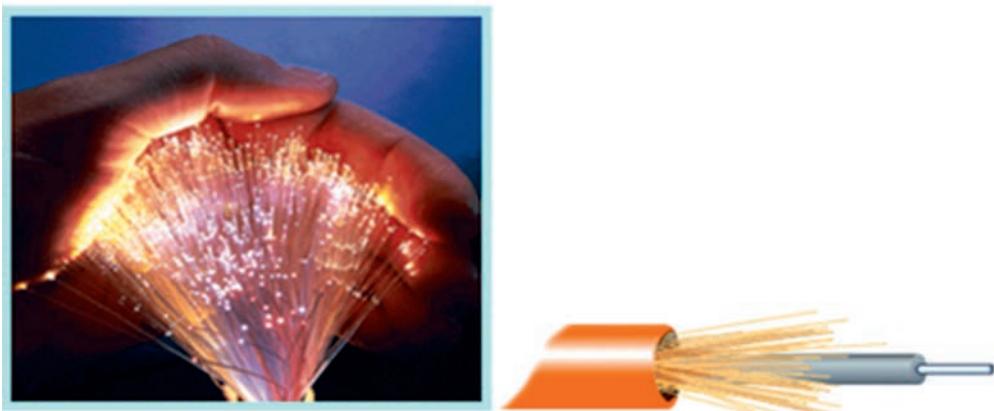


Figure 2.12 Fiber optic cable

Fiber optic cable can transmit signals over much longer distances than coaxial and twisted pairs. It can also carry information at vastly greater speeds. This capacity broadens communication possibilities to include services such as video conferencing and interactive services.

There are two common types of fiber cable: single mode and multimode cables. Multimode cable has a larger diameter; however, both cables provide high bandwidth at high speeds. The single mode cable can provide more distance, but it is more expensive.

Fiber-optic Cable Connectors

There are three types of connectors for fiber-optic cables, as shown in Figure 2.13. These are subscriber channel (SC), straight-tip (ST) and Mechanical Transfer Registered Jack (MT-RJ) connectors. The **subscriber channel (SC)** connector is used for cable TV. It uses a push/pull locking system. The **straight-tip (ST)** connector is used for connecting cables to networking devices. It uses a bayonet locking system and is more reliable than SC. **MT-RJ** is a connector that is the same size as RJ45.

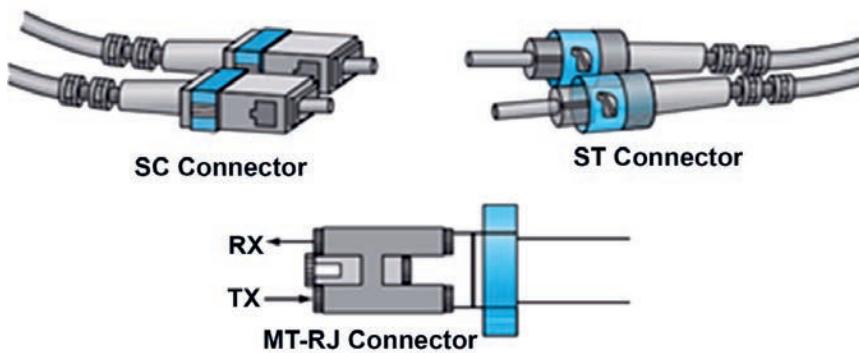


Figure 2.13 Fiber-optic cable connectors

Activity 2.3

Do the following activities in a group.

1. If an internet service provider (ISP) needs to connect offices from Addis Ababa to Bahir Dar, which types of cable do you think are relevant to this connection?
2. Explain the importance of the protection of these cables from damage.
3. Suppose you need to connect 20 computers to a local area network (LAN); which cable do you think is relevant? (Why?)
4. Explain the advantages and disadvantages of fiber optics cable over other copper cables.

Practical Exercise 2.3

Do the following activity in a group.

- Refer to Figure 2.14 and visit the installation of fiber-optics and twisted-pair cables in your school and present what observed to your classmates.

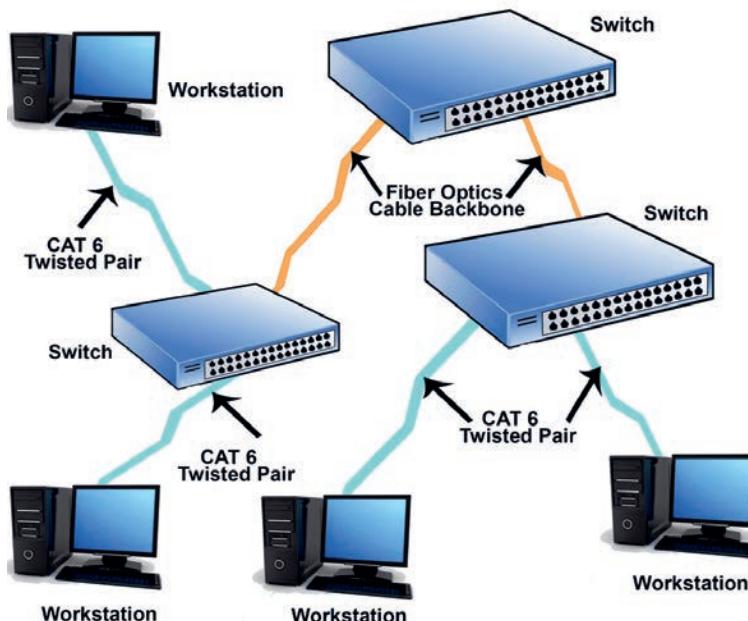


Figure 2.14 Fiber-optic backbone with CAT 6 twisted pair running to the workstations

2.2.2 Unguided (Wireless) Media

Unguided media transport electromagnetic waves without using a physical conductor. This type of communication is often referred to as **wireless communication**. Signals are normally broadcast through free space and thus are available to anyone who has a device capable of receiving them. Figure 2.15 shows categories of wireless transmission.

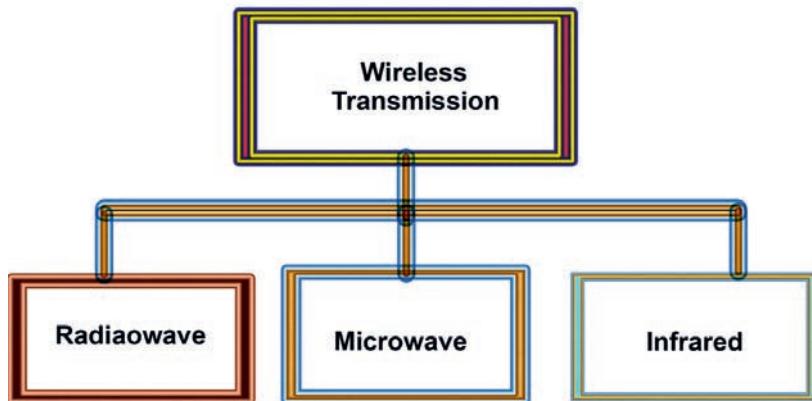


Figure 2.15 Categories of wireless transmission waves

Unguided signals can travel from a given source to its destination in several ways: ground propagation, sky propagation and line-of-sight propagation. Figure 2.16 shows propagation methods.

In-ground **propagation**, radio waves travel through the lowest portion of the atmosphere, hugging the earth. These low-frequency signals emanate in all directions from the transmitting antenna and follow the curvature of the planet. Distance depends on the amount of power in the signal. The greater the power, the greater the distance will be.

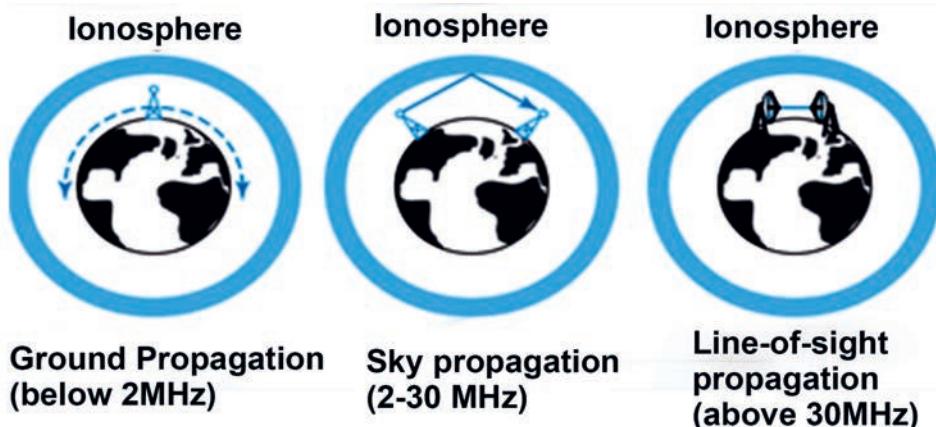


Figure 2.16 Propagation methods

In **sky propagation**, higher-frequency radio waves radiate upward into the ionosphere (the layer of the atmosphere where particles exist as ions) where they are reflected on earth. This type of transmission allows for greater distances with lower output power.

In **line-of-sight propagation**, very high-frequency signals are transmitted in straight lines directly from antenna to antenna. Antennas must be directional, facing each other and either tall enough or close enough together not to be affected by the curvature of the earth. Line-of-sight propagation is tricky because radio transmissions cannot be completely focused.

a. Radio Waves

Although there is no clear-cut demarcation between radio waves and microwaves, electromagnetic waves ranging in frequencies between 3 kHz and 1 GHz are normally called radio waves; waves ranging in frequencies between 1 and 300 GHz are called microwaves. However, the behavior of the waves, rather than the frequencies, is a better criterion for classification.

Radio waves, for most parts, are omnidirectional. When an antenna transmits radio waves, they are propagated in all directions. This means that the sending and receiving antennas do not have to be aligned. A sending antenna sends waves that can be received by any receiving antenna. The omnidirectional property has a disadvantage too. The radio waves transmitted by one antenna are susceptible to interference by another antenna that may send signals using the same frequency or band. Radio waves, particularly those that propagate in **the sky mode**, can travel long distances. This makes radio waves a good candidate for long-distance broadcasting such as **AM radio**.

Omnidirectional Antenna

Radio waves use omnidirectional antennas that send out signals in all directions. Based on the wavelength, strength and purpose of transmission, we can have several types of antennas. Figure 2.17 shows an omnidirectional antenna.



Figure 2.17 Omnidirectional antenna

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The omnidirectional characteristics of radio waves make them useful for multicasting, in which there is one sender but many receivers. **AM and FM radio, television, maritime radio, cordless phones and paging** are examples of multicasting.

b. Microwaves

A **microwave** is a line-of-sight wireless communication technology that uses high-frequency beams of radio waves to provide high-speed wireless connections that can send and receive voice, video and data information. Microwaves are unidirectional. When an antenna transmits microwaves, it can be narrowly focused. This means that the sending and the receiving antennas need to be aligned. The unidirectional property has an obvious advantage. A pair of antennas can be aligned without interfering with another pair of aligned antennas.

Activity 2.4

Discuss the following items in a group.

1. Explain the term *unguided media*.
2. Describe the fundamental characteristics of microwave propagation.
3. Summarize the advantages of microwave technology in today's communication system.
4. Compare and contrast omnidirectional and unidirectional antennas.

Unidirectional Antenna

Microwaves need unidirectional antennas that send out signals in one direction. Two types of antennas are used for microwave communications: parabolic dish and horn (see Figure 2.18).

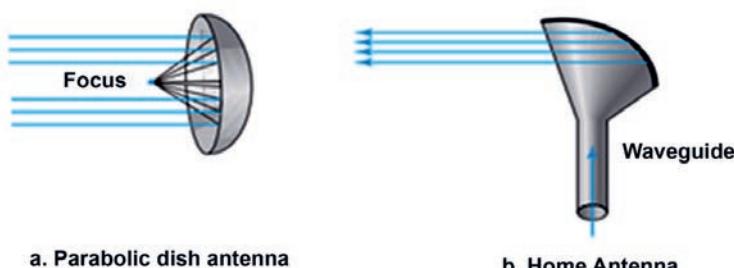


Figure 2.18 Unidirectional antenna

A **parabolic dish antenna** is based on the geometry of the parabola where every line is parallel to the line of symmetry (line of sight). Figure 2.18 portrays the curve at angles such that all the lines intersect in a common point called the focus. The parabolic dish works as a funnel, catching a wide range of waves and directing them to a common point. More of the signal is recovered in this way than a single-point receiver.

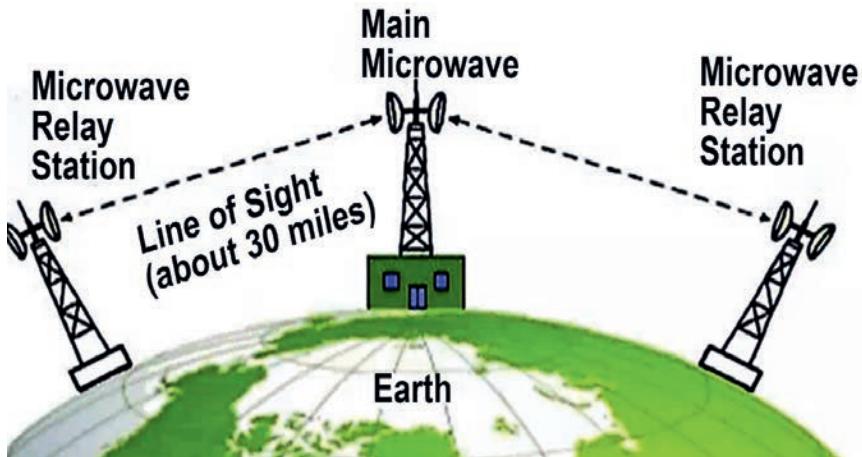


Figure 2.19 Microwave antenna

In microwave communications, line-of-sight devices must be placed in relatively high locations. Information is converted to a microwave signal, sent through the air to a receiver, and recovered.

A **horn antenna** looks like a gigantic scoop. Outgoing transmissions are broadcast up a stem (resembling a handle) and deflected outward in a series of narrow parallel beams by the curved head. Received transmissions are collected by the scooped shape of the horn, like the parabolic dish, and are deflected down into the stem.

Applications of Microwave Technologies

Microwaves, due to their unidirectional properties, are very useful when unicast (one-to-one) communication is needed between the sender and the receiver. They are used in **cellular phones**, **satellite networks** and **wireless LANs** (which will be discussed in the next sections of this unit).

Activity 2.5

Do the following activities in a group.

1. Explain the application area of radio waves, microwaves and infrared.
2. Discuss how microwave antennas and their accessories are protected in your local environment.
3. Explain the difference between omnidirectional and unidirectional waves.
4. Discuss the advantages of wireless media over wired ones.

c. Infrared Waves

Infrared, which is sometimes called infrared light, is electromagnetic radiation with wavelengths longer than those of visible lights. It is therefore invisible to the human eye. For example, you use infrared light waves to change channels on your TV. Figure 2.20 shows the remote control, which is an example of infrared wave device.



Figure 2.20 Remote control

KEY CONCEPTS

- ✍ **Electromagnetic (EM)** waves are waves that are created as a result of vibrations between an electric field and a magnetic field. Electromagnetic waves are formed when an electric field comes in contact with a magnetic field. They are, hence, known as electromagnetic waves.
- ✍ **Omnidirectional** means being in or involving all directions, especially receiving or sending radio waves equally well in all directions.
- ✍ **Omnidirectional antenna** is a wireless transmitting or receiving antenna that radiates or intercepts radio-frequency (RF) electromagnetic fields equally well in all horizontal directions in a flat, two-dimensional (2D) geometric plane.

 **Radio waves** are types of electromagnetic radiation with the longest wavelengths in the electromagnetic spectrum, typically with frequencies of less or equal to 300 gigahertz (GHz). They are used in standard broadcast radio and television, shortwave radio, navigation and air-traffic control, cellular telephony and even remote-controlled toys.

2.3 Telecommunications Network

Brainstorming

1. Can you describe the term telecommunication networks?
2. Can you mention the importance of telecommunication?
3. What are services offered by a telecommunication system?

2.3.1 Telecommunications Concepts

The term telecommunications generally refer to all types of long-distance communication that use common carriers, telephone, radio, and television. It is the exchange of information in any form (voice, data, text, images, audio, and video) over networks. Data communications is a subset of telecommunications and is achieved through the use of telecommunication technologies.

In modern organizations, communications technologies are integrated. Businesses are finding electronic communications essential for minimizing time and distance limitations. Telecommunications plays a special role when customers, suppliers, vendors, and regulators are part of a multinational organization in a world that is continuously awake and doing business somewhere 24 hours a day, 7 days a week ("24/7"). Figure 2.21 represents a model of an integrated computer and telecommunications system common in today's business environment.

Telecommunications system

A telecommunications system is a collection of compatible hardware and software arranged to communicate information from one location to another. These systems can transmit text, data, graphics, voice, documents, or video information. A typical telecommunications system is shown in Figure 2.22. Such systems have

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two sides: the transmitter and the receiver. The major components are:

1. **Hardware**— all types of computers and communications processors (such as a modems or small computers dedicated solely to communications).
2. **Communications media**— the physical media through which electronic signals are transferred; includes both wireline and wireless media.
3. **Communications networks**— the linkages among computers and communications devices.
4. **Communications processors**— devices that perform specialized data communication functions; includes front-end processors, controllers, multiplexors and modems.
5. **Communications software**—software that controls the telecommunications system and the entire transmission process.
6. **Data communications providers**— regulated utilities or private firms that provide data communications services.
7. **Communications protocols**—the rules for transferring information across the system.
8. **Communications applications**— electronic data interchange (EDI), teleconferencing, videoconferencing, e-mail, facsimile, electronic funds transfer, and others.

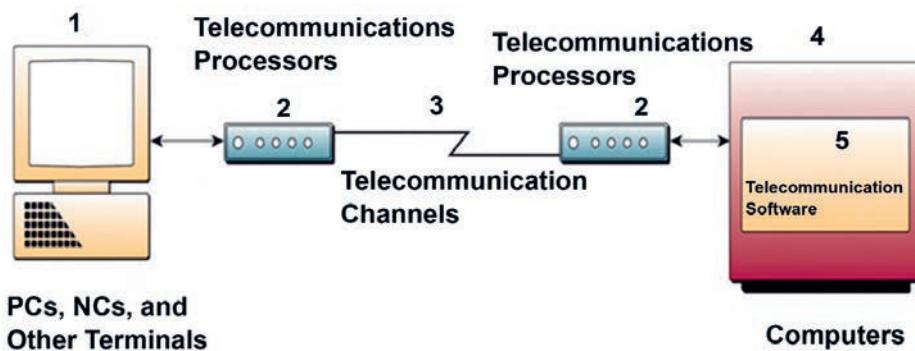


Figure 2.21 General telecom network components

To transmit and receive information, a telecommunications system must perform the following separate functions that are transparent to the user:

- Transmit information.
- Establish the interface between the sender and the receiver.

- Route messages along the most efficient paths.
- Process the information to ensure that the right message gets to the right receiver.
- Check the message for errors and rearrange the format if necessary.
- Convert messages from one speed to that of another communications line or from one format to another.
- Control the flow of information by routing messages, polling receivers, and maintaining information about the network.
- Secure the information at all times.

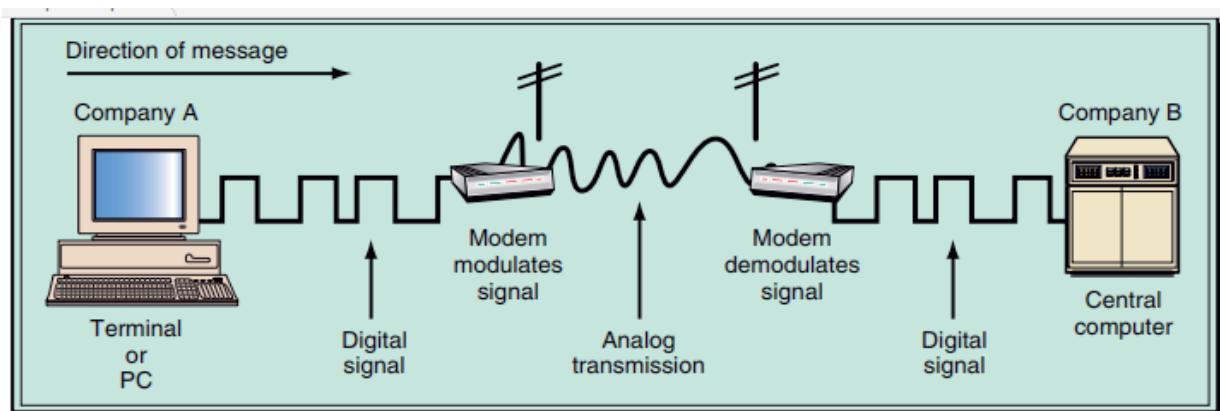


Figure 2.22 A modem converts digital to analog signals and vice versa.

Electronic Signals

Telecommunications media can carry two basic types of signals, analog and digital (see Figure 2.22). Analog signals are continuous waves that “carry” information by altering the amplitude and frequency of the waves. For example, sound is analog and travels to our ears in the form of waves—the greater the height (amplitude) of the waves, the louder the sound; the more closely packed the waves (higher frequency), the higher the pitch. Radio, telephones, and recording equipment historically transmitted and received analog signals, but they are rapidly changing to digital signals.

Digital signals are discrete on-off pulses that convey information in terms of 1's and 0's, just like the central processing unit in computers. Digital signals have several advantages over analog signals. First, digital signals tend to be less affected by interference or “noise.” Noise (e.g., “static”) can seriously alter the information carrying characteristics of analog signals, whereas it is generally easier, in spite

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of noise, to distinguish between an “on” and an “off.” Consequently, digital signals can be repeatedly strengthened over long distances, minimizing the effect of any noise. Second, because computer-based systems process digitally, digital communications among computers require no conversion from digital to analog to digital.

Communications processors are hardware devices that support data transmission and reception across a telecommunications system. These devices include modems, multiplexers, front-end processors, and concentrators.

Modem- a modem is a communications device that converts a computer’s digital signals to analog signals before they are transmitted over standard telephone lines. The public telephone system (called POTS for “Plain Old Telephone Service”) was designed as an analog network to carry voice signals or sounds in an analog wave format. In order for this type of circuit to carry digital information, that information must be converted into an analog wave pattern. The conversion from digital to analog is called modulation, and the reverse is demodulation. The device that performs these two processes is called a modem; a contraction of the terms modulate/ demodulate (see Figure 2.22). Modems are always used in pairs.

2.3.2 The Importance of Telecommunications

Advances in telecommunications technology allow us to communicate rapidly and learn at distance. Education sectors can take advantage of this technology and communicate almost anywhere in the world. In the business sector, telecommunications also reduce the amount of time needed to transmit information that can drive and conclude business actions.



Telecommunication in
Business-to-Business
collaboration



Telecommunication in
E-commerce market

Figure 2.23 Telecommunications in business

The range of telecommunications applications is broad and includes telephony and video conferencing, facsimile, broadcast and interactive television, instant messaging, e-mail, distributed collaboration, a host of Web- and Internet-based communication, and data transmission.

In general, telecommunications create an impact on the everyday activities of people all over the world. Through telecommunications, people can develop solutions and provide support to causes and problems across the world, hence, making it a closer and safer place to live in. For example, to take advantage of telecommunications, Ethio-telecom is installing 4G LTE advanced (this will be discussed under section 2.4 of this textbook) across all regions.



Figure 2.24 4GLTE

Activity 2.6

Do the following activities individually.

1. Explain the term *telecommunications* and its system components. (Refer to figures 2.21 and 2.22).
2. Currently, what are the fundamental effects of telecommunications systems in our daily life?
3. Define and discuss the terms *modem* and *multiplexer* in telecommunications systems.
4. For what purposes do students may use telecommunications technologies in school/local villages? What could be the impact of these technologies on their daily lives?
5. Discuss the implications of telecommunications system in business.

KEY CONCEPTS

- ☛ The term **telecommunications** refers to all types of long-distance communication that use common carriers, **telephone, radio and television** for the exchange of information in any form (voice, data, text, images audio and video) over networks.
- ☛ **Telecommunications system** is a collection of compatible hardware and software arranged to communicate information from one location to another.
- ☛ **Telecommunications network components** are terminals (inputs used to transmit and receive data), telecom processors (devices that perform control and provide support function), telecom channels (media for transmission of information), various computer and telecom control software (programs that control telecom activities).

2.4 Mobile Communications

Brainstorming

1. Can you describe what is meant by mobile communication?
2. Where and when do you think Bluetooth technology is so important?
3. What is wireless LAN?

Mobile communication is the use of technology that allows us to communicate with others in different locations without the use of any physical connection (wires or cables). Mobile communication saves time and effort and makes our life easier. The following sections discuss basic mobile communications technologies.

2.4.1 A Bluetooth Network

Bluetooth technology is a short-range wireless communications technology to replace the cables connecting electronic devices, allowing a person to have a phone conversation via a headset. Figure 2.25 shows a Bluetooth headset.



Figure 2.25 Example of a Bluetooth headset

The Bluetooth Radio Frequency transceiver operates in the unlicensed Industrial, Scientific, and Medical (**ISM**) band centered at 2.4 gigahertz (the same range of frequencies used by microwaves and Wi-Fi). Every Bluetooth-enabled device in the system can establish a connection via pairing and can communicate with each other. Figure 2.26 shows a Bluetooth connection.



Figure 2.26 Bluetooth connection

Activity 2.7

Answer the following activities in a small group.

1. Analyze the advantages of Bluetooth over other wireless technologies.
2. Use your mobile phones and share at least two messages with your nearby friends' via Bluetooth.
3. Discuss the basic features of Bluetooth.

2.4.2 Wireless Local Area Network (WLAN)

With the success of wired local area networks (LANs), the local computing market is moving toward wireless LAN (WLAN) with the same speed as the current wired LAN. It is a communication system established through the use of radio frequency (RF) technology that can function either as an extension to an existing LAN or as an alternative for a wired LAN. There is a need for an access point (AP) that bridges wireless LAN traffic into the wired LAN. Figure 2.27 shows WLAN.

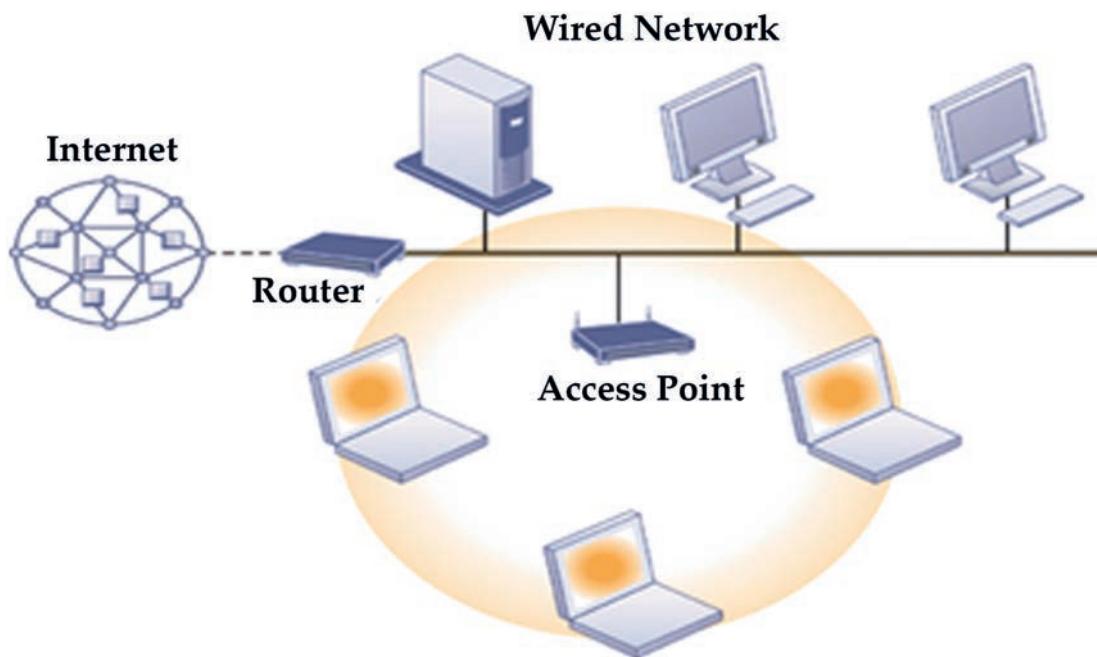


Figure 2.27 Wireless local area network (WLAN)

Wireless local area networks are flexible data communication systems that can be used for applications in which **mobility** is required. This gives users the ability to move around within a local coverage area and still be connected to the network.

Currently, WLANs can provide data rates up to 11 Mbps, but the industry is making a move toward high-speed WLANs. The high speed makes WLANs a promising technology for the future data communications market. The International Enterprise for Electronics Engineering (IEEE) 802.11 committee is responsible for WLAN standards. Most modern WLANs are based on IEEE 802.11 standards and marketed under the Wi-Fi brand name.

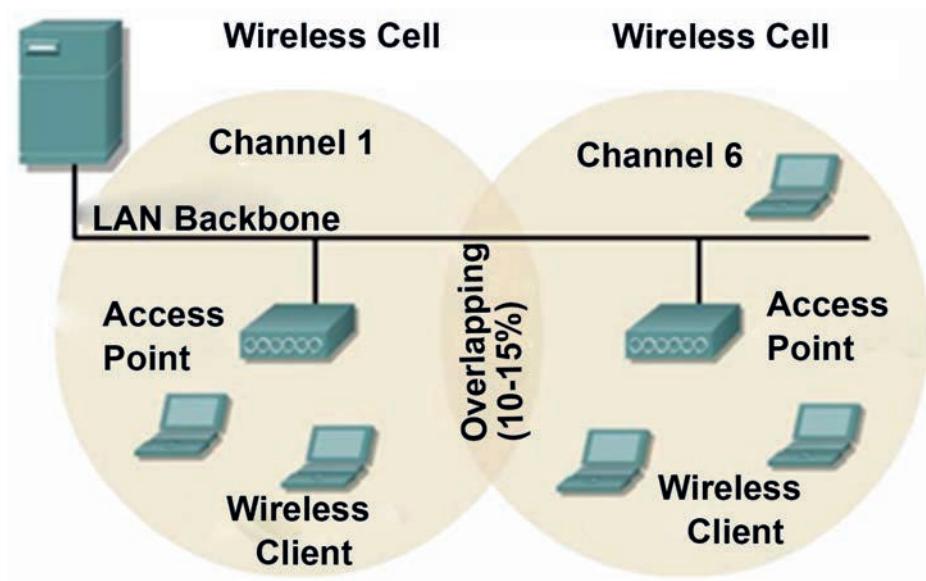


Figure 2.28 APs overlap.

The access point (AP), can also act as a repeater for wireless nodes, effectively doubling the maximum possible distance between nodes. To service larger areas, multiple APs may be installed with a 10-15% overlap. Figure 2.28 above shows the access points overlap.

Activity 2.8

Answer the following activities in a group.

1. Discuss the fundamental components of WLAN (Refer to Figure 2.27).
2. Analyze wireless LAN and report to the class based on:
 - a. Its implication to learning in school.
 - b. Advantages and disadvantages.
 - c. Similarities and differences with wired local area network.
3. Visit WLAN (Wi-Fi) at your school or local environment and report its implication to business to your class.
4. Summarize the role of access points in WLAN.
5. Describe the advantages of overlapping the access points?

KEY CONCEPTS

- ✍ Mobility is the ability to move freely.
- ✍ Bluetooth is a wireless technology that uses a radio frequency to share data over a short distance, eliminating the need for wires. You can use Bluetooth on your mobile device to share documents or to connect with other Bluetooth-enabled devices.
- ✍ Electromagnetic fields, radio waves, microwaves and wireless signals are referred to as radio frequency (RF) energy.
- ✍ **Wireless local area networking**, also known as WLAN or wireless LAN, is a term used to refer to wireless digital signals to connect computers and other devices.

2.5 Cellular Networks

Brainstorming

1. How is your handheld device mobile?
2. What are the services provided by cellular systems?
3. In Ethiopia, which organization(s) provide(s) cellular system services?

A cellular network or mobile network is a radio network distributed over land areas called cells, each served by at least one fixed-location transceiver, which is known as a cell site or base station.

A cellular network is designed to provide communications between two moving units (called mobile stations (MSs)), or between one mobile unit and one stationary unit (often called a land unit). A service provider must be able to locate and track a caller, assign a channel to the call and transfer the channel from the base station to the base station as the caller moves out of range. To make this tracking possible, each cellular service area is divided into **small regions** called **cells**. Each cell contains an antenna and is controlled by a solar- or AC-powered network station called the base station (BS).

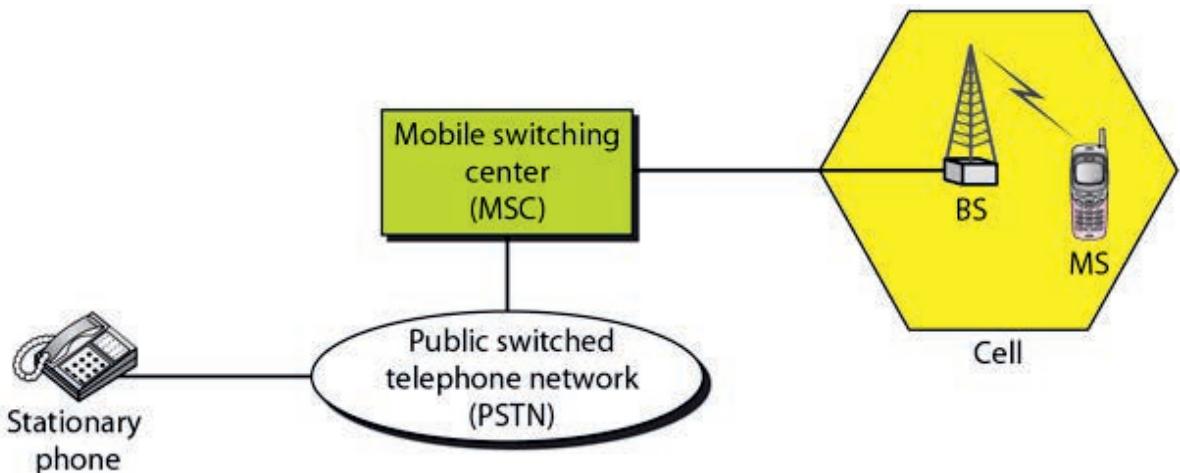


Figure 2.29 Cellular system

Each base station is controlled by a switching office called a mobile switching center (MSC). The MSC coordinates communication between all the base stations and the telephone central office. It is a computerized center that is responsible for connecting calls, recording call information and billing. Figure 2.29 shows the cellular system.

Activity 2.9

Discuss the following activities in a group.

1. Describe the role of the cellular base station around you or at school.
2. Explain how your hand-held device (mobile) accesses the base stations.
3. Visit any Ethio-telecom office found in your local area and summarize the services of a cellular system.
4. Analyze how cell sizes are different from one another in the cellular system.

KEY CONCEPTS

- ✍ **Cellular** refers to a **network technology** that facilitates **mobile device communication over areas comprised of cells and transceivers**, which are also known as base stations or cell sites. In a cellular network, the most widely used mobile transceivers are mobile phones, or cell phones.
- ✍ **Base station** is a fixed transceiver that is the main communication point for one or more wireless mobile client devices. A base station serves as a central connection point for a wireless device to communicate.
- ✍ **Cell** is a small geographic unit in a cellular system.

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Generation of Cellular System

The cellular communication networks are known by their numeric generation such as **1G**, **2G**, **3G** and **4G** designations. We are currently in the fourth generation with **5G** emerging.

Activity 2.10

Discuss the following items and present them to the class.

1. Discuss the basic characteristics and advantages of 1G, 2G and 3G cellular.
2. Explain the fundamental reason to move from one generation to another.
3. Analyze the difference between 1G, 2G, 3G, 4G and 5G.
4. Describe your handheld device to which generation it complies. Why?
5. Discuss advantages of cellular network over Wireless LAN.

a. Fourth Generation (4G)

The fourth generation of cellular telephony is expected to be a complete evolution in wireless communications.



Figure 2.30 4G devices

Some of the objectives defined by the 4G working group are:

- High network capacity.
- Data rate of 100 Mbit/s for access in a moving car and 1 Gbit/s for stationary users.
- Data rate of at least 100 Mbit/s between any two points in the world.
- Smooth handoff across heterogeneous networks.
- Seamless connectivity and global roaming across multiple networks.

- High quality of service for next-generation multimedia support.
- Interoperability with existing wireless standards.

4G is also known as mobile broadband everywhere.

4G LTE

4G LTE (long term evolution) is a type of 4G technology. It is a mobile broadband technology that promises data transfer rates of 100 Mbps. See Figure 2.24 for 4GLTE.

b. 5G

5G is the 5th generation mobile network and it is the latest in the evolution of mobile wireless technologies. 5G goes beyond 4G LTE and is expected to bring not just faster downloads, but a much more flexible and responsive network that can adapt to enable different uses. 5G enables a new kind of network that is designed to connect everyone and everything virtually including machines, objects and devices. Figure 2.31 shows the 5G network.

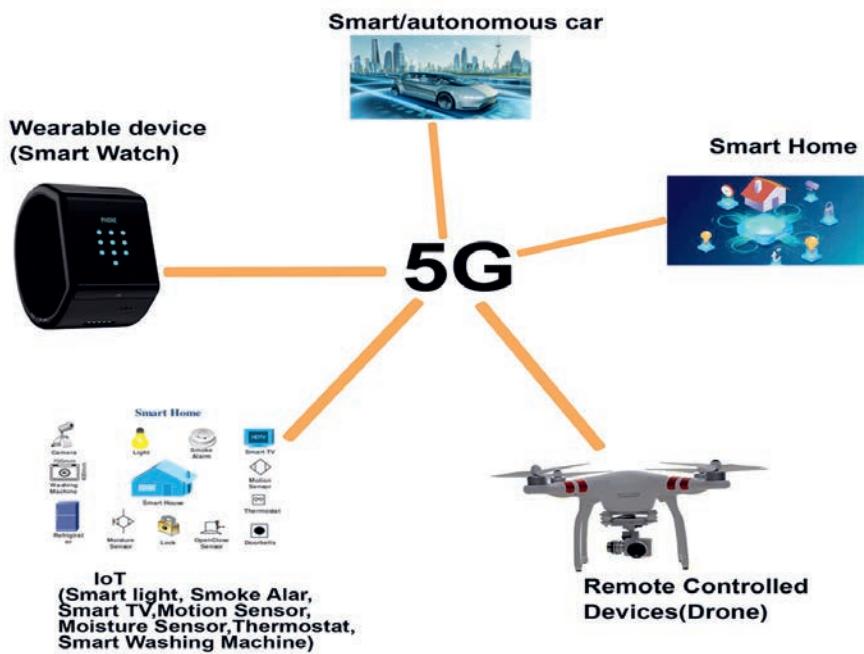


Figure 2.31 5G network

5G wireless technology is meant to deliver higher multi-Gbps peak data speeds, ultra-low latency, more reliability, massive network capacity, increased availability and a more uniform user experience to more users. Higher performance and improved efficiency empower new user experiences and connect new industries.

2.6 Satellite Networks

Brainstorming

1. What is a satellite network?
2. Which type of network do you think that television broadcast we watch at home belongs to?

A satellite network is a combination of nodes, some of which are satellites that provide communication from one point on the earth to another point. A node in the network can be a satellite, an earth station, an end-user terminal or a telephone. The fundamental components of a satellite system are earth stations, uplink, downlink and transponder. Satellites communicate with antennas on earth by using radio waves. Figure 2.32 shows components of the satellite network.

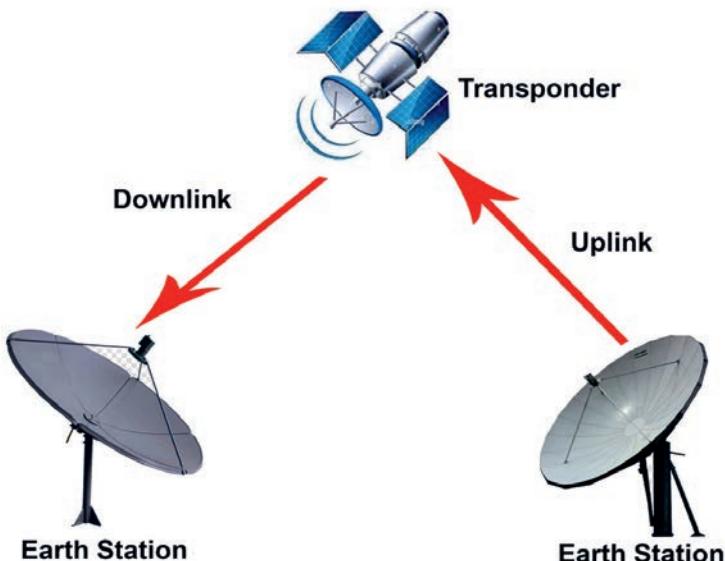


Figure 2.32 Components of satellite system

Satellite networks are like cellular networks in that they divide the **planet into cells**. Satellites can provide transmission capability to and from any location on Earth, no matter how remote they are. This advantage makes high-quality communication available to **undeveloped parts** of the world without requiring a huge investment in ground-based infrastructure.

Activity 2.11

Answer the following activities individually.

1. Describe the role of the satellite system in education.
2. Explain each component of the satellite system as shown in Figure 2.32.
3. Discuss the advantages of satellite systems over other wireless technologies.
4. In Ethiopia, which part of the community do you think benefits more from the satellite system?

2.6.1 Orbits of Satellite

An artificial satellite needs to have an orbit, the path in which it travels around the Earth. The orbit can be equatorial, inclined or polar. Figure 2.33 shows satellite orbits.

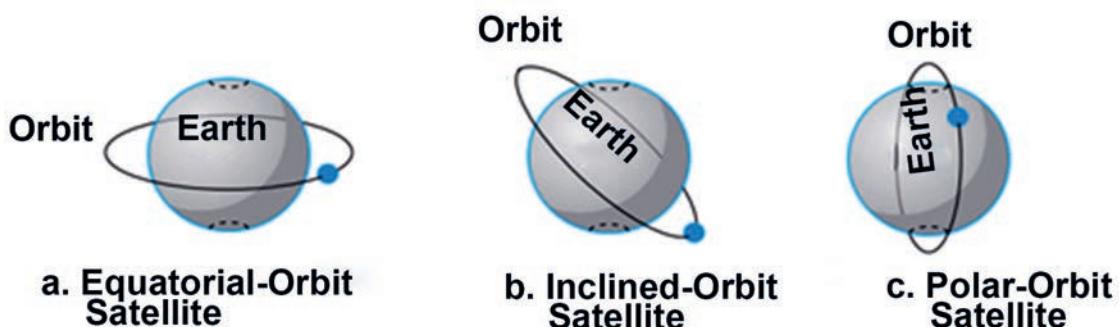


Figure 2.33 Satellite Orbits

2.6.2 Categories of Satellites

Based on the location of the orbit, satellites can be divided into three categories: **geostationary Earth orbit (GEO)**, **low-Earth-orbit (LEO)** and **medium-Earth-orbit (MEO)**. Figure 2.34 shows the satellite altitudes concerning the surface of the Earth. There is only one orbit, at an altitude of 35,786 km, for the GEO satellite. MEO satellites are located at altitudes between 5000 and 15,000 km. LEO satellites are normally below an altitude of 2000 km.

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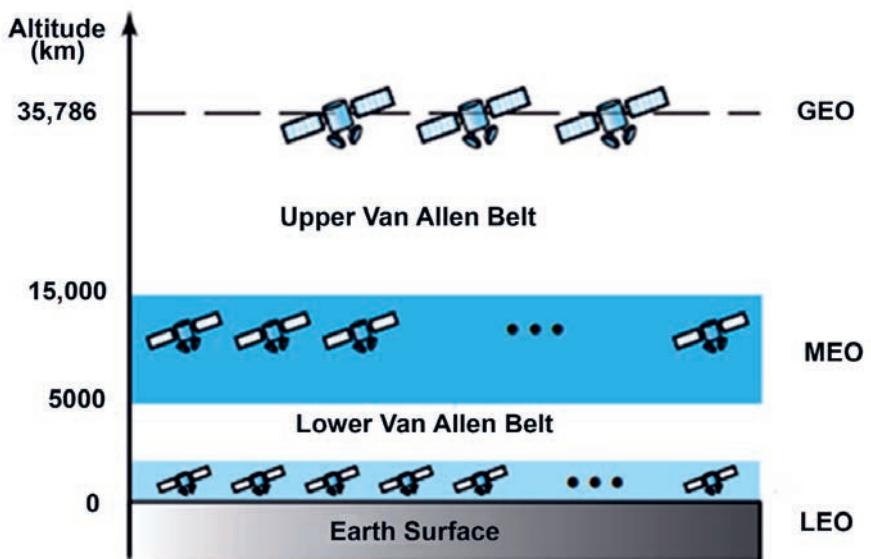


Figure 2.34 Satellite types and their orbit altitudes

One reason for having different orbits is the existence of two Van Allen belts. A Van Allen belt is a layer that contains charged particles. A satellite orbiting in one of these two belts would be destroyed by the energetic charged particles. The **MEO** orbits are located between these two belts.

Activity 2.12

Answer the following activities in a group.

1. Discuss satellite systems in your respective group and report to class.
2. Among the categories of satellite systems, which one(s) correspond(s) to Ethiopian satellite system?
3. Visit a home dish system and report its basic installations to your class.

KEY CONCEPTS

✍ A **satellite** is basically a self-contained communication system with the ability to receive signals from Earth and to retransmit those signals back with the use of a transponder - an integrated receiver and transmitter of radio signals.

- ✍ **Satellite networks** are defined as the orientation of various elements that establish communication through various nodes from one point of the earth to another. Any satellite network can provide both types of transmission technologies, i.e. point to point as well as broadcasting connections.
- ✍ **An orbit** is a regular, repeating path that one object in space takes around another one. An object in an orbit is called a satellite. A satellite can be natural like Earth and the moon. Many planets have moons that orbit them. A satellite can also be man-made like International Space Station.

2.6.3 Data Communications

Brainstorming

1. What do you mean by data communication?
2. Can you explain how data is communicated?

Data communication is a specialized subset of telecommunications that refers to the electronic collection, processing, and distribution of data, typically between computer system hardware devices. The effectiveness of a data communication system depends on **four fundamental** characteristics: **delivery, accuracy, timeliness and jitter**.

2.6.4 Components of Data Communication

A data communications system has five components (see Figure 2.35).

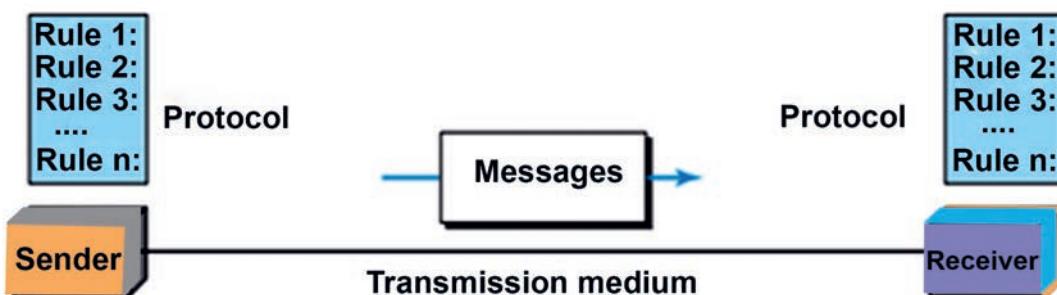


Figure 2.35 Five components of data communication

2.6.5 Data Transmission Mode/Flow

Data transmission mode refers to the direction of signal flow between two linked devices. Communication between two devices can be simplex, half-duplex or full-duplex.

Simplex

In **simplex mode**, the communication is unidirectional, as on a one-way street. Only one of the two devices on a link can transmit; the other can only receive. Figure 2.36 shows simplex transmission.



Figure 2.36 Example of simplex transmission

Keyboards and traditional monitors are examples of simplex devices. The keyboard can only introduce input; the monitor can only accept output. The simplex mode can use the entire capacity of the channel to send data in one direction.

Half-Duplex

In half-duplex mode, each station can both transmit and receive, but not at the same time. When one device is sending, the other can only receive and vice versa.

The half-duplex mode is like a one-lane road with traffic allowed in both directions. When cars are traveling in one direction, other cars going the other way must wait. In half-duplex transmission, the entire capacity of a channel is taken over by whichever of the two devices is transmitting at the time. Figure 2.37 shows a half-duplex.

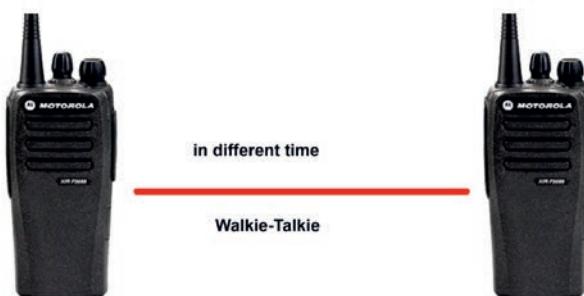


Figure 2.37 Half-duplex

The half-duplex mode is used in cases where there is no need for communication in both directions at the same time; the entire capacity of the channel can be utilized for each direction.

Full-duplex

In full-duplex mode (also called duplex), both stations can transmit and receive simultaneously

The full-duplex mode is like a two-way street with traffic flowing in both directions at the same time. In full-duplex mode, signals going in one direction share the capacity of the link with signals going in the other direction. This sharing can occur in two ways: either the link must contain two physically separate transmission paths, one for sending and the other for receiving, or the capacity of the channel is divided between signals traveling in both directions. Figure 2.38 shows the full-duplex.

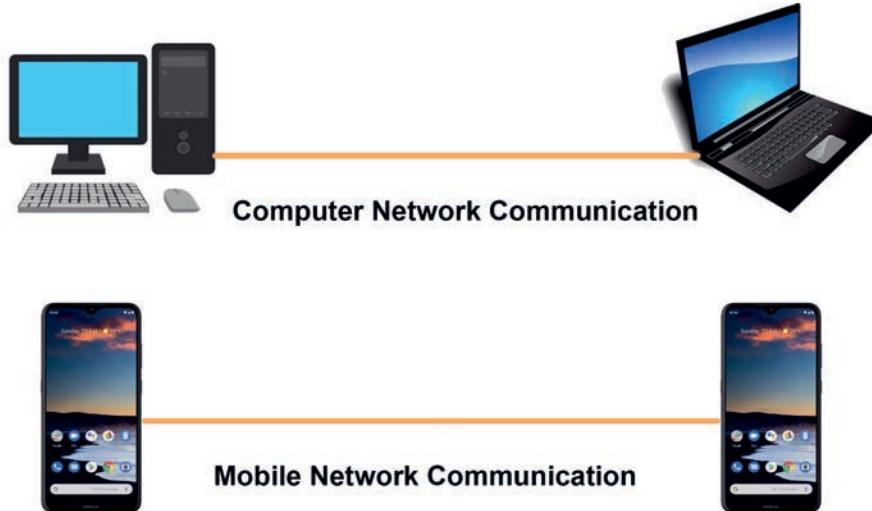


Figure 2.38 Full-duplex

One common example of full-duplex communication is the telephone network. When two people are communicating by a telephone line, both can talk and listen at the same time. The full-duplex mode is used when communication in both directions is required all the time. The capacity of the channel, however, must be divided between the two directions.

Activity 2.13

Do the following activities in a group.

1. Explain the fundamental characteristics of data communication.
2. Refer back to grade 9 IT textbook and explain the terms *data* and *communication*.
3. Explain the fundamental components of data communications that are illustrated in Figure 2.35.

2.7 Internet Protocol

Brainstorming

1. Can you state what Internet protocol (IP) is?
2. Can you identify the IP into which your computer is connected to the net-

The Internet Protocol (IP) is the principal communications protocol in internetworking; it would not be an exaggeration to say that you cannot comprehend modern networking without a good understanding of IP.

2.7.1 IP Address

An IP address is a unique address that identifies a device on the internet or a local network. As it is described earlier, IP stands for Internet Protocol, which is the set of rules governing the format of data sent via the internet or local network. In essence, IP addresses are the identifier that allows information to be sent between devices on a network; they contain location information and make devices accessible for communication.

The internet needs a way to differentiate among different computers, routers and websites. IP addresses provide a way of doing so and form an essential part of how the Internet works. The IP address has two fundamental versions: IPv4 and IPv6. IPv4 is a common version that can be used in current networks. IP v4 (version 4) addresses are 32-bit integers that can be expressed in hexadecimal notation. The most common format, known as dotted quad or dotted decimal, is x.x.x.x, where each x can be any value between 0 and 255. For example, 192.0.2.146 is a valid IPv4 address.

Activity 2.14

Do the following activities in a group.

1. Discuss different types of IP address notation which are illustrated in Figure 2.39.
2. Discuss the role of IP addresses in today's communication network.
3. How is IP address unique and universal?
4. Compare and contrast IPv4 and IPv6.

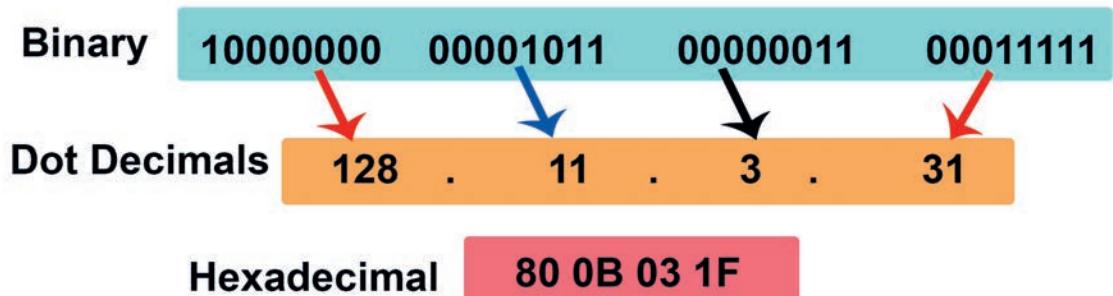


Figure 2.39 Three different notations in IPv4 addressing

2.7.2 Classes of IP Address

When Internet addresses were standardized (the early 1980s), the Internet address space was divided into classes. TCP/IP defines five classes of IP addresses: Class A, B, C, D and E. Each class has a range of valid IP addresses. The value of the first octet determines the class.

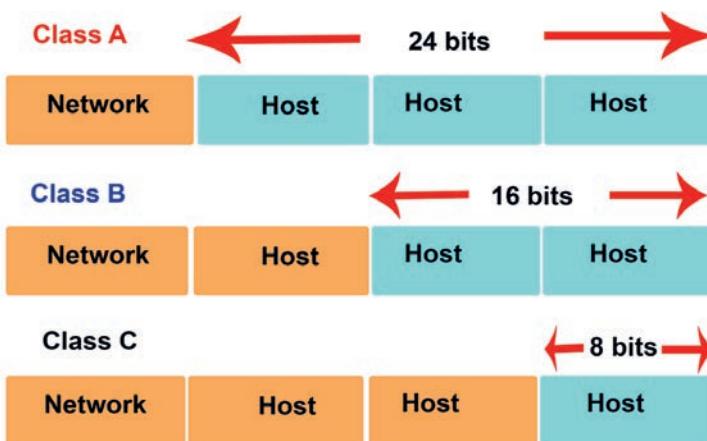


Figure 4.40 Classes of IP address

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IP addresses from the first three classes (A, B and C) can be used for host addresses. The other two classes are used for other purposes. Class D is used for multicast and Class E for experimental purposes. Figure 2.40 and table 2.1 show classes of IP addresses.

The system of IP address classes was developed for Internet IP addresses assignment. The classes created were based on the network size. For example, Class A was created for the small number of networks with a very large number of hosts. Class C was created for numerous networks with a small number of hosts.

- **Class A:** The first octet is the network portion. Octets 2, 3 and 4 are for subnets/hosts. Class A starts with 0.
- **Class B:** The first two octets are the network portion. Octets 3 and 4 are for subnets/hosts. Class B starts with 10.
- **Class C:** The first three octets are the network portion. Octet 4 is for subnets/hosts. It starts with 110.

Table 2.1 Classes of IP address

IP Address Class	High Order Bits	First Octet Address Range	Number of Bits in the Network Address
Class A	0	0-127*	8
Class B	10	128-191	16
Class C	110	192-223	24
Class D	1110	224-239	0
Class E	1111	240-255	0

Network Masks

A network mask distinguishes which portion of the address identifies the network and which portion identifies the node.

Default Masks

- **Class A:** 255.0.0.0
- **Class B:** 255.255.0.0
- **Class C:** 255.255.255.0

Activity 2.15

Answer the following items accordingly.

1. Explain fundamental steps used to demonstrate IP address on Windows10 computer.
2. Discuss the purpose of IP address.
3. Find the class of each of the following addresses.
 - a. 00000001 00001011 00001011 11101111
 - b. 1000001 10000011 00011011 11111111
 - c. 10100111 11011011 10001011 01101111
 - d. 11110011 10011011 11111011 00001111
4. Rewrite the following IP addresses using the binary notation.
 - a. 110.11.5.88
 - b. 12.74.16.18
 - c. 201.24.44.32
5. Open your computer on the network and identify the classes of the address and its subnet mask.
6. Explain how IP addresses work.

KEY CONCEPTS

-  An IP address is a **unique address that identifies a device on the internet or a local network**. IP (Internet Protocol) is the set of rules governing the format of data sent via the internet or local network.
-  **Netmasks** (or network masks) are shorthand for referring to ranges of consecutive IP addresses in the Internet Protocol. They are used for defining networking rules. Every entity (server or client) communicating on the internet will have a unique IP address.

2.8 Unit Summary

A transmission medium can be broadly defined as anything that can carry information from a source to a destination. For example, the transmission medium for two people having a dinner conversation is the air. The air can also be used to convey the message in a smoke signal or semaphore. The transmission medium for a written message might be a mail carrier, a truck, or an airplane.

A guided medium provides a physical conduit from one device to another. Twisted-pair cable consists of two insulated copper wires twisted together. Twisted-pair cable is used for voice and data communications. Coaxial cable consists of a central conductor and a shield. Coaxial cable is used in cable TV networks and traditional Ethernet LANs. Fiber-optic cables are composed of a glass or plastic inner core surrounded by cladding, all encased in an outside jacket. Fiber-optic transmission is becoming increasingly popular due to its noise resistance, low attenuation and high bandwidth capabilities. Fiber-optic cable is used in backbone networks, cable TV networks and fast Ethernet networks.

Unguided media (free space) transport electromagnetic waves without the use of a physical conductor. Wireless data are transmitted through ground propagation, sky propagation and line-of-sight propagation. Wireless waves can be classified as radio waves, microwaves or infrared waves. Radio waves are omnidirectional; microwaves are unidirectional. Microwaves are used for cellular phone, satellite and wireless LAN communications. Infrared waves are used for short-range communications such as those between a PC and a peripheral device. They can also be used for indoor LANs.

The nature and characteristics of a wireless network are different from those of a wired network. There are some issues in a wireless network that are negligible in a wired network. Wireless communication is one of the fastest-growing technologies and the demand for connecting devices without the use of cables is increasing everywhere. Wireless networks, as the name implies, interconnect devices without using wires; instead they use air, radio frequency (RF) as the main transmission medium.

Bluetooth technology is a short-range wireless communications technology to replace the cables connecting electronic devices, allowing a person to have a phone conversation via a headset, use a wireless mouse and synchronize information from a mobile phone to a PC, all using the same core system.

Telecommunications are the means of electronic transmission of information over distances. The information may be in the form of voice telephone calls, data, text, images or video. Telecommunications link form a channel through which information is transmitted from a sending device to a receiving device.

In data communication terminology, a transmission medium is a physical path between the transmitter and the receiver; that is, it is the channel through which data is sent from one place to another. Transmission media is broadly classified into the following types: guided and unguided.

WLANs are flexible data communication systems that can be used for applications in which mobility is required. In the indoor business environment, although mobility is not an absolute requirement, WLANs provide more flexibility than that achieved by the wired LAN.

Cellular network provides communication between two devices. One or both may be mobile. A cellular service area is divided into cells. Advanced mobile phone system (AMPS) is a first-generation cellular phone system. Digital AMPS (D-AMPS) is a second-generation cellular phone system that is a digital version of AMPS. Global System for mobile communication (GSM) is a second-generation cellular phone system used in Europe. The third-generation cellular phone system provides universal personal communication. The fourth generation is the new generation of cellular phones that are becoming popular.

Satellite networks are defined as the orientation of various elements that establish communication through various nodes from one point of the earth to another. Any satellite network can provide both types of transmission technologies, i.e. point to point as well as broadcasting connections. A satellite network uses satellites to provide communication between any points on Earth.

An IP address is a unique address that identifies a device on the internet or a local network. IP (Internet Protocol) is the set of rules governing the format of data sent via the internet or local network.

2.9 Unit Review Exercise

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

1. Fiber-optic cables are composed of a glass or plastic inner core surrounded by cladding, all encased in an outside jacket.

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2. Guided media transport electromagnetic waves without the use of a physical conductor.
3. Infrared waves are used for short-range communications such as those between a PC and a peripheral device.
4. Twisted-pair cable is used for voice and data communications.
5. Satellite network does not influence the education system.
6. Data communication is a specialized subset of telecommunications that refers to the electronic collection, processing and distribution of data.
7. It is possible to achieve communication in the network without an IP address.

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

1. Which of the following cable consists of an inner copper core and a second conducting outer sheath?
 - A. Twisted-pair
 - B. Shielded twisted-pair
 - C. Coaxial
 - D. Fiber-optic
2. ____ cable can carry signals of higher frequency ranges than ____ cable.
 - A. Coaxial; twisted-pair
 - B. Twisted-pair; fiber-optic
 - C. Coaxial; fiber-optic
 - D. None of the above.
3. ____ are used for cellular phone, satellite and wireless LAN communications.
 - A. Radio waves
 - B. Infrared waves
 - C. Microwaves
 - D. None of the above.

4. The inner core of an optical fiber is _____ in composition.
 - A. copper
 - B. glass or plastic
 - C. bimetallic
 - D. liquid
5. What is the major factor that makes the coaxial cable less susceptible to noise than twisted-pair cable?
 - A. Insulating material
 - B. Inner conductor
 - C. Diameter of cable
 - D. Outer conductor
6. In fiber optics, the signal is _____ waves.
 - A. radio
 - B. light
 - C. infrared
 - D. very-low-frequency
7. Which of the following is not a guided medium?
 - A. Fiber-optic cable
 - B. Coaxial cable
 - C. Twisted-pair cable
 - D. Atmosphere
8. Microwaves are _____.
 - A. omnidirectional
 - B. bidirectional
 - C. unidirectional
 - D. None of the above.

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9. Which of the following primarily uses guided media?
 - A. Radio broadcasting
 - B. Satellite communications
 - C. Local telephone system
 - D. Cellular telephone system
 10. Transmission media are usually categorized as _____.
 - A. determinate or indeterminate
 - B. fixed or unfixed
 - C. guided or unguided
 - D. metallic or nonmetallic
- Part III: Discuss the following questions.**
1. Write the two major categories of transmission media.
 2. How is guide media different from unguided media?
 3. What are the three major classes of guided media?
 4. What is the function of the twisting in the twisted-pair cable?
 5. Name the advantages of optical fiber over twisted-pair and coaxial cable.
 6. Compare the medium of a wired LAN with that of a wireless LAN in today's communication environment.
 7. Explain the role of the access points in WLAN.
 8. What are the basic components of WLAN?
 9. Compare and contrast Bluetooth and WLAN
 10. What is the relationship between a base station and a mobile switching center?
 11. What are the functions of a mobile switching center?
 12. What are the three types of orbits?
 13. Explain uplink and downlink in the satellite system.
 14. What is the difference between omnidirectional and unidirectional waves?

UNIT

3

APPLICATION SOFTWARE

UNIT OUTCOMES

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

- Create tables.
- Organize and insert pictures, clip arts and shapes.
- Explain how page numbers are formatted.
- Analyze mathematical operators on data to perform addition and others.
- Summarize functions such as filter, sort and rank.
- Apply different effects to a cell and its contents.
- Prepare and present a slide show.
- Create a slide master.

3.1 Unit overview

You learned basic concepts on word processing and spreadsheet in grade 9, unit 3. In this unit, you are going to learn advanced topics such as creating table, formatting table, inserting pictures, clip arts and shapes, and formatting page numbers in word processor. Under spreadsheet, advanced topics are included like understanding and displaying formulas, functions, working with data, working with charts and applying different effects to a cell (formatting cells). Finally, you are going to learn other advanced topics such as using animation and transitions, and creating a slide master in PowerPoint.

3.2 Word Processing

Brainstorming

1. Can you open and identify word processing on your school computer?
2. Can you explain for why word processing is used?

Word processing refers to the act of using a computer to create, edit, save and print documents. In order to perform word processing, specialized software (known as word processor) is needed. One example of word processor is Microsoft Word, but other word processing applications are also widely used. For the purpose of accessibility, we use Microsoft word in this textbook

3.2.1 Creating a Table

A table, such as the one shown in Figure 3.1 below, is an arrangement of data made up of horizontal rows and vertical columns. Cells are rectangles that are formed when rows and columns **intersect**. Tables are often used to organize and present information, but they have a variety of uses as well. You can use tables to align numbers and create interesting page layouts. Calendars, invoices and contact lists are examples of how tables are used every day.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Figure 3.1 A table in word processor

Word provides several options for **creating tables** including **dragging method**, **inserting table dialog box**, **table drawing tools** and **quick table method**. Depending on the situation and availability of resources, you can use different versions of the word application.

a. Inserting a Table by Dragging

In this section, you will learn how easily and quickly you can create a table from the **Insert Table** menu by dragging the mouse pointer to specify the number of rows and columns you need. Using this method, you can create a new, empty table as many as you like. Follow the following steps and insert a table by dragging. Before you begin these steps, **launch** Microsoft Word and **open** a new blank Word document.

1. On the Insert tab, in the Tables group, click the table button. The **Insert Table** menu appears.
2. Point to the cell in the fifth column, second row. The menu title should read 5x2 table, as shown in Figure 3.2. Click the mouse button to create the table. Once the table is inserted into the document, you are ready to begin entering data.

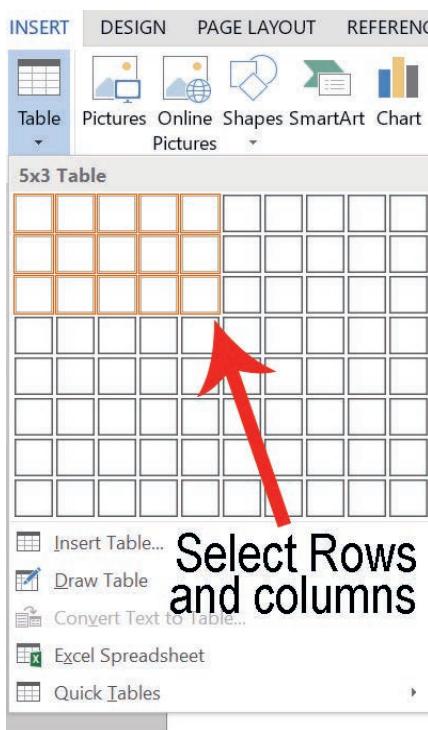


Figure 3.2 Inserting table menu

3. Click below the table and press enter twice to insert blank lines. When you insert more than one table in a document, you should separate them with a blank line to avoid joining the tables.
4. You can save the document as **Table 1** in the folder on your drive.

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b. Using Insert Table Dialog Box

In the insert table dialog box, you can click the spin box arrows or type in the number of columns and rows you need in a table. You can use the document that is open from the previous exercise. The numbers used here are for practice; once you master the concept, you can use any number. Figure 3.3 shows the Insert Table dialog box.

Following the steps below you can create a table using Insert Table dialog box.

1. On the Insert tab, in the Tables group, click the **table** button to open Insert Table menu.
2. On the menu, just below the rows and the columns, select Insert Table. **The Insert Table dialog box** appears.

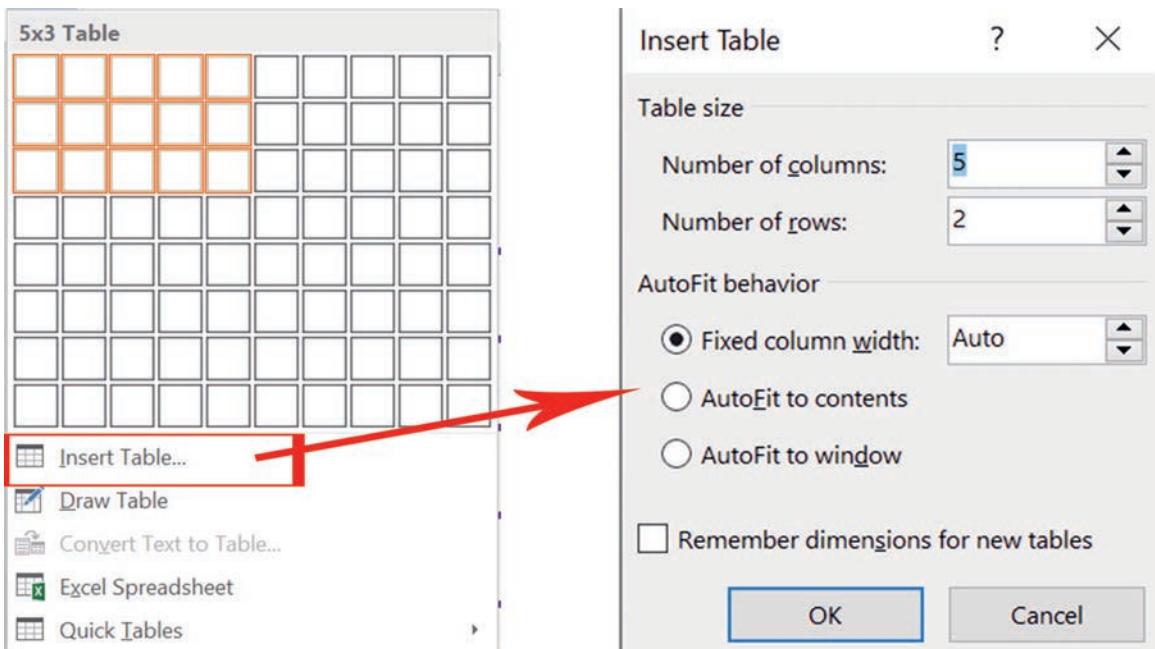


Figure 3.3 Inserting table dialog box

3. In the number of columns box, set the value to 9.
4. In the number of rows box, set the value to 3. The AutoFit behavior is shown in the dialog box
5. Click **Ok** to insert the table. You inserted a new table with 9 columns and 3 rows.
6. Click below the table and press enter twice to insert blank lines.
7. Save the document as **Table 2** in the lesson folder on your flash drive.

c. Drawing Table

Word provides options to draw complex tables using the draw table command, which enables you to draw a table as you would with a pencil and paper. The draw table command transforms the mouse pointer into a pencil tool, which you can use to outline the table and then draw rows and columns exactly where you need them. Keep your eyes on the following steps to draw a table from the Table menu. Use the document that is open from the previous exercise.

1. If your ruler is not displayed, select the ruler check box on the View tab in the Show group.
2. Make sure that your insertion point is at the bottom of the document; then use the scroll bar to scroll down; the insertion point is at the top of the screen.
3. On the Insert tab, in the Tables group, click the Table button to open the Insert Table menu.
4. On the menu, just below the rows and columns, select draw table. The pointer becomes a pencil tool.
5. To begin drawing the table, as shown in Figure 3.4, click at the blinking insertion point and drag down and to the right until you draw a rectangle that is as wide as you want. Notice that the table tools' contextual design and layout tabs automatically appear with the active layout tab.

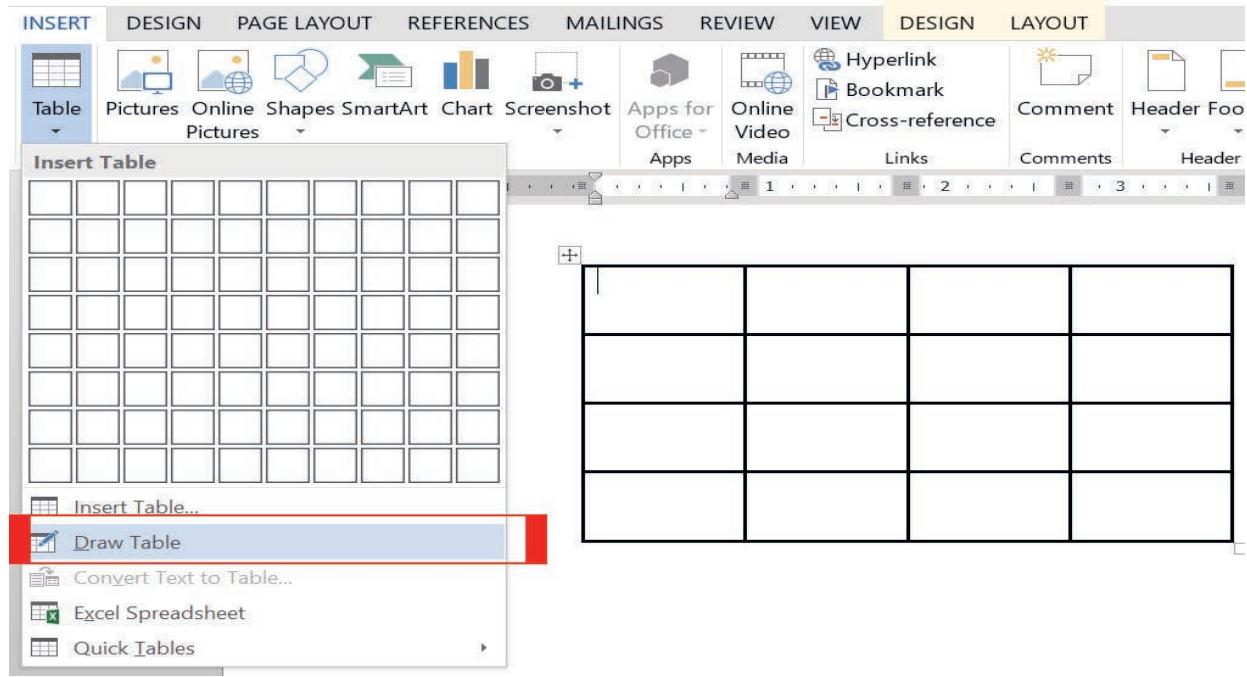


Figure 3.4 Drawing table

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6. Click and drag the pencil from the left border to the right border to draw a horizontal line. Use your ruler as your guide.
7. Click the Draw Table button in the drawing group of the table tools – layout tab to turn the pencil tool off.
8. Click below the table and press enter twice to create blank lines. If necessary, place your insertion point outside the last cell and then press enter.
9. Save the document as **Table 3** in the lesson folder on your flash drive.

d. Inserting a Quick Table

Quick tables are built-in preformatted tables, such as calendars and tabular lists which you can insert and use in your documents. You can edit the quick table calendar to reflect the current month and year. In this exercise, you insert a quick table calendar into a document.

1. On the Insert tab, in the Tables group, click the Table button to open the Insert Table menu.

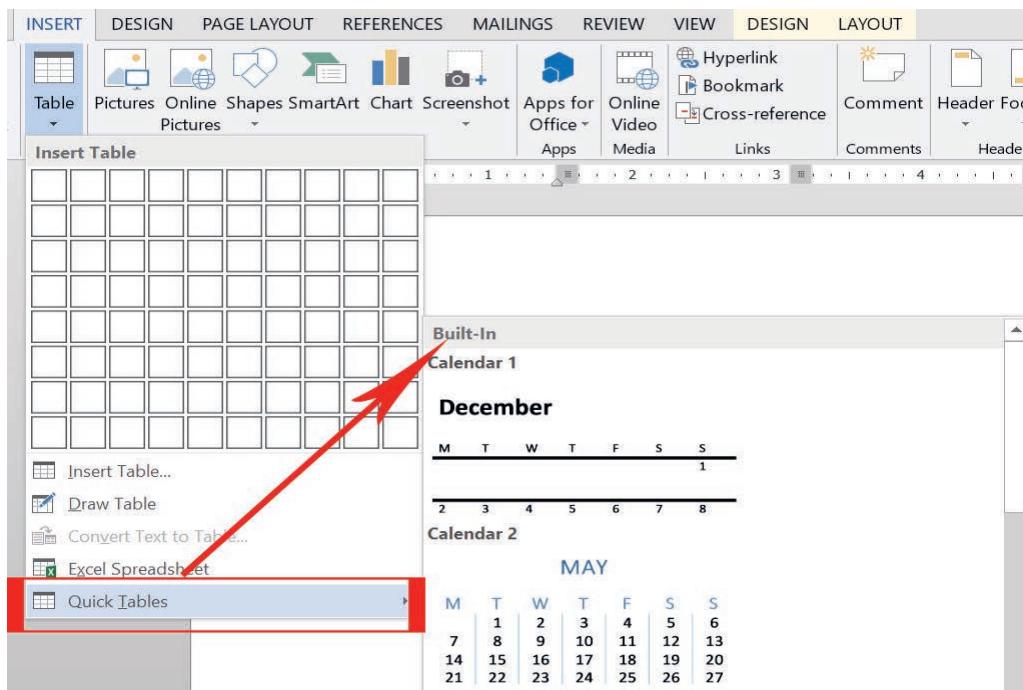


Figure 3.5 Built-in quick table gallery

2. On the menu, just below the rows and columns, select quick tables from the menu. A gallery of built-in quick tables appears, as shown in Figure 3.5.
3. Select Calendar 2. You can edit the data in the calendar to display the current month and year.

4. Save the document as **Table4** in the lesson folder on your drive and then close the file.

Practical Exercise 3.1

Practice drawing a table individually using the following steps.

1. Open MS word document.
2. Draw a table having 15 rows and 7 columns.
3. Insert a new row between rows 3 and row 4.
4. Insert a new column between columns 2 and column 3.
5. Delete row 1 and column 6.
6. Save your file by the name **Draw Table**.

3.2.2 Formatting a Table

Once you have inserted a table into a document, you can apply a preformatted style using the table styles gallery. These styles add a professional appearance to the tables in your documents. In the table tools, design tab, in the borders group, you can manually format a table's borders. The borders group enables you to draw and apply styles to the table.

a. Applying a Style to a Table

With table styles, it is easy to change a table's formatting quickly. You can apply styles to tables in the same way you learned to apply styles to text in previous lessons, i.e. by positioning the insertion point in a table and selecting a style from the table styles gallery. You can preview the style before applying it and change the style as many times as needed. You can modify an existing table style or create a new table style and add it to the gallery and then modify or delete it, as appropriate. In this exercise, you apply a table style to a table in your Word document. Follow the steps below to apply styles to a table.

1. Position the insertion point anywhere in the table.
2. On the table tools design tab, in the table styles group, click **More buttons** to view a gallery of table styles. There are three options available: **plain tables**, **grid tables** and **list tables**.

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3. Scroll down to the third row under the grid tables and select the **grid table 3, accent 3** styles, as shown in Figure 3.6.
4. Save the document as **Clients Table 5** in the lesson folder on your drive.

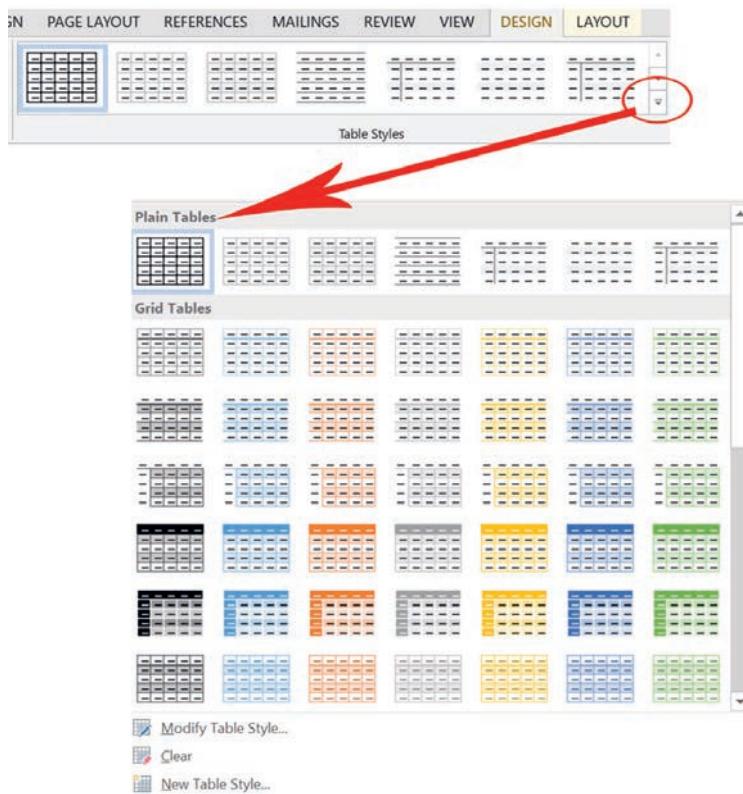


Figure 3.6 Table styles gallery

b. Resizing Rows and Columns

Word offers several tools for resizing rows or columns. You can resize a column or a row using the mouse or the commands on the **ribbon**. You can use commands in the cell size group on the table tools, layout tab to adjust height and width or ruler to adjust the column width. In addition, the table properties dialog box enables you to set the measurements at a precise height for rows or an ideal width for columns, cells and tables.

Practice how to resize rows and columns in a word table using the following steps. Use the document that is open from the previous exercise.

1. Click in the first column and position the mouse pointer over the horizontal ruler on the first column marker (see Figure 3.7). The pointer changes to a double-headed arrow () along with the screen tip move table column.
2. Click and drag the column marker to the right, just until the contents in the first column fit in a single line. On the table tools, layout tab, in the cell

size group, the width automatically adjusts to 2.19''. Just as columns can be adjusted manually, so can rows; you use the vertical ruler to adjust the row markers.

3. Position the insertion point in the phone number column of the table. On the table tools, layout tab, in the Table group, click Select button and choose Select Column from the drop-down menu.
4. On the table tools, layout tab, in the cell size group, click Up Arrow in the width box until it reads 1.1'' and the column width changes. The phone numbers now fit on a single line.

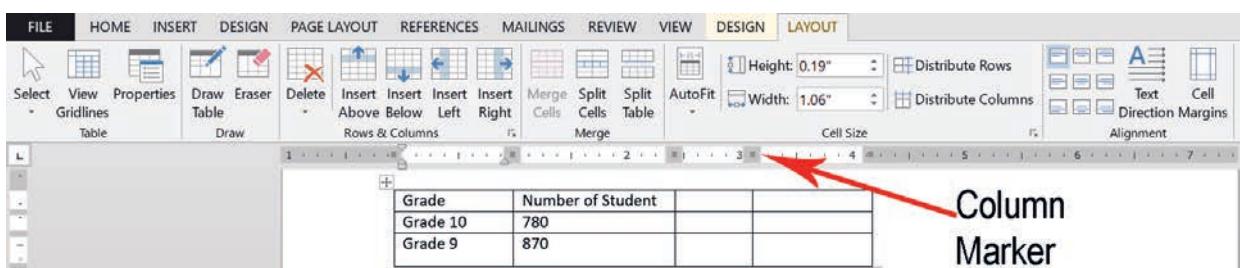


Figure 3.7 Horizontal ruler on the first column marker

5. Place the insertion point anywhere in the first row. In the table group, click the select button again, and then click Select Row from the drop-down menu. The first row is selected.
6. On the table tools layout tab, in the cell size group, click the dialog box launcher. The table properties dialog box appears.
7. Click the row tab in the dialog box.
8. Select the specific height checkbox. In the height box, click the up arrow until the box reads 0.5''.
9. Click the next row button and notice that the changes are applied only to the first row. By clicking the next row button, the selection moves down one row.
10. Click Ok. In the cell size group, notice that the height for row 2 is 0.14'' and row 1 is 0.29''. You can also adjust the height of a row individually or by selection.
11. Click in any cell to remove the selection.
12. Save the document as **Client Table 6** in the lesson folder on your flash drive.

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c. Inserting Rows and Columns

Insert control feature

The insert control feature utilizes an interface we noticed when we were in the process of selecting various sections of the table. The tool will appear when pointing to the left or top border of the table and in the general vicinity between two rows or two columns. Figure 3.8 shows the Insert control feature. As opposed to other insertion methods, this tool facilitates an insertion without having to select any particular portion of the table. When the tool is completely in focus, it will turn from grey to blue and can then be clicked to perform an insertion. It will insert a row below the insert control tool or a column to the right of it.

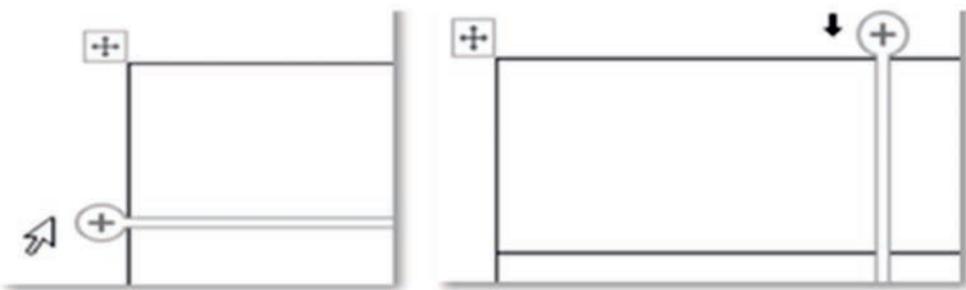


Figure 3.8 Insert control feature

We follow the steps below to insert rows and columns.

1. Point to the left border of the table and move your mouse until you see the blue insert control tool on the border between the first and second rows. Click the +. Note it inserts a row below the first row. Click Undo.
2. Point to the top border of the table and move your mouse until you see the blue insert control tool on the border between the first and second column and click the +. Note it inserts a column to the right of the first column. Click Undo.

Practical Exercise 3.2

Practice the following exercise in a group.

1. Open word document and insert table using any of the table insertion methods.
2. Insert days of a week (starting from Monday) in the first raw of the table.

3. Use automatic insert provided.
4. Observe the difference when you input manually.

d. Deleting Rows and Columns

Both the ribbon and the right-click menu have tools to delete rows and columns. The ribbon tool, named delete, can be accessed when the insertion point is in a cell in the row or the column to be deleted. The right-click menu offers a specific delete button when the row or the column is selected first.

Right-click menu

1. Insert table, as shown in Figure 3.1, and select the row with the Wednesday cell in it.
2. Maintain cursor focus on the selected row and right-click.
3. Click Delete Rows. Note the deletion. Click Undo.

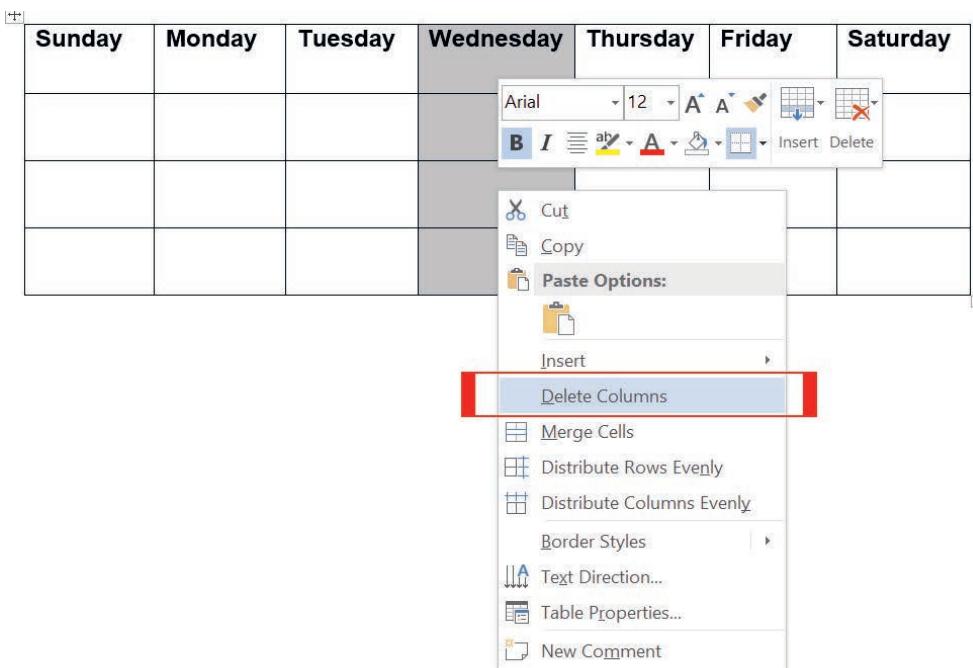


Figure 3.9 Delete rows

4. Select the column with the Wednesday cell in it.
5. Maintain cursor focus on the selected column and right-click.
6. Click Delete Columns. Note the deletion. Click Undo.

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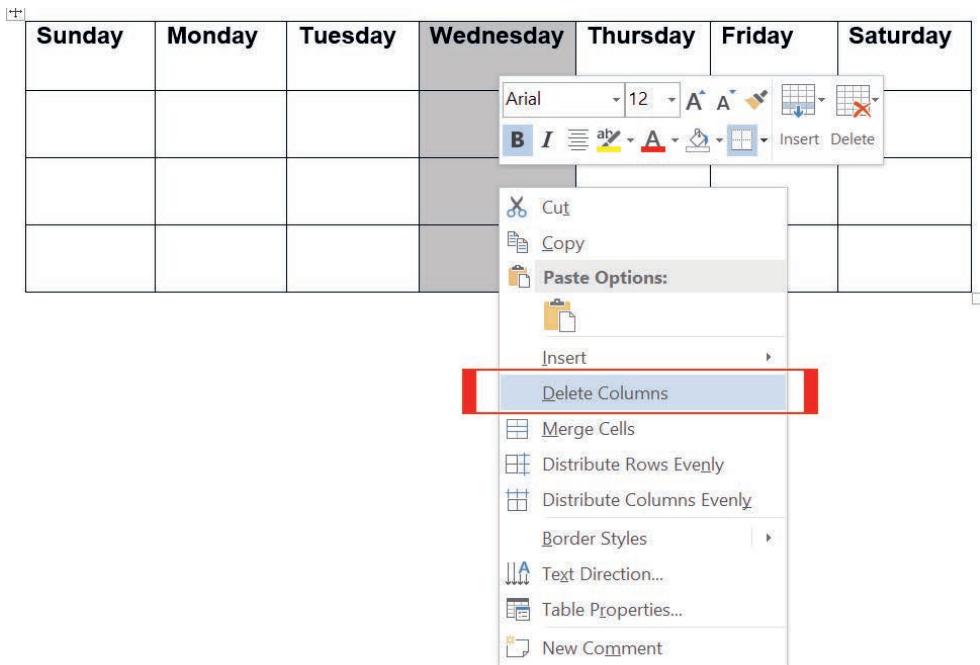


Figure 3.10 Delete columns

Practical Exercise 3.3

Do the following exercise in a group.

1. Open a blank word document and create a table as shown in Figure 3.11 below; maintain out fill to complete days and months.
2. Insert row March and delete column Friday, then observe the change.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
September							
October							
November							
January							
February							

Figure 3.11 Format table

3. Create your table and insert any data you like and demonstrate it to your class.
4. Save it by your name and into your flash drive.

5. To resize your table, see Figure 3.12 below, locate the small square at the bottom right of the table. This is a resize handle. Point to it and notice that the pointer changes to a white arrow with two ends.

Wednesday	Thursday	Friday	Saturday

Figure 3.12 Resize the table

6. Click and drag towards the center of the table and resize it to raw 12 and column 9.

3.2.3 Inserting Pictures, Clip arts and Shapes

Word offers several tools to help you capture your readers' attention with illustrations that include pictures, shapes, SmartArt, charts and screenshots. You can modify images in several ways including converting them to SmartArt, adding **captions**, resizing, cropping what you do not need, rotating, applying styles and colors, creating artistic effects and positioning images within the document.

a. Inserting Pictures

When you insert a picture into a document, MS Word marks it as an **embedded object** by default, which means it becomes part of the document and is no longer connected to the original image. Inserting a picture is very similar to opening a document file. You use the pictures button on the Insert tab in the Illustrations group to open images instead of opening backstage. The following steps demonstrate inserting pictures.

Steps to insert pictures

1. Open a new blank document and type **Green Legacy** on a blank page.
2. Select the text; then right-click it to display the **Mini toolbar**.
3. Change the font of the title to **Cambria** and the font size to **28-point, bold**,

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green color, and align center.

4. Center horizontally; then deselect the text.
5. Press **Enter**.
6. Click the Insert tab, and then click the pictures button in the illustrations group. The insert picture dialog box appears.
7. Locate your lesson folder on your flash drive and select the image you like
8. Click Insert.

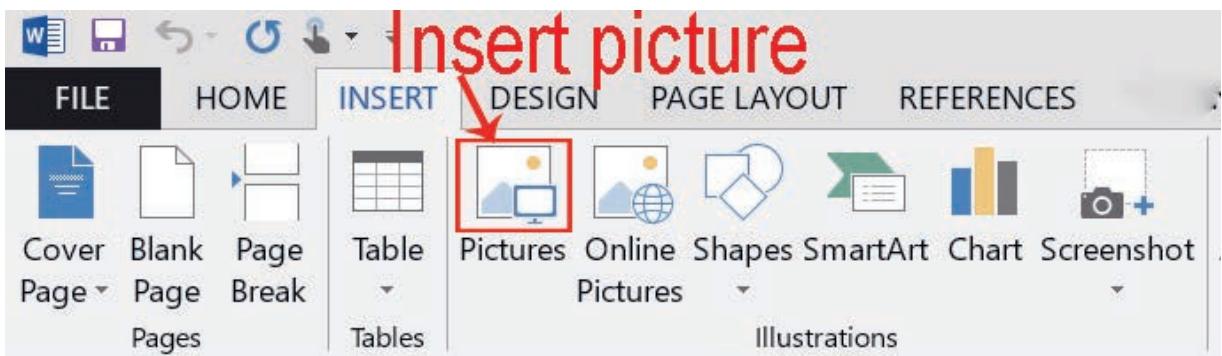


Figure 3.13 Insert picture

9. Insert caption as shown in Figure 3.13 above.
10. The picture appears in the document at the cursor location and the Format tab appears with the picture tools command groups.
11. Save the document as Ethiopian Green Legacy in the lesson folder on your flash drive.

Similarly, you can insert pictures shapes, smart arts, charts and screenshots from online following the steps. In the following section, we will learn how to insert screenshots.

b. Inserting Screenshots

In addition to inserting images from existing picture files, Word also enables you to capture images of all or part of the current screen display and insert them directly into your documents. When you click the Screenshot button in the Illustrations group on the Insert tab, a menu containing thumbnails of the computer's currently open windows appears. Selecting a thumbnail inserts an image of that window or you can select Screen Clipping which enables you to draw a box and capture an image of its contents.

Steps to insert a screenshot

1. Open a new blank document.
2. On a blank page, type **Athlete Haile G/Silase**.
3. Select the text then right-click it to display the **mini toolbar**.
4. Change the font of the title to **Cambria** and the font size to **28 points and bold**.
5. Center horizontally; then deselect the text and press enter.
6. Locate your lesson folder on your flash drive and double-click any folder containing photos. A photos window appears, displaying the image in the file.
7. Switch to the word window, click the Insert tab and then click the screenshot button in the illustrations group. The screenshot menu appears.
8. On the screenshot menu, select screen clipping. The photos window appears, with a gray cast over the entire screen. The pointer changes to a **cross**.
9. Use the point to draw a rectangle around the photograph in the photo's window. When you release the mouse button, the selected photo is pasted into the word document.
10. Save the document as an **Athlete** in the lesson folder on your flash drive and close the document.

c. Inserting Clip Arts

Clip Art can help in making a document look colorful and presentable. Clip arts are pre-defined images available for use in documents. For example, if you would like to create a greeting card for your friend, you can use clip arts such as balloons, flowers and much more along with text messages. You can also download clipart from websites. Depending on which version of office you have, you may be able to use an office library of clip art or get clip art from the web.

Steps to insert clip art in a document

1. Click Insert tab on the ribbon.
2. Click Option Clip Art in the illustrations group.

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3. The clip art task pane appears. Enter the clipart category name in the search box and click Go.
4. Select the clipart that you want to use, double-click on it and it will be inserted into your document
5. Select Insert online pictures.
6. Type a word or phrase to describe what you are looking for and then press enter.
7. Filter the results by type for clipart.



Figure 3.14 Example of online Picture

8. Select a picture.
9. Select Insert.
10. Save the document as **Practice**.

d. Inserting Shapes

Microsoft word allows you to insert various shapes into your document. For example, you could place a circle around important information in a document. If you use the word to create marketing flyers, newsletters or other types of publications, you may want to insert various types of shapes to add visual interest to your documents.

Steps to insert a shape into your document

1. Click Insert tab in the ribbon and then click Shapes button in the Illustrations group.

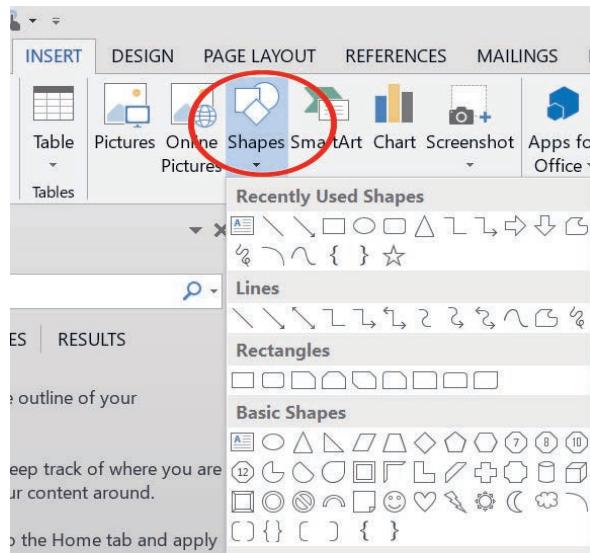


Figure 3.15 Insert tab

2. Roll your mouse pointer over the shape that you want to insert and then click it to select it.

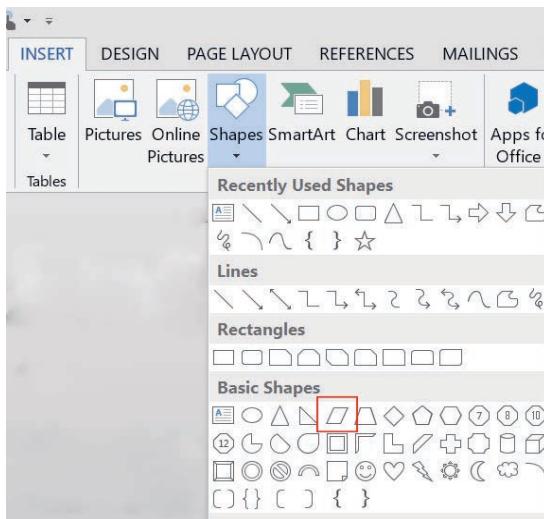


Figure 3.16 Shapes options

3. Your mouse pointer will appear as a black cross-hair when you place it back over the document. Decide where you want the graphic to appear in your document and then click and drag across the area in the document where you want the object to appear. The object will then be inserted into your document.

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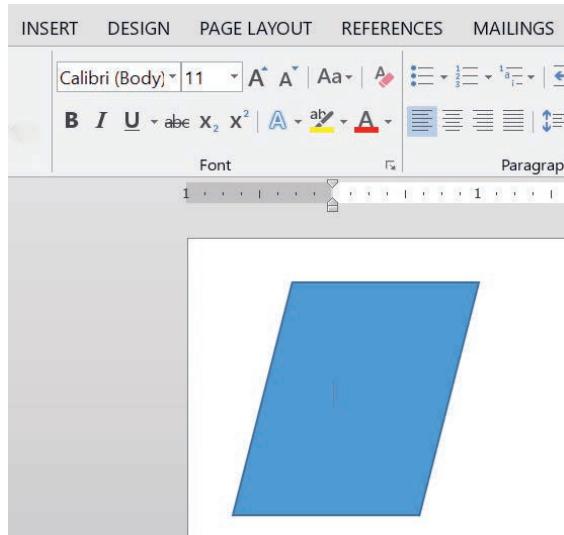


Figure 3.17 Selected shape

4. When drawing the object, you can hold down Shift key as you click and drag while drawing to create a “perfect” version of the selected shape.

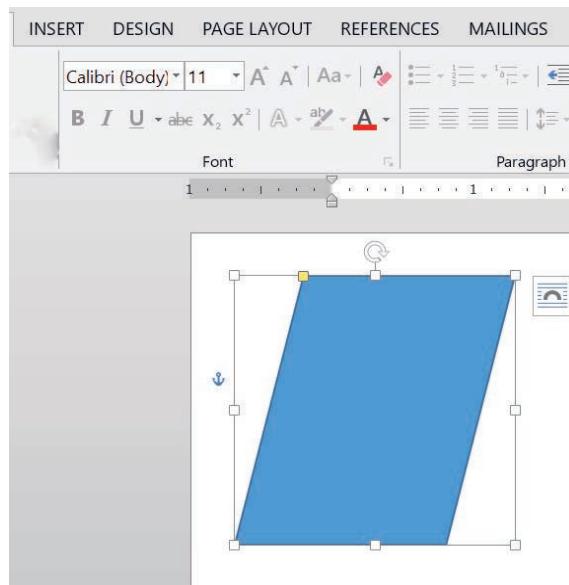


Figure 3.18 Shape resize

5. If you want to lock Word into its drawing mode as you select your desired shape from the Shapes button’s drop-down menu, simply right-click on the shape that you want to draw in the drop-down menu, instead of clicking it. From the pop-up menu that appears, click the **Lock Drawing Mode** command. Now you can return to your document and draw as many instances of the selected shape as you wish. Note that you can cancel the drawing mode lock by simply pressing the Esc key on your key board or by right-clicking on the blank area of the document.

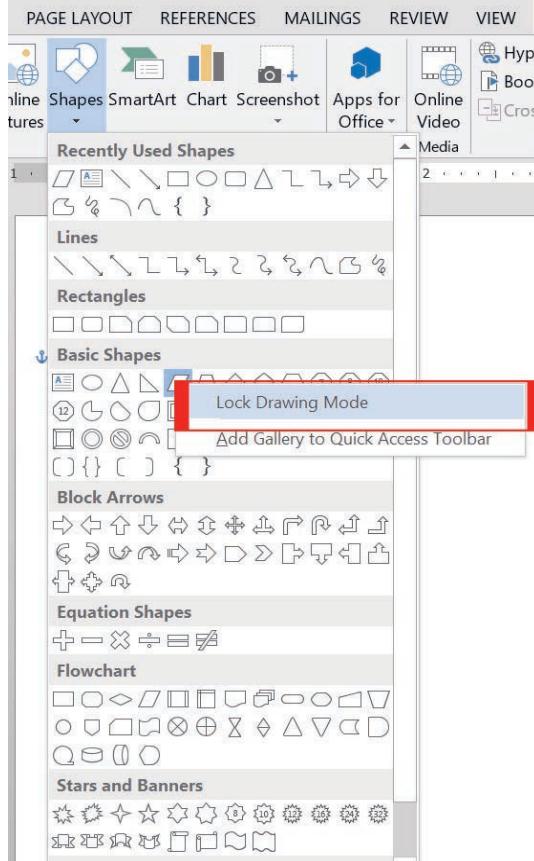


Figure 3.19 Lock Drawing Mode

Practical Exercise 3.4

Answer the following exercises in a group.

1. Open Microsoft word and write two paragraphs about the eagle and its lifestyle. (See Figure 3.14). Furthermore, insert the picture of the eagle from the online library.
2. Use the picture from earlier practice to crop, resize, scale and rotate it.
3. Write a text and arrange it around the picture.
4. Insert some of the shapes in your document.
5. Save the file you have created by the name Eagle on the desktop.

3.2.4 Formatting Page Number

Page numbers can be used to automatically number each page in your document. They come in a wide range of number formats and can be customized to suit your needs. Page numbers are usually placed in the **header, footer, or side margin**.

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When you need to number some pages differently, Word allows you to restart page numbering.

Follow the following logical steps to add page numbers.

1. On the **Insert tab**, click the **page number** command.

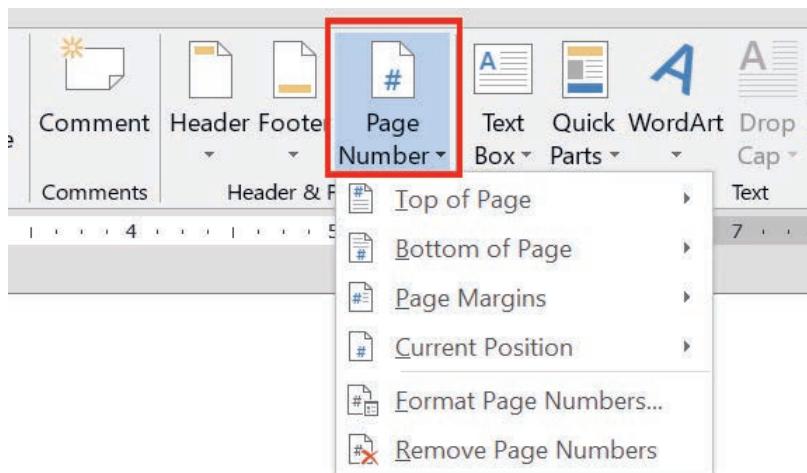


Figure 3.20 Page inserts tab

2. Open the top of the page, the bottom of the page or the page margin menu, depending on where you want the page number to be positioned, and then select the desired style of header.

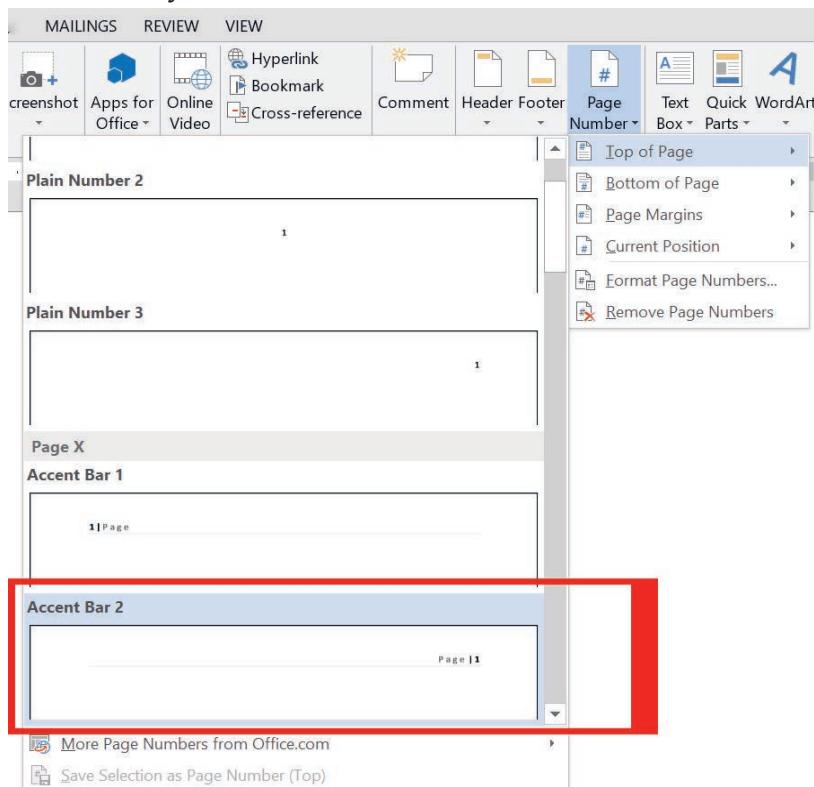


Figure 3.21 Add page numbers

3. Page numbering will appear.

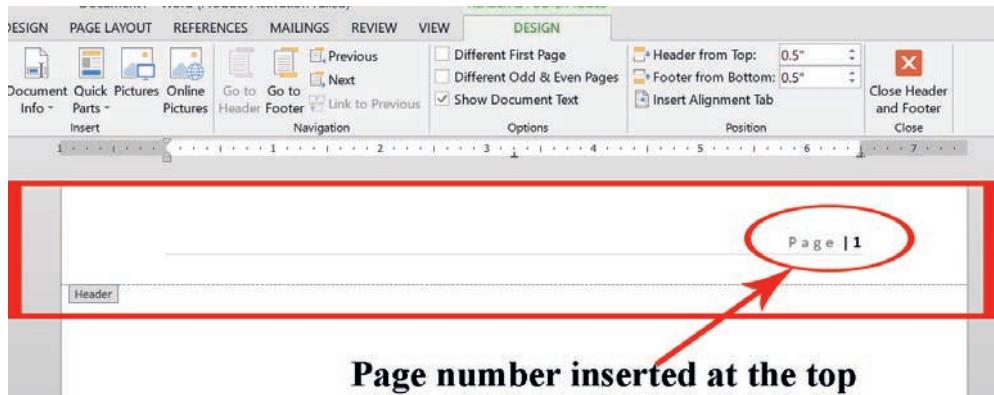


Figure 3.22 Page numbers position

4. Press the Esc key to lock the header and footer.
5. If you need to make any changes to your page numbers, simply double-click the header or footer to unlock it.

Practical Exercise 3.5

Practice formatting page number in a group following the steps below.

1. Open the file by the name “Eagle” you saved in Practical Exercise 3.4.
2. Insert page numbers, header, and footer to your file.
3. Hide the page number on the first page.
4. Save the file to keep the changes you have made.

KEY CONCEPTS

- ✍ **Microsoft Word** is a word processing application that allows you to create a variety of documents including letters and resumes.
- ✍ A **table** is the arrangement of data made up of horizontal rows and vertical columns. The intersection of a row and column is called a cell.
- ✍ **Quick Tables** are built-in preformatted tables such as calendars and tabular lists which you can insert and use in your documents.
- ✍ **Clip Arts** are pre-defined images available for use in documents.
- ✍ **Picture tools** format tab appears whenever you insert a picture into a document or select an existing picture within the document.

3.3 Spreadsheet

Brainstorming

1. What do you think spreadsheet programs are used for?
2. Can you observe different functions of spreadsheet programs from word processing?

A spreadsheet or worksheet is a file made of rows and columns that is used to sort, organize and arrange data efficiently, and calculate numerical data. What makes a spreadsheet software program unique is its ability to calculate values using mathematical formulas and the data in cells.

Today, Microsoft Excel is the most popular and widely used spreadsheet program, but there are also many alternatives. For accessibility, we are using Microsoft Excel to create a spreadsheet. Figure 3.23 shows Microsoft Excel window.

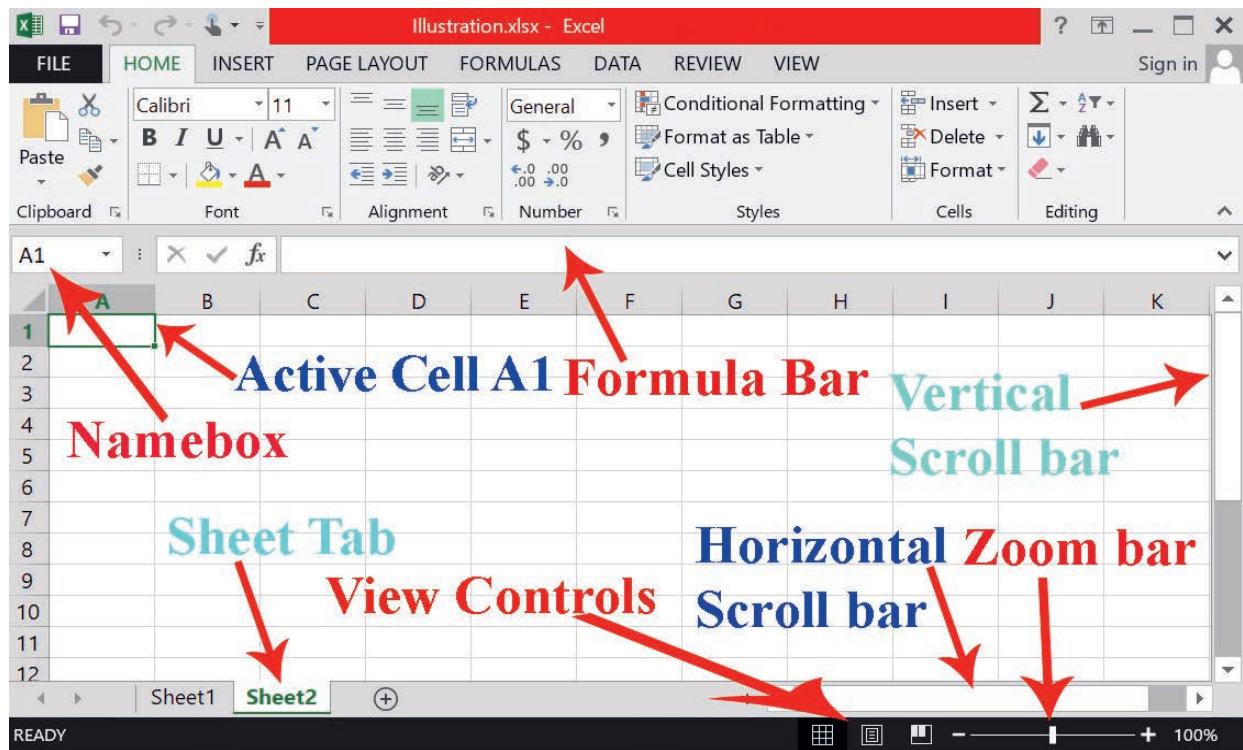


Figure 3.23 Microsoft excel window

Each cell may contain either numeric or text data or the results of formulas that automatically calculate and display a value based on the contents of other cells.

A spreadsheet may also refer to a program that displays data (text and numbers) in a table called a **worksheet**.

3.3.1 Understanding and Displaying Formulas

The real strength of Excel is its capability to perform common and complex calculations. The formula is one of the essential elements of Excel which enables you to add, subtract, multiply and divide numbers. 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 as you double-click the cell to edit it or use the Formulas tab.

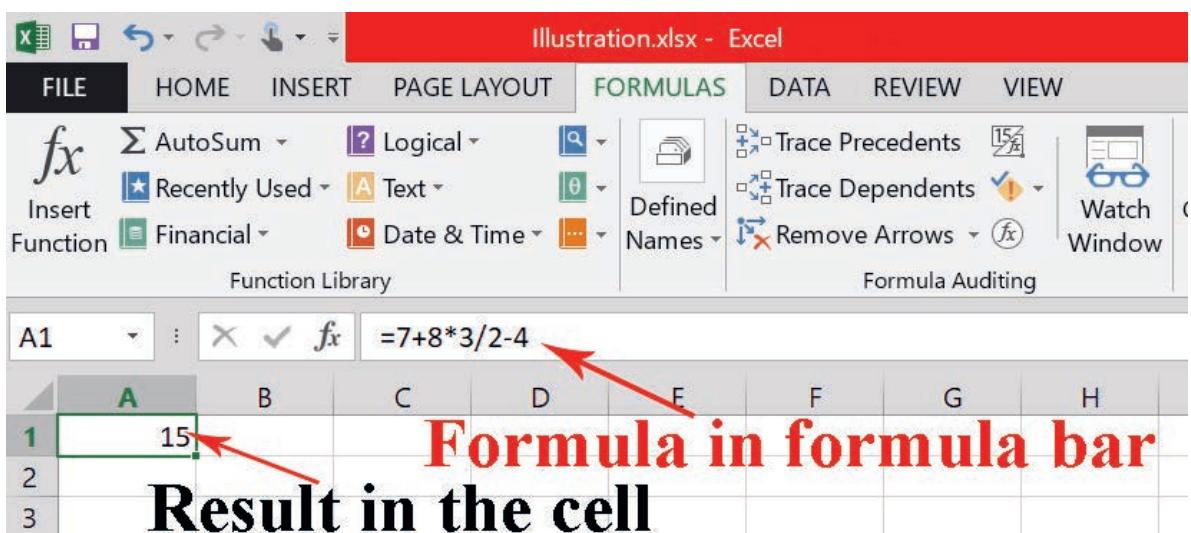


Figure 3.24 Viewing a formula in the formula bar

Just like a calculator, Excel can add, subtract, multiply and divide. In this lesson, you will learn how complex formulas are used in Excel.

A simple formula is a mathematical expression with one operator, such as $7+9$. A **complex formula** has more than one mathematical operator, such as $5 + 2 * 8$. When there is more than one operation in a formula, the **order of operations** tells Excel which operation to calculate first. To use Excel to calculate complex formulas, you will need to understand the order of operations.

Order of operations

Excel calculates formulas based on the following order of operations:

- Operations enclosed in parentheses.
- Exponential calculations (3^2 , for example).

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- Multiplication and division whichever comes first.
- Addition and subtraction whichever comes first.

3.3.2 Functions

A **function** is a **predefined formula** that performs calculations using specific values in a particular order. Excel includes many common functions that can be useful for quickly finding the **sum**, **average**, **count**, **maximum value** and **minimum value** for a range of cells. To use functions correctly, you will need to understand the different parts of a function and how to create arguments to calculate values and cells.

Formula =A1+A2+A3+A4+A5+A6+A7+A8

Function =SUM(A1:A8)

Parts of a function

To work correctly, a function must be written in a specific way, which is called **syntax**. The basic syntax for a function is an **equal sign** (=), the function name (SUM, for Example) and one or more **arguments**. Arguments contain the information you want to calculate.

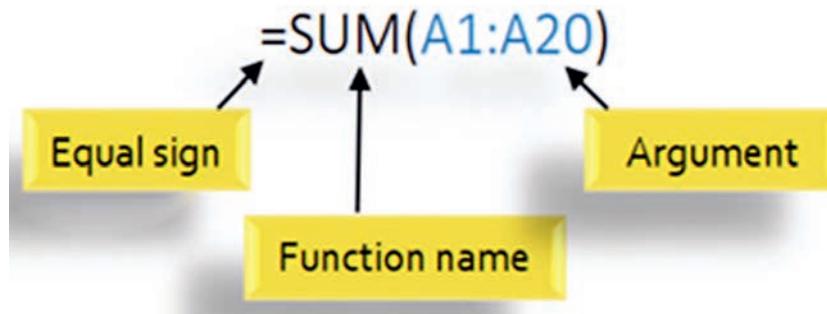


Figure 3.25 Parts of a function

Working with arguments

Arguments can refer to both **individual cells** and **cell ranges**, and must be enclosed within **parentheses**. You can include one argument or multiple arguments depending on the syntax required for the function.

For example, the function =AVERAGE (B1:B9) would calculate the average of the values in the cell range B1 to B9. This function contains only one argument.

Function Library		
CON...	X ✓ fx	=AVERAGE(B1:B9)
A	B	C
1	10	
2	20	
3	34	
4	56	
5	65	
6	45	
7	34	
8	55	
9	45	
10	=AVERAGE(B1:B9)	

Figure 3.26 One argument

Multiple arguments must be separated by a **comma**. For example, the function **=SUM(A1:A3, C1:C2, E2)** will **add** the values of all the cells in the three arguments. Figure 3.27 shows multiple arguments.

Function Library		
A5	X ✓ fx	=SUM(A1:A3,C1:C2,E1)
A	B	C
1	34	65
2	21	23
3	56	
4		
5	=SUM(A1:A3,C1:C2,E1)	6
6		
7		

Figure 3.27 Multiple arguments

Creating a function

Excel has a variety of functions available. Here are some of the most common functions you will use:

- **SUM:** This function adds all of the values of the cells in the argument.
- **AVERAGE:** This function determines the average of the values included in the argument. It calculates the sum of the cells and then divides that value by the number of cells in the argument.

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- **COUNT:** This function counts the number of cells with numerical data in the argument. This function is useful for quickly counting items in a cell range.
- **MAX:** This function determines the highest cell value included in the argument.
- **MIN:** This function determines the lowest cell value included in the argument.

Creating a basic function

In our example, Figure 3.28 below, we will create a basic function to calculate the **average price per unit** for a list of recently ordered items using the **AVERAGE** function. To do so:

1. Select the **cell** that contains a function.
2. Type an **equal sign (=)** and enter the desired function name. You can also select the desired function from the list of **suggested functions** that will appear below the cell as you type. In our example, we will type **=AVERAGE**.
3. Enter the **cell range** for the **argument inside parentheses**. In our example, we will type **(D3:D12)**.
4. Press **Enter on your keyboard**. The function will be **calculated** and the **result** will appear in the cell.

The screenshot shows a Microsoft Excel spreadsheet titled "Sale Taxes". The data is organized into columns A through E, with headers: Items, Price, Quantity, Total, and Tax. Rows 3 through 12 contain data for ten items. Row 13 is the active cell, containing the formula "=Aver". A dropdown menu is open over the formula, listing four suggested functions: AVERAGE, AVERAGEA, AVERAGEIF, and AVERAGEIFS. The "AVERAGE" option is highlighted. The status bar at the bottom right shows the text "Iter".

A	B	C	D	E	
Sale Taxes					
2	Items	Price	Quantity	Total	Tax
3	Item 1	\$23.0	4	\$92.0	
4	Item 2	\$34.0	5	\$170.0	
5	Item 3	\$45.0	6	\$270.0	
6	Item 4	\$67.0	7	\$469.0	
7	Item 5	\$89.0	9	\$801.0	
8	Item 6	\$90.0	5	\$450.0	
9	Item 7	\$23.0	6	\$138.0	
10	Item 8	\$24.0	4	\$96.0	
11	Item 9	\$45.0	8	\$360.0	
12	Item 10	\$34.0	9	\$306.0	
13	=Aver				
14					
15					
16					

Figure 3.28 Create basic function

Creating a function using the AutoSum command

The **AutoSum** command allows you to automatically insert the most common functions into your formula including **SUM**, **AVERAGE**, **COUNT**, **MIN** and **MAX**. In our example below, we will create a function to calculate the total cost for a list of recently ordered items using the **SUM** function. We follow the steps below for the same.

1. Select the **cell** that contains a function.
2. In the **Editing** group on the **home** tab, locate and select the arrow next to the **AutoSum** command and then choose the desired function from the drop-down menu. In our example, we will select **Sum**.

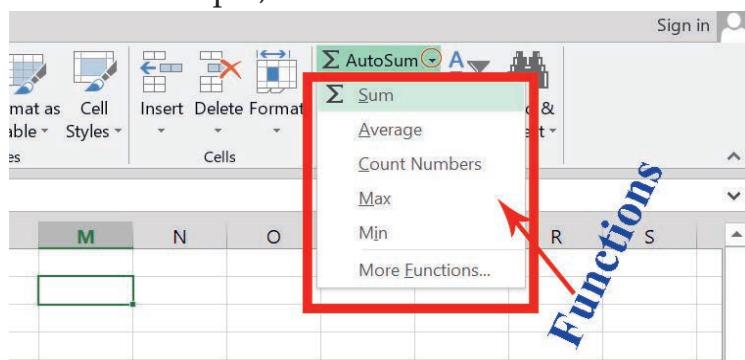


Figure 3.29 Automatic command

3. The selected function will appear in the cell. If logically placed, the AutoSum command will automatically select a cell range for the argument. You can also manually enter the desired cell range into the argument.

	A	B	C	D	E	F
1	Sale Taxes					
2	Items	Price	Quantity	Total	Tax	
3	Item 1	\$23.0	4	\$92.0		
4	Item 2	\$34.0	5	\$170.0		
5	Item 3	\$45.0	6	\$270.0		
6	Item 4	\$67.0	7	\$469.0		
7	Item 5	\$89.0	9	\$801.0		
8	Item 6	\$90.0	5	\$450.0		
9	Item 7	\$23.0	6	\$138.0		
10	Item 8	\$24.0	4	\$96.0		
11	Item 9	\$45.0	8	\$360.0		
12	Item 10	\$34.0	9	\$306.0		
13				=SUM(D3:D12)		
14						

Figure 3.30 Cell range selection

4. Press Enter on your keyboard.

Practical Exercise 3.6

Practice computing with different functions in spreadsheet in a group.

1. Open the blank worksheet and enter data as it is in Table 3.1, and compute sum, average, count, maximum and minimum.

Table 3.1 Students' grade record

Stdents grade Report												
No	Name	RollNo.	Test1	Test2	Test3	Test4	Total	Average	Count	Maximum	Minimum	
1	stu 1		12	12	17	17						
2	stu 2		6	6	16	16						
3	stu 3		15	13	10	10						
4	stu 4		9	11	19	19						
5	stu 5		12	14	17	17						
6	stu 6		12	12	16	16						
7	stu 7		8	8	16	16						
8	stu 8		14	14	18	18						
9	stu 9		15	11	17	17						
10	stu 10		11	11	17	17						
11	stu 11		14	14	17	17						
12	stu 12		15	5	17	17						
13	stu 13		15	15	19	19						
14	stu 14		8	8	16	16						
15	stu 15		9	10	17	17						

2. Format the excel sheet as it is shown above.

3.3.3 Working with Data

Whenever you are working with a lot of data, it can be difficult to **compare** information in your workbook.

a. Freezing Panes and View Options

Excel includes several tools that make it easier to view content from different parts of your workbook at the same time such as the ability to **freeze panes** and **split** your worksheet.

Freezing rows

You may want to see certain rows or columns all the time in your worksheet, especially **header cells**. By **freezing rows or columns** in place, you will be able to scroll through your content while continuing to view the frozen cells. Follow the steps below to freeze rows.

1. Select the **row below** the row(s) you wish to **freeze**.
2. Click the **View tab** on the **Ribbon**.

3. Select the **Freeze Panes** command, and then choose **Freeze Panes** from the drop-down menu.

The screenshot shows the Microsoft Excel ribbon with the 'VIEW' tab selected. In the 'Freeze Panes' section, a red box highlights the 'Freeze Top Row' option, which is described as 'Keep the top row visible while scrolling through the rest of the worksheet.' A red arrow points to this option. The main area of the screen displays a table with 11 rows and 9 columns, with the first row frozen at the top.

	A	B	C	D	E	F	G	H	I
1	Items	Price	Quantity	Total	Tax				
2	Item 1	\$23.0	4	\$92.0					
3	Item 2	\$34.0	5	\$170.0					
4	Item 3	\$45.0	6	\$270.0					
5	Item 4	\$67.0	7	\$469.0					
6	Item 5	\$89.0	9	\$801.0					
7	Item 6	\$90.0	5	\$450.0					
8	Item 7	\$23.0	6	\$138.0					
9	Item 8	\$24.0	4	\$96.0					
10	Item 9	\$45.0	8	\$360.0					
11	Item 10	\$34.0	9	\$306.0					
12				\$3,152.0					

Figure 3.31 Freeze panes

The rows will be **frozen** in place, as indicated by the **gray line**. You can scroll down the worksheet while continuing to view the frozen rows at the top.

Freezing columns

In order to freeze columns, follow the steps below.

1. Select the **column** to the right of the **column(s)** you wish to **freeze**
2. Click the **View tab** on the **Ribbon**.
3. Select the **Freeze Panes** command, and then choose **Freeze Panes** from the drop-down menu.
4. The column will be **frozen** in place, as indicated by the gray line. You can **scroll across** the worksheet while continuing to view the frozen column on the left.

If you want to **unfreeze rows or columns**, click the **Freeze Panes** command, then select **Unfreeze Panes** from the drop-down menu.

Splitting a worksheet

Sometimes you may want to compare different sections of the same workbook without creating a new window. The **Split** command allows you to **divide** the worksheet into multiple panes that scroll separately. To split a worksheet, follow the steps below.

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1. Select the **cell** where you wish to split the worksheet.
2. Click the **View tab** on the **Ribbon**, and then select the **Split** command.

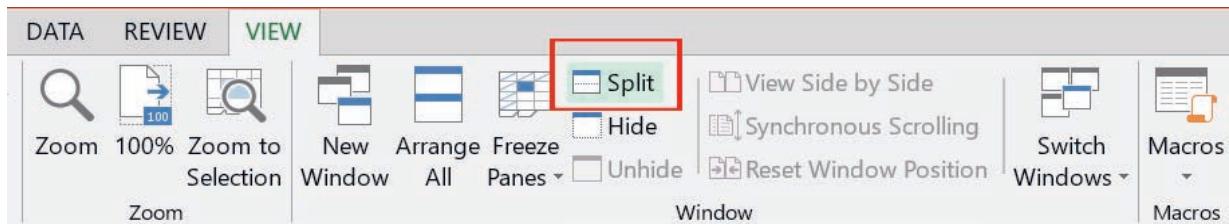


Figure 3.32 Split worksheet

3. The workbook will be split into different panes. You can scroll through each pane separately using the scroll bars, allowing you to compare different sections of the workbook.
4. To remove the split, click the Split command again.

Practical Exercise 3.7

Practice freezing and splitting in a group.

1. Open an existing Excel worksheet.
2. Try freezing a row or column in place.
3. Use the Split command to split your worksheet into multiple panes.

b. Sorting Data

As you add more content to a worksheet, organizing that information becomes especially important. You can quickly **reorganize** a worksheet by **sorting** your data. For example, you could organize a list of contact information by the last name. Content can be sorted alphabetically, numerically and in many other ways. When **sorting data**, it is important to first decide if you would like the sort to apply to the entire worksheet or just a **cell range**.

- **Sort sheet** organizes all of the data in your worksheet by one column.
- **Sort range** sorts the data in a range of cells which can be helpful when working with a sheet that contains several tables. Sorting a range will not affect other content on the worksheet.

Sorting a sheet

Sorting data in Excel helps the user to understand and visualize data more effectively, facilitates investigation of data, aids the process of searching, organizing and formatting data and ultimately, helps in making efficient decisions. You can sort data by text (A to Z or Z to A), numbers (smallest to largest or largest to smallest) and dates and times (oldest to newest and newest to oldest) in one or more columns. You can also sort using a custom list you create (such as A, C, and B) or by the format of cells which can be done on the basis of cell color, font color or cell icon.

In Figure 3.33, we will sort a **student's grade report** form alphabetically by **First Name (column C)**. In order to sort, you need to select a **cell** in the column you wish to sort by. In our example, we will select cell **C2** and let us follow other steps.

The screenshot shows a Microsoft Excel spreadsheet titled "221680". The data consists of 13 rows and 7 columns, with headers from row 1. Row 1 contains the column labels: A (empty), B (IDNo.), C (First Name), D (Last Name), E (Assignment(20%)), F (Mid_Exam(20%)), and G (Literature_Review(20%)). Rows 2 through 13 contain student records. A "Sort" dialog box is open over the spreadsheet. The "Sort On" dropdown is set to "Values" and the "Order" dropdown is set to "A to Z". The "Column" dropdown is set to "Sort by". A list of columns is displayed in a dropdown menu, with "First Name" highlighted with a red box. The "My data has headers" checkbox is checked. At the bottom of the dialog box are "OK" and "Cancel" buttons.

Figure 3.33 Sort data

1. Select the Data tab on the Ribbon, and then click the Ascending command to sort A to Z or the Descending command to sort Z to A. In our example, we will click Ascending command.

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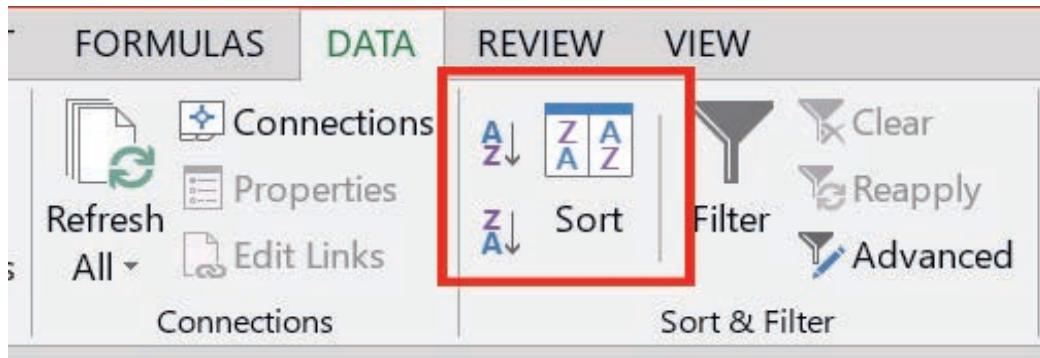


Figure 3.34 Data Sort and Filter group

2. The worksheet will be sorted by the selected column. In our example, the worksheet is now sorted by the first name.

	F17	A	B	C	D	E	F	G
1	#	IDNo.	First Name	Last Name	Assignment(20%)	Mid_Exam(20%)	Literature_Review(20%)	
2	295875	IHWMIT-56461-14	Abiyot	Lankamo	14	16	0	
3	295981	IHWMIT-72694-14	Adanech	Aschalew	15	19	0	
4	259749	IHWMIT-78650-14	Dejen	Getchew	15	18	0	
5	315100	IHWMIT-25649-14	Dereje	Yohannis	14	10	0	
6	360480	IHWMIT-62615-14	Emnet	Endrias	14	14	0	
7	221680	IHWMIT-29225-14	Firaol	Tola	16	18	0	
8	295887	IHWMIT-90365-14	Kiros	Habtom	16	18	0	
9	282770	IHWMIT-77999-14	Masresha	Abate	17	18	0	
10	360487	IHWMIT-82218-14	Petros	Tsegaye	14	11	0	
11	287761	IHWMIT-89418-14	Surafel	Tute	15	11	0	
12	288804	IHWMIT-35976-14	Yakob	Balcha	17	16	0	
13	363628	IHWMIT-91666-14	Zekarias	Kassa	17	12	0	

Figure 3.35 Sorted worksheet

c. Filtering Data

If your worksheet contains a lot of contents, it can be difficult to find information quickly. Filters can be used to **narrow down** the data in your worksheet, allowing you to view only the information you need. Figure 3.36 shows data filtering.

To filter data:

1. For filtering to work correctly, your worksheet should include a **header row** which is used to identify the name of each column.
2. Select the **Data tab**, and then click the **Filter** command.

#	IDNo.	First Name	Last Name	Assignment(20%)	Mid_Exam(20%)	Literature_Review(20%)
295875	IHWMIT-56461-14	Abiyot	Lankamo	14	16	0
295981	IHWMIT-72694-14	Adanech	Aschalew	15	19	0
259749	IHWMIT-78650-14	Dejen	Getchew	15	18	0
315100	IHWMIT-25649-14	Dereje	Yohannis	14	10	0
360480	IHWMIT-62615-14	Emnet	Endrias	14	14	0
221680	IHWMIT-29225-14	Firaol	Tola	16	18	0
295887	IHWMIT-90365-14	Kiros	Habtom	16	18	0
282770	IHWMIT-77999-14	Masresha	Abate	17	18	0
360487	IHWMIT-82218-14	Petros	Tsegaye	14	11	0
287761	IHWMIT-89418-14	Surafel	Tute	15	11	0
288804	IHWMIT-35976-14	Yakob	Balcha	17	16	0
363628	IHWMIT-91666-14	Zekarias	Kassa	17	12	0

Figure 3.36 Filter data

3. A drop-down arrow will appear in the header cell for each column.
4. Click the drop-down arrow for the column you wish to filter.
5. The filter menu will appear.
6. Uncheck the box next to Select All to quickly deselect all data.
7. Check the boxes next to the data you wish to filter, and then click Ok.

To **remove** all filters from your worksheet, click the **Filter command** on the Data tab.

3.3.4 Working with Charts

A chart is a powerful tool that allows you to visually display data in a variety of different chart formats such as bar, column, pie, line, area, scatter, surface or radar charts. With Excel, it is easy to create a chart.

Creating a chart in Microsoft Office Excel is quick and easy. Excel provides a variety of **chart types** that you can choose from when you create a chart. Excel offers **pie, line, bar and column charts**, to name a few. Showing data in a chart can make it clearer, more interesting and easier to read. Charts can also help you evaluate your data and make comparisons between different values. Figure 3.37 shows how to insert a chart.

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To insert a chart:

1. Select the cells you want to insert chart, including the column titles and row labels. These cells will be the source data for the chart.
2. From the **Insert tab**, click the desired Chart command.
3. Choose the desired chart type from the drop-down menu.

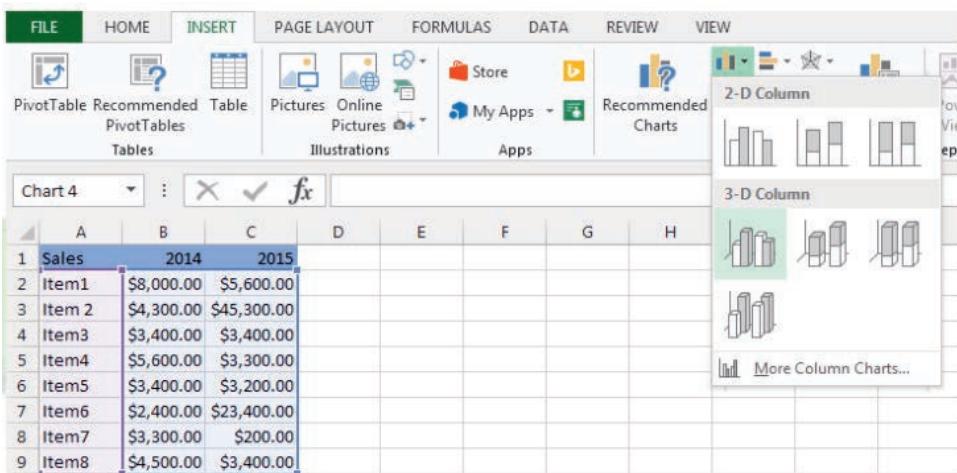


Figure 3.37 Insert chart

4. The selected chart will be inserted into the worksheet.

NOTE If you are not sure which type of chart to use, the recommended charts command will suggest several different charts based on the source data. See Figure 3.38.

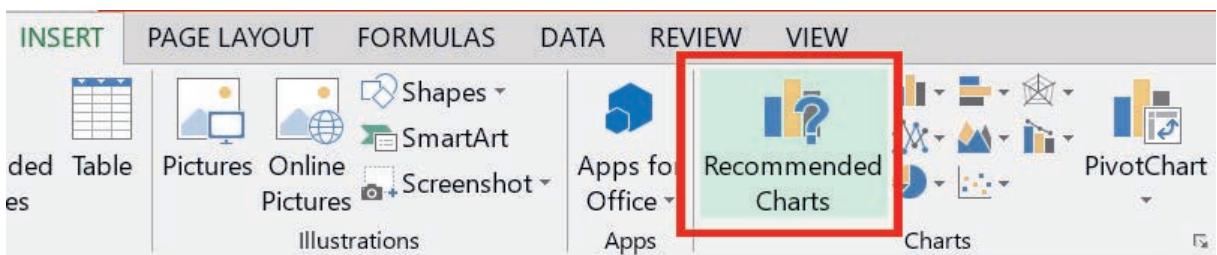


Figure 3.38 Recommended chart

Chart layout and style

After inserting a chart, there are several things you may want to change about the way your data is displayed. It is easy to edit a chart's layout and **style** from the **Design tab**. Figure 3.39 shows chart elements.

Excel allows you to add **chart elements** such as chart titles, legends and data labels to make your chart easier to read. To add a chart element, click the **Add Chart Element** command on the **Design** tab; then choose the desired element from the drop-down menu.

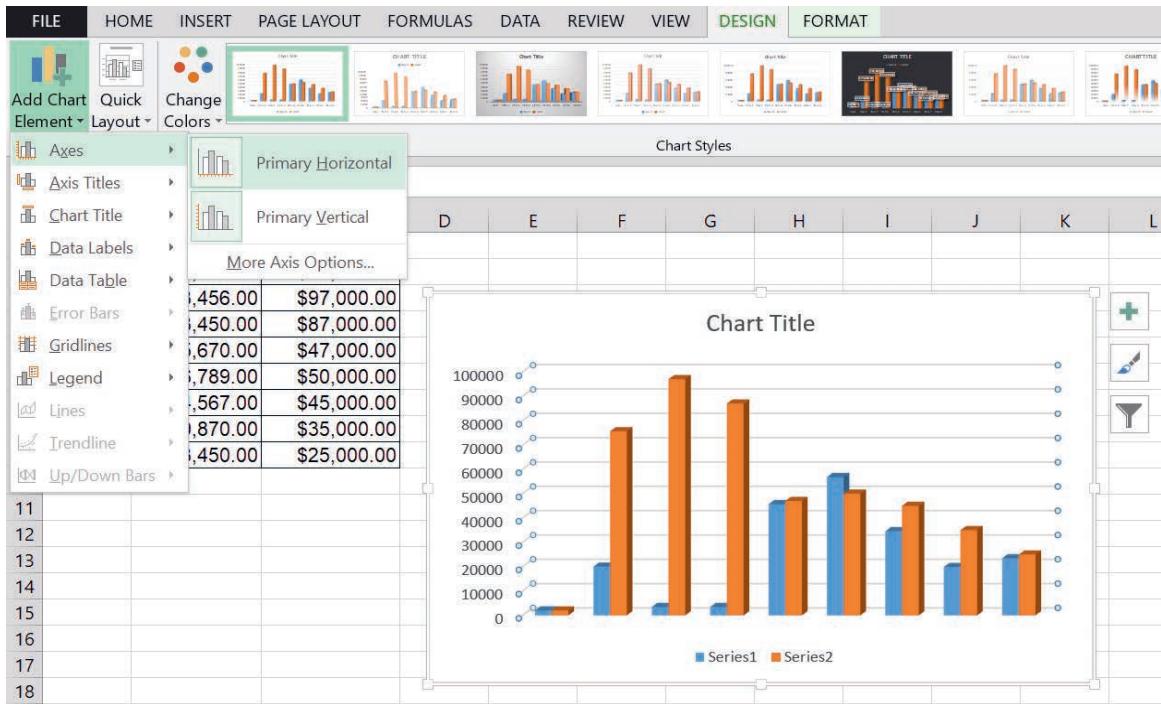


Figure 3.39 Add chart

- To edit a chart element, like a chart title, simply double-click the placeholder and begin typing.

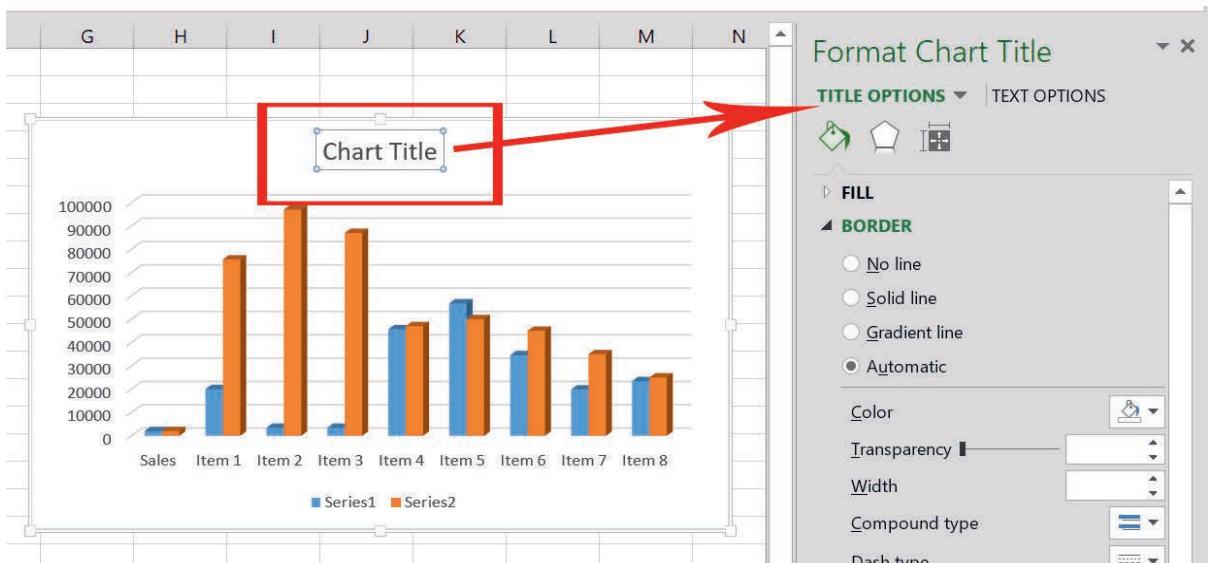


Figure 3.40 Edit chart element

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- If you do not want to add chart elements individually, you can use one of Excel's predefined layouts. Simply click the Quick Layout command, and then choose the desired layout from the drop-down menu.



Figure 3.41 Chart styles

- Excel also includes several different chart styles which allow you to modify the look and feel of your chart quickly. To change the chart style, select the desired style from the Chart styles group.



Figure 3.42 Edited chart

Practical Exercise 3.8

Open Excel's spread sheet and practice the following in a group.

- Create a pie chart or line chart.
- Change the chart layout as you like.
- Rewrite chart title as *Student Grade Record*.

3.3.5 Applying Different Effects to a Cell (Formatting a Cell)

All cell contents use the same **formatting** by default which can make it difficult to read a workbook with a lot of information. Basic formatting can customize the **look and feel** of your workbook, allowing you to draw attention to specific sections and making your content easier to view and understand. You can also apply **number formatting** to tell excel exactly what type of data you are using in the workbook such as percentages (%), currency (\$) and so on.

a. Font Formatting

By default, the font of each new workbook is set to Calibri. However, Excel provides a variety of other fonts you can use to customize your cell text. In the example below, we will format our title cell to help distinguish it from the rest of the worksheet.

1. Select the **cell(s)** you wish to modify.
2. Click the **drop-down arrow** next to the **font** command on the **home tab**. The **font drop-down** menu will appear.
3. Select the desired font. A live preview of the new font will appear as you hover the mouse over different options.

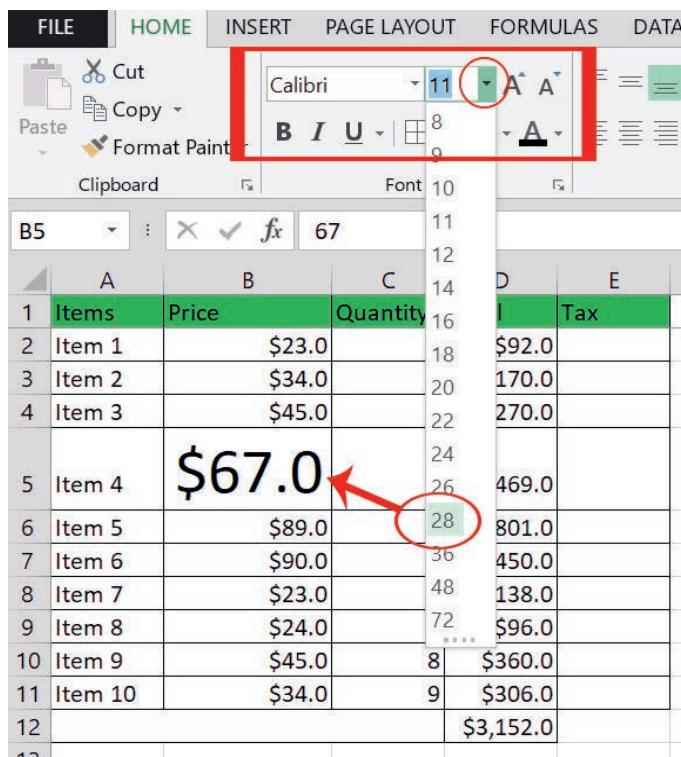


Figure 3.43 font options

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4. The text will change to the selected font.

To change the font size:

1. Select the **cell(s)** you wish to modify.
2. Click the **drop-down arrow** next to the **font size** command on the **home tab**.
The **font size** dropdown menu will appear.
3. Select the **desired font size**. A **live preview** of the new font size will appear as you hover the mouse over different options.
4. The text will change to the **selected font size**.

NOTE You can also use Increase Font Size and Decrease Font Size commands or enter a custom font size using your keyboard.

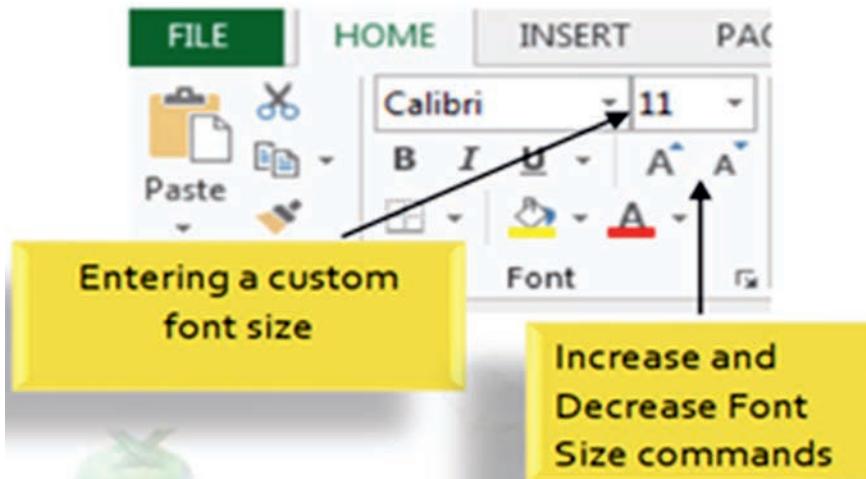


Figure 3.44 Increase Font Size

To change the font color:

1. Select the **cell(s)** you wish to modify.
2. Click the **drop-down arrow** next to the **Font Color** command on the **home tab**. The **Color menu** will appear.
3. Select the **desired font color**. A **live preview** of the new font color will appear as you hover the mouse over different options.

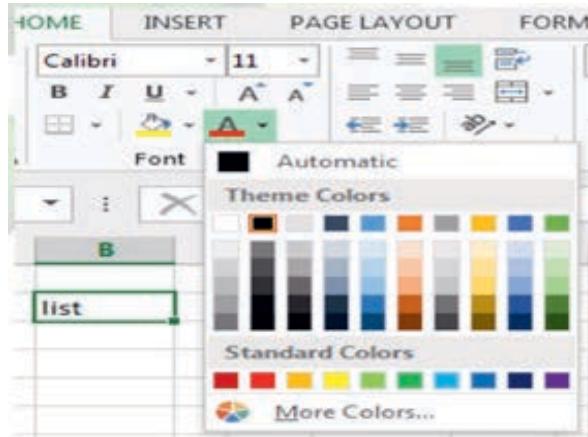


Figure 3.45 Font colors

4. The text will change to the selected font color.

To use the Bold, Italic and Underline commands:

1. Select the cell(s) you wish to modify.
2. Click Bold (B), Italic (I) or Underline (U) commands on the home tab. In our example, we will make the selected cells bold.



Figure 3.46 Font commands

3. The selected style will be applied to the text.



You can also press **Ctrl+B** on your keyboard to make the selected text bold, **Ctrl+I** to apply italics and **Ctrl+U** to apply an underline.

b. Text Alignment

By default, any text entered into your worksheet will be aligned to the bottom-left of a cell, so all numbers will be aligned to the bottom-right of a cell. Changing the alignment of your cell content allows you to choose how the content is displayed in any cell which can make your cell content easier to read.

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To change horizontal text alignment:

1. Select the **cell(s)** you wish to modify.
2. Select one of the three **horizontal alignment** commands on the **home tab**. In our example, we will choose **Center Align**.

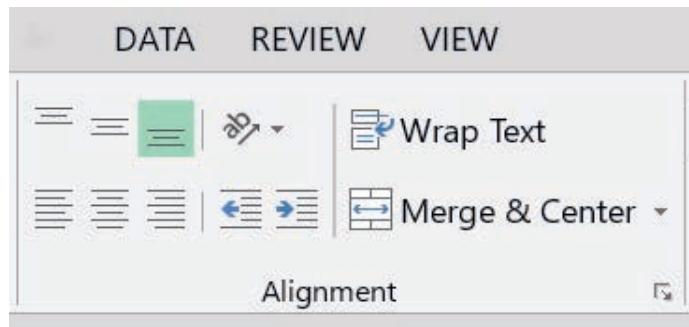


Figure 3.47 Text alignment options

3. The text will be realigned.

To change vertical text alignment:

1. Select the **cell(s)** you wish to modify.
2. Select one of the three **vertical alignment** commands on the **home tab**. In our example, we will choose a **Middle Align**.

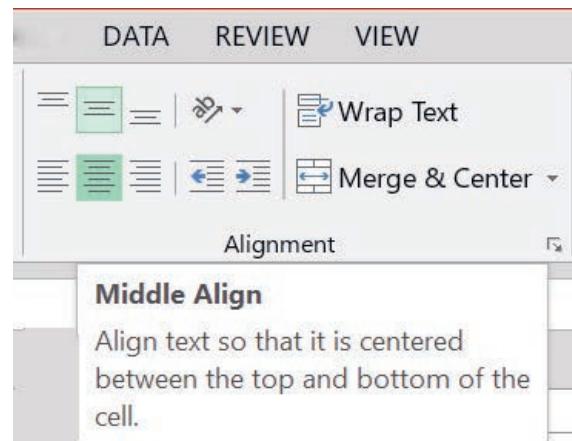


Figure 3.48 Text realignment

3. The text will be realigned.

c. Cell Borders and Fill Colors

Cell **borders** and **fill colors** allow you to create clear and defined **boundaries** for different sections of your worksheet.

To add a border:

1. Select the **cell(s)** you wish to modify.
2. Click the **drop-down arrow** next to the **Borders** command on the **Home** tab.
The **Borders dropdown menu** will appear.

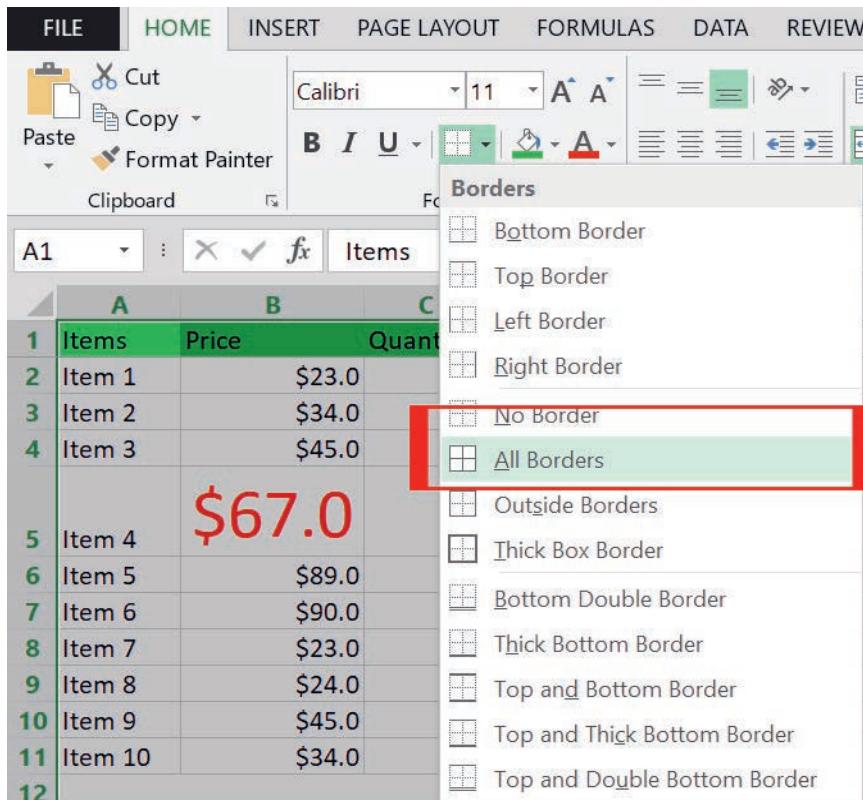


Figure 3.49 Boarders dropdown menu

3. Select the border style you want to use.
4. The selected border style will appear.



You can draw borders and change the line style and color of them with the Draw Borders tools at the bottom of the Borders drop-down menu.

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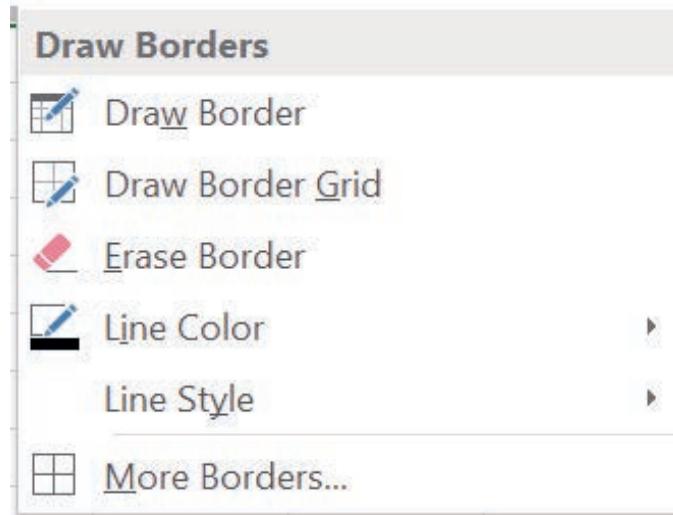


Figure 3.50 Draw borders

To add a fill color:

1. Select the cell(s) you wish to modify.
2. Click the drop-down arrow next to the **fill color** command on the home tab.
The **fill color menu** will appear.
3. Select the fill color you want to use. A live preview of the new fill color will appear as you hover the mouse over different options. In our example, we will choose Light Green.

The screenshot shows the Microsoft Excel ribbon with the 'HOME' tab selected. A data table is visible below the ribbon. On the right side of the ribbon, the 'Font' group is active, showing font and style options. To the right of the font group is the 'Fill Color' button, which is highlighted with a red circle. A dropdown menu titled 'Theme Colors' is open, displaying a grid of color swatches. Below the theme colors are sections for 'Standard Colors' and 'More Colors...'. The table data is as follows:

	A	B	C
1	Items	Price	Quantity
2	Item 1	\$23.0	4
3	Item 2	\$34.0	5
4	Item 3	\$45.0	6
5	Item 4	\$67.0	7
6	Item 5	\$89.0	9
7	Item 6	\$90.0	5
8	Item 7	\$23.0	6
9	Item 8	\$24.0	4
10	Item 9	\$45.0	8
11	Item 10	\$34.0	9
12			\$3,152.0

Figure 3.51 Fill color menu

4. The selected fill color will appear in the selected cells.

d. Cell Styles

Rather than formatting cells manually, you can use Excel's **predesigned cell styles**. Cell styles are quick ways to include professional formatting, such as **titles and headers**, for different parts of your workbook.

To apply a cell style:

1. Select the **cell(s)** you wish to modify.
2. Click the **Cell Styles** command on the **home tab**, and then choose the desired style from the drop-down menu.

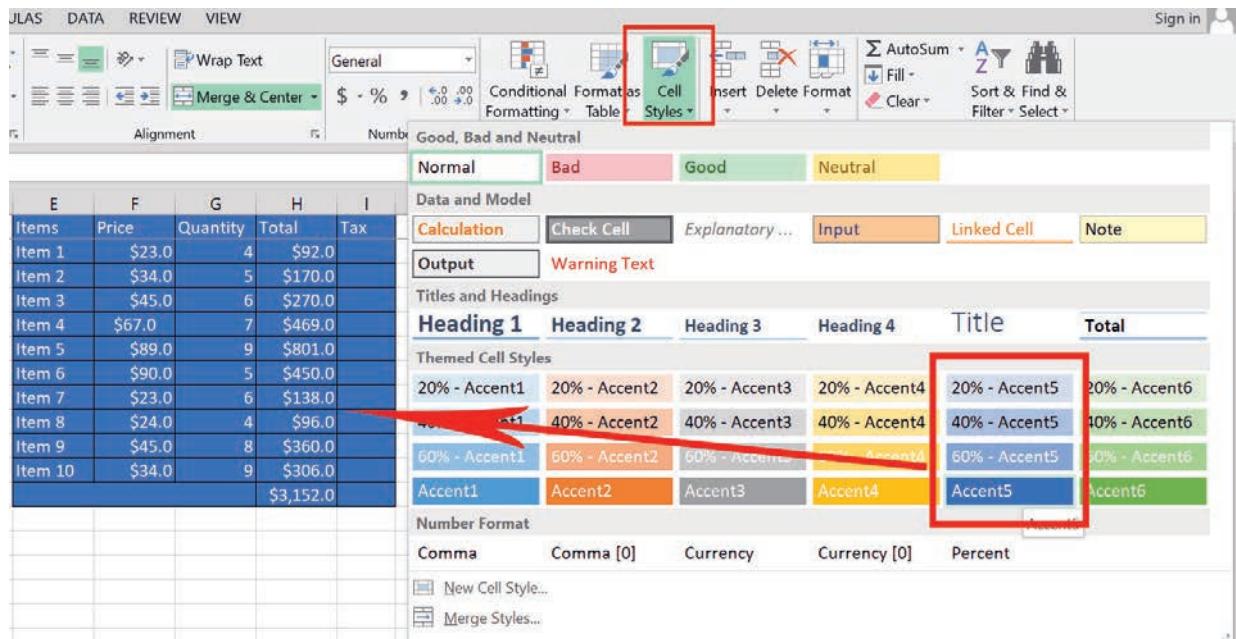


Figure 3.52 Color style

3. The selected cell style will appear.

e. Formatting Text and Numbers

One of the most powerful tools in Excel is the ability to apply specific formatting for text and numbers. Instead of displaying all cell contents in the same way, you can use formatting to change the appearance of dates, times, decimals, percentages (%), currency (\$) and much more.

To apply number formatting:

1. Select the **cells(s)** you wish to modify.
2. Click the **drop-down** arrow next to the **Number Format** command on the **home tab**. The Number Formatting **drop-down menu** will appear.

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3. Select the **desired formatting** option.
 4. The **selected cells** will change to the new **formatting style**.

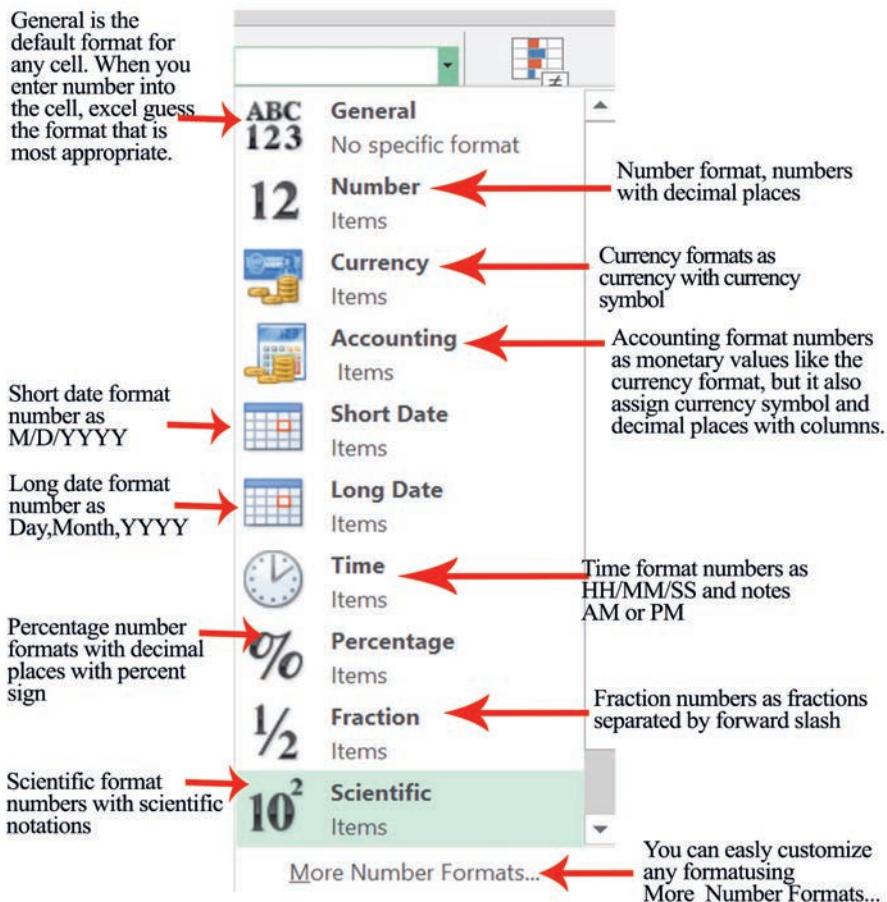


Figure 3.53 Number formatting

Practical Exercise 3.9

Practice the following activities individually.

1. Open an existing Excel's workbook.
 2. Select cells from G3 to M12 and do the following.
 - a. Change the font style to Tahoma.
 - b. Change the font size to 32.
 - c. Change the color of the text to Blue, Accent 5, lighter 40%.
 - d. Make the texts on cells H4 to J5 bold, italics and underlined.
 - e. Change alignment to vertical for cells G3 to M3.
 - f. Add a border to cells H4 to k11.

KEY CONCEPTS

- ✍ A **Spread sheet** is a computer application for organization, analysis and storage of data in tabular form. Spreadsheets were developed as computerized analogs of paper accounting worksheets.
- ✍ A **spreadsheet** may also refer to a program that displays data (text and numbers) in a table called a worksheet.
- ✍ All **formulas in Excel** must begin with **an equal sign (=)**. This is because the cell contains or is equal to the formula and the value it calculates.
- ✍ A **chart** is a powerful tool that allows you to visually display data in a variety of different chart formats. With Excel we can easily create charts such as bar, column, pie, line, area, scatter, surface or radar charts.

3.4 PowerPoint Presentation

Brainstorming

1. Can you describe why PowerPoint presentation software is used for?
2. Have you ever heard of the term animation?
3. What are the fundamental contents of a PowerPoint presentation?

As it was defined and discussed in grade 9, unit 3, PowerPoint is a graphical presentation program used to organize and present information. PowerPoint presentations consist of several individual pages or slides. Slides may contain text, graphics, sound, movies and other objects that can be freely arranged.

Presentations can be printed, displayed live on a computer or navigated through at the command of the presenter. For larger audiences, the presentation is often projected onto a large screen. Handouts, speaker notes or outlines can also be produced from the slides.

3.4.1 Using Animation and Transitions

Presentations are greatly improved by adding animation. PowerPoint gives you a wide selection of built-in animations, both when moving between one slide and the next, and within each slide.

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a. Slide Transitions

Transitions are animated effects that occur when you move from one slide to another. They differ from animations in that animations apply to individual items on a slide whereas transitions apply only to entire slides. You can control the effect, its speed, its sound effect (if any) and, in some cases, other options such as direction. Figure 3.5 shows the transition tab.



Figure 3.54 Transition tab

Instead of simply moving abruptly from one slide to another during a presentation, slide transitions allow slides to dissolve into each other, using a variety of different special effects. These can make your on-screen presentation **look even better and more professional**.

To insert transitions:

1. Check that you are in **normal view** and that the first slide is selected.
2. Move to the **transitions** tab and click to see the ribbon as seen in Figure 3.54.
3. Choose one of the transition effects for the first slide (the **more** button shows all the effects)
4. Note that a small star symbol appears to the left of the first slide miniature; this indicates that a transition has been set up on this slide. Next, explore the options available.
5. Click on **effect options** and change the direction of the effect.
6. Increase the duration of the transition to slow it down and see the effect more clearly.
7. Open the sound drop-down list and then click camera (to add the sound of a camera shutter opening and closing at each transition).

If you do not hear the sound, try previewing it again. If you still do not hear the sound, make sure that your speakers are on or your system's sound is not muted in Windows and that the volume is turned up.

8. Under the advance slide, set the next slide to appear after you have set the number of seconds.
9. Move to the next slide and repeat steps 3 to 6, choosing different effects.
10. Finally save your presentation (press Ctrl+S); then run it (press F5) to see the effects; press Esc when you have seen enough.



Having different transition effects between slides may add interest, but it is not good practice. It distracts from the talk and is not good for accessibility. It is best to stick to one transition throughout (and only use a different one for effect, if you need to).

To standardize the transition:

1. Remove the effects by choosing **None**, the first in the list; then click **Apply to All**.
2. Next, choose your preferred transition; repeat steps 3 to 6, and then click **Apply to All**
3. Finally, press **F5** to see the effects.

b. Animation Schemes

PowerPoint allows information on your slides to appear one item at a time. This stops your audience from reading ahead of you, making them concentrated on each point individually. Figure 3.55 shows the animation tab.

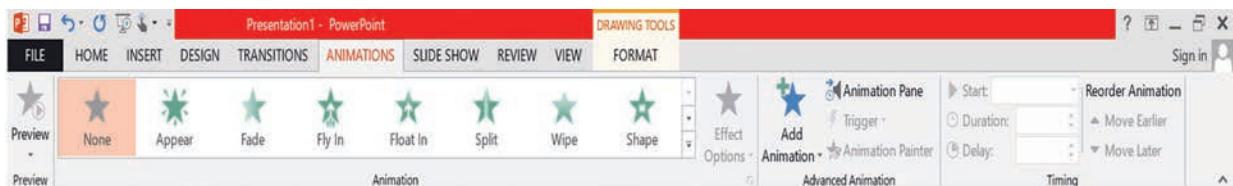


Figure 3.55 Animation tab

To animate a set of bullet points:

1. Move to the **ANIMATIONS** tab, and then click on a slide with a bulleted list on it.
2. Click on the **bullet points**; then move the mouse over the **Animations icons** and watch the effects.

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3. Click on the **More** button at the foot of the Animations scroll bar to see more animations.

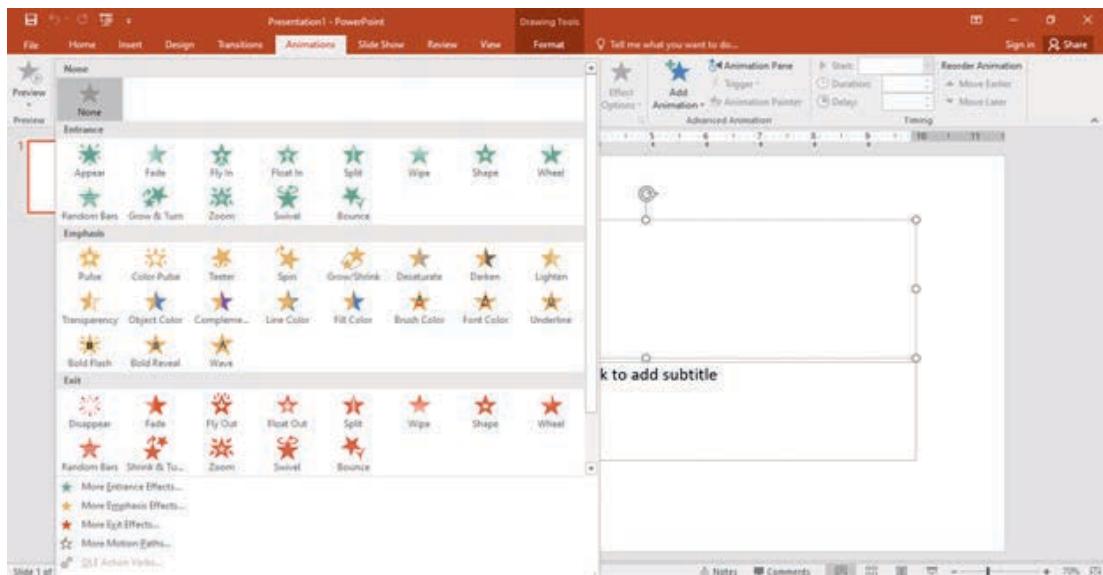


Figure 3.56 Animation options

4. From the list of animations, choose one of them, for example, **Fade**.
5. Click on **Effect Options**, if active, and see what is available.
6. Repeat steps 3 to 5 for another slide with bullet points, choosing a different animation.



As with slide transition, it is not a good idea to use too many different animations as they can distract the viewer. Always bear accessibility in mind and avoid some of the more 'exciting' animations.

To see what you can do with advanced animation:

1. Click on the slide title on one of the slides that you have already animated.
2. Next, click on the animation pane button in the advanced animation group to display the task pane.



Figure 3.57 Animation pane

Currently, the title and the picture are not animated. To add animation:

1. Click on the add animation button and choose an entrance animation.
2. Click the \triangle button (or move earlier in the timing group) to animate it before the list.
3. Select the title again and this time add animation choosing an emphasis animation.
4. Repeat step 10 to move it to the second in the list.
5. Click Play from or Preview button to view your changes.
6. Next, try animating the picture, displaying it after the title animations.
7. Finally, save your presentation (**press Ctrl+S**), and then run it from the first slide (**press F5**).
8. End by closing the animation pane (click on the button or the [x] at its top right).

Activity 3.1

Complete the following activities in a group.

1. Compare and contrast transitions and animations in PowerPoint presentations.
2. Explain the importance of inserting transitions and animations into your PowerPoint presentation.
3. Summarize and identify transition effect inserted slide and animated slide from the normal slide.

3.4.2 Creating a Slide Master in PowerPoint

A slide master is a top slide in a hierarchy of slides that stores information about the theme and slide layouts of a presentation, including the background, color, fonts, effects, placeholder sizes and positioning. Figure 3.58 shows the slide master view.

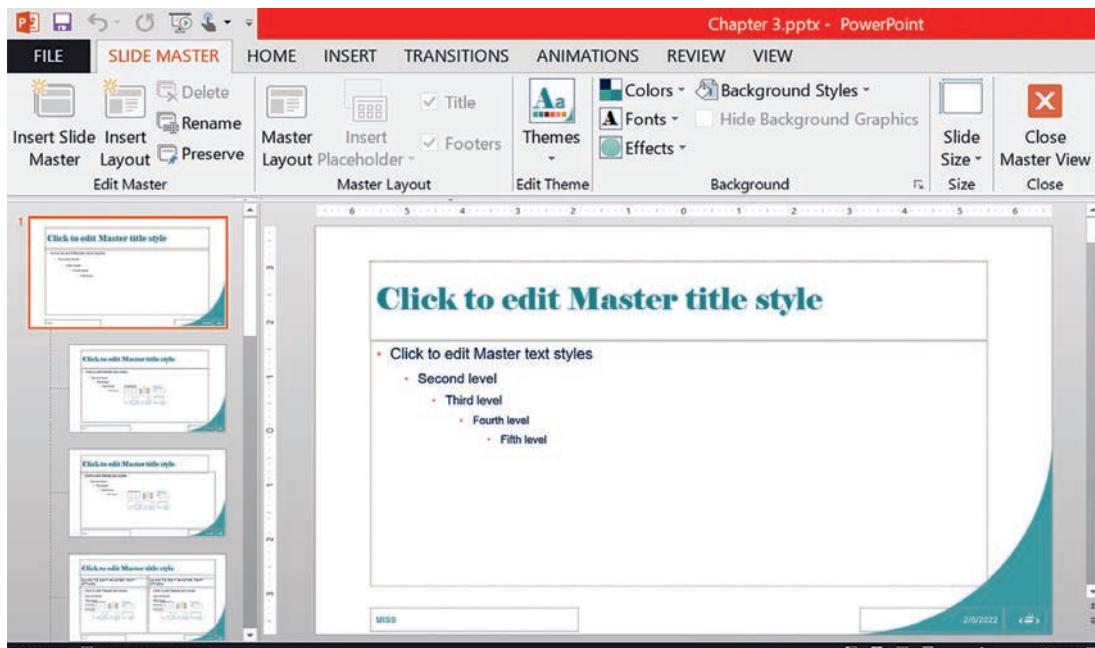


Figure 3.58 Slide master view

To create a slide master:

1. On the view tab, click the slide master. In slide master view, the slide master appears at the top of the thumbnail pane with related layouts beneath it.
2. Click to select the master slide, and then click Master Layout on the slide master tab.
3. Make the updates that you want.
4. To remove any built-in slide layouts that accompany the default slide master, in the slide thumbnail pane, right-click each slide layout that you want to delete, and then click Delete layout.
5. To set the page orientation for all of the slides in your presentation, on the slide master tab, click Slide Orientation, and then select either portrait or landscape.

6. On the file tab, click Save as.
7. In the file name box, type a file name.
8. In the Save as type list, click PowerPoint template, and then click Save.

Practical Exercise 3.10

Answer the following items accordingly.

1. Explain the advantages of using a slide master.
2. Create a slide master by inserting your school logo or **your picture on top of the slide master.**
3. Change the background style to style 6, and theme to crop.
4. Save your slide master and demonstrate it to your class.

KEY CONCEPTS

- ✍ **PowerPoint** (ppt) is a graphical presentation program used to organize and present information. PowerPoint presentations consist of a number of individual pages or slides which may contain text, graphics, sound, movies and other objects that can be freely arranged.
- ✍ **Presentations** can be printed, displayed live on a computer or navigated through at the command of the presenter.
- ✍ **Transitions** are animated effects that occur when you move from one slide to another.
- ✍ **Slide masters** are very important features that control the layout of your whole presentation. They allow you to create your own slide template which is applied to every slide.

3.5 Unit Summary

Word Processing refers to the act of using a computer to create, edit, save and print documents. In order to perform word processing, a specialized software (known as Word Processor) is needed. The common example of a Word Processor is Microsoft Word; other word processing applications are also widely used.

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The Insert Table dialog box enables you to create large tables by specifying up to 63 columns and thousands of rows. Note that in the Insert Table dialog box, you can click the spin box arrows or type in the number of columns and rows you need in a table. In this exercise, you use the insert table dialog box to create a table.

Word offers several tools for resizing rows or columns. You can resize a column or row using the mouse or the commands on the ribbon. You can use commands in the cell size group on the table tools – use layout tab to adjust height and width or use the ruler to adjust the column width. In addition, the table properties dialog box enables you to set the measurements at a precise height for rows or an ideal width for columns, cells and tables.

A spreadsheet is a computer application for the organization, analysis and storage of data in tabular form. Spreadsheets were developed as computerized analogs of paper accounting worksheets. The program operates on data entered in cells of a table. Each cell may contain either numeric or text data or the results of formulas that automatically calculate and display a value based on the contents of other cells. A spreadsheet may also refer to a program that displays data (text and numbers) in a table called a worksheet.

The real strength of spreadsheet is its capability to perform common and complex calculations. The formula is one of the essential elements of spreadsheet which enables you to add, subtract, multiply and divide numbers. 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 you use the formulas tab.

A **function** is a **predefined formula** that performs calculations using specific values in a particular order. Excel includes many common functions that can be useful for quickly finding **sum, average, count, maximum value and minimum value** for a range of cells. To use functions correctly, you need to understand the different parts of a function and how to create arguments to calculate values and cells.

There are two types of cell references: **relative** and **absolute**. Relative and absolute references behave differently when copied and filled into other cells. Relative references **change** when a formula is copied to another cell. Absolute references, on the other hand, remain **constant**, no matter where they are copied.

Creating a chart in spreadsheet is quick and easy. It provides a variety of

chart types that you can choose from when you create a chart. Excel offers **pie**, **line**, **bar** and **column** charts. Showing data in a chart can make it clearer, more interesting and easier to read. Charts can also help you evaluate your data and make comparisons between different values. One of the most powerful tools in Excel is the ability to apply specific formatting for text and numbers. Instead of displaying all cell content in the same way, you can use formatting to change the appearance of dates, times, decimals, percentages (%) and currency (\$).

PowerPoint is a graphical presentation program used to organize and present information. PowerPoint presentations consist of several individual pages or slides, which contain text, graphics, sound, movies and other objects that can be freely arranged.

Presentations can be printed, displayed live on a computer or navigated through at the command of the presenter. For larger audiences, the presentation is often projected onto a large screen. Handouts, speaker notes or outlines can also be produced from the slides.

Presentations are greatly improved by adding animation. PowerPoint gives a wide selection of built-in animations, both when moving between one slide and the next, and within each slide. Instead of simply moving abruptly from one slide to another during a presentation, slide transitions allow slides to dissolve into each other, using a variety of different special effects. These can make your on-screen presentation **look even better and more professional**.

Slide masters are very important as they control the layout of your whole presentation. They allow you to create your slide template which is applied to every slide. This is useful if you want to put your logo, picture, or even just your name in the same place on each slide.

3.6 Unit Review Exercise

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

1. Table is an arrangement of data made up of horizontal rows and vertical columns.
2. When you double-click and your mouse pointer has changed to the “adjust width” or “adjust height” pointers, the row/column will auto-adjust, based on the size of your text.

Unit 3 : Application Software

3. A word processor is a computer application for the organization, analysis and storage of data in tabular form.
4. The real strength of Excel is its capability to perform common and complex calculations.
5. In a worksheet, if you copy the formula $=a_1+b_1$ from row 1 to row 2, the formula will become $=a^2+b^2$.
6. PowerPoint allows you to create static slide presentations.
7. Transitions are animated effects that occur when you move from one slide to another.

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

1. Which of the following is not an essential function of a word processing software package?
 - A. Indexing
 - B. Saving
 - C. Editing
 - D. Formatting
2. Which of the following is the benefit of Word Processor to create a table?
 - A. Providing insert table dialog box
 - B. Providing insert drawing tools
 - C. Providing insert quick table method
 - D. All of the above.
3. Among the following, which is not the way to modify images in Microsoft Word?
 - A. Converting them to SmartArt and adding captions
 - B. Saving and deleting what you do not need
 - C. Rotating and applying styles and colors
 - D. Creating artistic effects and positioning images within the document

4. _____ can be used to automatically number each page in your document.
- A. Clip arts
 - B. Pictures
 - C. Page numbers
 - D. Smart arts
5. Which of the following does not describe the table of content in an MS-word document?
- A. It gives users an overview of the document's contents and organization.
 - B. It allows readers to go directly to a specific section of an online document.
 - C. It is a snapshot of the headings and page numbers in your document.
 - D. It can be updated automatically at any time.
6. _____ is a computer application used for organization, analysis and storage of data in tabular form.
- A. Spreadsheet
 - B. Word Processor
 - C. PowerPoint
 - D. Word Publisher
7. Which of the following functions calculates the average of the values in the cell range from B1 to B9?
- A. =AVERAGE (B1:B9)
 - B. AVERAGE (B1:B9)
 - C. =SUM (B1:B9)
 - D. =AVERAGE (B1, B9)
8. _____ allow your audience to see the meaning behind the numbers and make showing comparisons and trends much easier in an Excel worksheet.
- A. Pictures
 - B. SmartArt
 - C. Symbols
 - D. Charts

Unit 3 : Application Software

9. Which of the following is not an area of importance for MS Excel in our daily and business lives?
- A. Availability of online access
 - B. Bringing all the data to one place
 - C. Difficulty of arithmetic solutions
 - D. Analysis of charts
10. Which of the following key combination can you press on the keyboard to make a selected text bold in a worksheet?
- A. Ctrl+I
 - B. Ctrl+U
 - C. Ctrl+B
 - D. Ctrl+V
11. _____ is a graphical presentation program used to organize and present information.
- A. Worksheet
 - B. Word Processor
 - C. PowerPoint
 - D. Graphic user interface
12. What does an animation effect do in a PowerPoint presentation?
- A. It is used to draw the audience's attention to specific content.
 - B. It is used to make the slide easier to read.
 - C. It makes the presenter tell stories and communicate emotions and ideas.
 - D. All of above.
13. _____ are so important that they control the layout of your whole presentation.
- A. Control menus
 - B. Slide masters
 - C. Pictures
 - D. Slide shows

14. How is PowerPoint Presentation so powerful?

- A. It is less text-heavy and builds space for interaction with the audience.
- B. Its visual nature encourages attention, interpretation and interest of the audience.
- C. It is an efficient way of conveying your full message.
- D. All of the above.

Part III: Discuss the following questions.

1. Discuss how word processing is so important? What are some basic characteristics of word processing?
2. Open blank Microsoft Word, create a table and do the following.
 - a. Insert columns for all days of the week starting from Sunday.
 - b. Insert rows for all months of the year starting from September.
 - c. Change the table style to Grid table 5, dark-Accent 5.
 - d. Add borders to all cells.
 - e. Save with the name **Grade 10**.
 - f. Among the SmartArt group on the insert tab, among the pyramid group, insert the basic pyramid below your table and write grade 9 at the bottom, grade 10 in the middle, and grade 10 at the top; be sure that the font size fits inside the pyramid.
 - g. Save the change.
3. What are some powerful features of Microsoft Excel?
4. Open a blank worksheet, insert all of the data as shown in the table below and answer the questions that follow it.

Unit 3 : Application Software

Stdents grade Report												
No	Name	RollNo.	Test1	Test2	Test3	Test4	Total	Average	Count	Maximum	Minimum	
3	1 Feleke		12	12	17	17						
4	2 Endalemawu		6	6	16	16						
5	3 Wubshet		15	13	10	10						
6	4 Tesfaye		9	11	19	19						
7	5 Behailu		12	14	17	17						
8	6 Getachew		12	12	16	16						
9	7 Mathewos		8	8	16	16						
10	8 Obang		14	14	18	18						
11	9 Abebe		15	11	17	17						
12	10 Lorisso		11	11	17	17						
13	11 Ledamo		14	14	17	17						
14	12 Bakalo		15	5	17	17						
15	13 Shukuri		15	15	19	19						
16	14 Ujulu		8	8	16	16						
17	15 Aster		9	10	17	17						

- a. Calculate Total, AVERAGE, COUNT, MAXIMUM and MINIMUM on the given cells (Hint: Use embedded functions).
- b. Filter students' names A-Z.
- c. Sort the total grade from largest to smallest.
- d. Insert line chart by using students' name, total grade and average.
5. Discuss the advantages of PowerPoint presentations.
6. Open Blank PowerPoint and use the following to create your own slide master.
 - a. Insert **Ethiopian Renaissance Dam** as a title, **Abay** as a subtitle, **Calibri-Light** font style, **60** font size and **Green font color**.
 - b. Make Figure 3.59 below a logo and align left.



Figure 3.59 Green legacy

- c. Save as **Green Legacy**.

UNIT

4

IMAGE PROCESSING AND MULTIMEDIA

UNIT OUTCOMES

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

- Explain Multimedia and their components.
- Describe multimedia authoring and its tools.
- Summarize multimedia editing.
- Edit and publish multimedia files.
- Explain computer animation.

4.1 Unit Overview

In grade 9, unit four, you learned image processing, which is a method used to perform some operations on an image, get an enhanced image or contract some useful information from it. It is a type of signal processing in which input is an image and output may be an image or features associated with that image. In this unit, you are going to learn basics of multimedia, components of multimedia, multimedia file formats, application area of multimedia, multimedia authoring and authoring tools, multimedia production, multimedia editing, and computer animation and its strategies.

4.2 Basics of Multimedia

Brainstorming

1. Can you state what is meant by multimedia?
2. Can you explain what animation is?

Unit 4 : Image Processing and Multimedia

Multimedia is a representation of information attractively and interactively with the use of a combination of text, audio, video, graphics and animation. In other words, multimedia is a computerized method of presenting information combining **textual data, audio, visuals (video), graphics and animations**. The development of the World Wide Web expanded the Internet to include pictures, sound, music and text as well. Figure 4.1 shows a combination of content forms that multimedia contains.



Figure 4.1 Forms of multimedia content

Importance of multimedia

Multimedia enhances the way we learn and understand things. Integration of multiple media such as text, audio, video, graphics and animation together multiply the impact of the message.

Multimedia is appropriate whenever a human interface connects a human user to electronic information of any kind. Multimedia improves information retention. When it is properly constructed, multimedia can be entertaining as well as useful. The importance of multimedia grows as new technology develops.

Multimedia plays an important role in education, entertainment, public places, collaboration and healthcare. Let us see its importance one by one.

- 1. Education:** Computer-assisted programs like Microsoft PowerPoint have allowed classrooms to use graphics and visuals to do presentations in creative ways. Interactive graphics make learning more visually enhanced and can clarify ideas. Multimedia activities encourage students to work in groups, express their knowledge in multiple ways, solve problems, revise their work

and construct knowledge. The advantages of integrating multimedia in the classroom are many. Students can learn new skills and knowledge without teachers' guidance, for example virtual learning. They can also design and run websites.



Figure 4.2 Virtual learning

Virtual learning is a learning experience that is enhanced through utilizing computers and/or the internet both outside and inside the facilities of the educational organization. The teaching and learning activities are carried out online whereby the teacher and learners are physically separated (in terms of place, time or both). Figure 4.2 shows virtual learning.

- 2. Entertainment:** People can watch movies, listen to music and read books with multimedia access on move. This allows people to entertain themselves wherever they go.



Figure 4.3 Multimedia entertainment

Unit 4 : Image Processing and Multimedia

3. **Public Places:** Multimedia is available at stand-alone terminals or kiosks used in hotels, railway stations, shopping malls, museums and libraries. The way we live is changing as multimedia penetrates our day-to-day experience and our culture. Today, multimedia is found in churches and places of worship as live videos with attached song lyrics shown on large screens using elaborate sound systems with special effects lighting and recording facilities.
4. **Collaboration:** Multimedia platforms can be used as a collaboration device that can link to two or more people from different regions of the world. People can talk over the computer through chatting, social networking and video cameras, for example virtual meeting.



Figure 4.4 Virtual meeting

A virtual meeting is a type of collaboration technique where people from anywhere in the world can share their ideas using audio, video conferencing, screen sharing, and webinars. Figure 4.3 shows virtual meetings.

5. **Healthcare:** The healthcare staff uses multimedia applications for saving and sending images. Multimedia helps them make diagnoses. It is also used for medical education, training, telemedicine and virtual surgery. Figure 4.5 shows virtual surgery.



Figure 4.5 Virtual surgery

Virtual surgery is a virtual reality technology that simulates surgical procedures without the need of a patient or cadaver; instead it allows surgeons to practice surgery on 3D models. It helps the surgeons to have a clear understanding of the outcome.

Telemedicine is the exchange of medical information from one location to another using electronic communication, which improves patient health status. Patients use multimedia as an informatics tool in their education and rehabilitation. Figure 4.6 shows telemedicine.



Figure 4.6 Telemedicine

Activity 4.1

Discuss the following activities in a group.

1. Explain the benefits of multimedia in classroom teaching and learning activities.
2. Visit certain banks in your local area and summarize their multimedia experiences.
3. Analyze the application of multimedia in the health sector.

Unit 4 : Image Processing and Multimedia

4. Explain the business implications of multimedia.
5. Describe virtual meetings and virtual learning.

Components of Multimedia

The various components of multimedia are **text, audio, graphics, video and animation**. All these components work together to represent information effectively and easily. Let us see them one by one.

1. Text

In multimedia, the text is used as headlines, subtitles and captions. In addition to supplying content, the text is used to give directions and communicate information, text-based menus and buttons. These guide users through multimedia applications, electronic books, magazines and reference materials still rely on text to inform and educate. The text can have various types of fonts and sizes to suit the professional presentation of the multimedia application. Examples of fonts used to create words, sentences and paragraphs are shown in Figure 4.7 below.

Titles

Multimedia is a rich media that accommodates numerous instructional strategies. Multimedia address many of the challenging instructions in both the academic and corporate environment. It is accessible over distance and time and provide a vehicle for consistent delivery. Multimedia can provide the best medium which to communicate a concept

- . Keyboard
- . Mouse
- . Monitor
- . Speaker

Figure 4.7 Multimedia text

2. Graphics

Graphics are visual elements often used to point readers and viewers to particular information. They are also used to supplement text to aid readers in their understanding of a particular concept or make the concept clearer and more interesting. Figure 4.8 shows multimedia graphics.

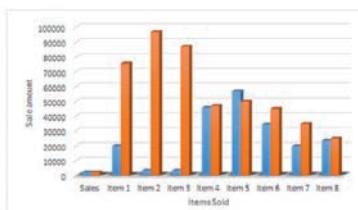


Figure 4.8 Multimedia graphics

Graphics that fit most needs are quite easy to find. Commercially prepared drawings, called clipart, come packaged with many application programs. Charts, another type of graphics, can convey a great deal of information in a very limited space. Photographs can also be used to enhance multimedia applications.

When a graphic or other multimedia object serves as a link to additional information about a topic, the link is called hypermedia.

3. Audio

A multimedia application may require the use of speech, music and sound effects. These are called audio or sound elements of multimedia. In multimedia applications, a sound that has been digitized is called audio. Audio can be obtained by capturing sound into a personal computer using a microphone or another input device. It can also be played from a synthesizer, keyboard, or another musical instrument that is connected to the computer using a MIDI (Musical Instrument Digital Interface) port.

4. Video

Video can do a great deal to enhance a presentation, illustrate a proper technique or advertise a new product. Video files are photographic images played at speeds that make them appear as if the images are in full motion. Video files are incredibly large because a huge number of images are required to give appearance for the motion.



Figure 4.9 Multimedia video

Interactive multimedia allows users to respond directly to and control media elements. Users of interactive multimedia become active participants in an application instead of passive recipients of the information. Digital video is useful in multimedia applications for showing real-life objects.

5. Animation

Animation refers to graphic images that change or move. Animation can convey information, add visual interest or draw attention to important information or

Unit 4 : Image Processing and Multimedia

links in a multimedia application. Animation is commonly used in advertising and marketing on the Web because the movement does grab visitor's attention.



Childre 3D animation Game



Early years education development play

Figure 4.10 Multimedia animation

By illustrating proper techniques or explaining complex procedures, animation can also serve as an excellent learning aid in computer-based training programs. Like clipart and stock photography, animated graphics are available for purchase on CD-ROM or they can be downloaded from the Internet. In addition, commercial software and shareware can be purchased or downloaded and used to create simple or complex animations. Figure 4.10 above shows multimedia animation.

Hardware and Software Requirements for Multimedia

A multimedia computer system is a computer system capable of integrating two or more types of media (text, graphics, animation, audio and video) for the generation, storage, representation, manipulation and access of multimedia information.



Figure 4.11 Typical multimedia computers

To use multimedia on a computer system, one needs certain hardware components and software.

Hardware Requirements for Multimedia

The basic hardware requirements for multimedia are:

1. Central Processing Unit (CPU) — Pentium Processor
2. Random Access Memory (RAM) — 1 GB RAM
3. Monitor — Super Virtual Graphics Arrays (SVGA)
4. Video Card
5. Sound Card
6. CD-ROM Drive

Software Requirements for Multimedia

The basic software requirements for multimedia are:

1. Word processor for entering text.
2. Image processing software such as Photoshop, CorelDraw, etc.
3. Animation creators like 3D Max, Flash, etc.
4. Sound can be created using a Sound forge and the like.
5. Video can be used by using software like Video for Windows, Author Ware, etc.

Activity 4.2

Discuss the following activities in a group.

1. Describe the components of multimedia.
2. Explain the multimedia components that are applied on television (TV) or YouTube.
3. Summarize some multimedia devices and their uses in your local environment.
4. Describe the roles of animation in education.
5. Describe the advantages of graphics over text.

KEY CONCEPTS

- ✍ 2D animation is the art of creating movement in a two-dimensional space.
- ✍ 3D describes animating objects that appear in a three-dimensional space. They can be rotated and moved like real objects.
- ✍ Virtual reality (VR) is a special kind of graphical user interface that presents a computer-generated immersive, three-dimensional, interactive environment that is accessed and manipulated using, for instance, stereo headphones, head-mounted stereo television goggles and data gloves.

4.3 Multimedia File Formats

Brainstorming

1. Can you define the term file format?
2. Can you open different multimedia file formats on your computer?

A file format is the structure in which information is stored or encoded in a computer file. The current multimedia file formats are used for the production and delivery of multimedia data including **text**, **image**, **digital audio file** and **digital video file** formats.

Images and photographs can be inserted inside the actual document or inked to the document. There are lots of different file formats for images, video and sound. The most common ones are given below.

Sound file formats

- a. WAV (Windows Wave Format)
- b. MIDI (Musical Instrument Digital Interface)
- c. WMA (Windows Media Audio)

Image file formats

- a. TIFF (Tagged Interchange File Format)
- b. JPEG (Joint Photographic Experts Group)
- c. GIF (Graphics Interchange Format)

- d. PNG (Portable Network Graphics)
- e. BMP (Windows Bitmap Format)

Video file formats

- a. AVI (Audio Video Interleave)
- b. MPEG (Moving Picture Experts Group)

Activity 4.3

Answer the following activities individually.

1. Explain each multimedia file format.
2. Which type of multimedia file format is the most popular file format in your school and local environment?
3. Discuss the difference between digital audio and video file formats.
4. Open a PDF file application and observe the basic layout.

4.4 Multimedia Production

Brainstorming

1. Can you explain the term *multimedia production*?
2. Why is multimedia production so important?

In basic terms, multimedia production is any sort of production that uses **imagery and a combination of text, audio and graphics to tell a story**. This story might be the sale of a product or the narration of an event. It can be educational, artistic or both, or all of the above.

Multimedia production is a complicated process which usually involves many people. Typically, one or more of the following people may be involved in making a multimedia product: production manager, content specialist, text editor, multimedia architect (or program authoring specialist), scriptwriter, computer graphic artist, audio/video specialist and computer programmer. Table 4.1 summarizes people involved in multimedia production.

Unit 4 : Image Processing and Multimedia

Table 4.1 People involved in multimedia production

People Involved in Multi-media Production	Roles Played
Production manager	defines, coordinates and facilitates the production of multimedia production
Content specialist	responsible for performing all necessary research concerning the content of the proposed application
Scriptwriter	visualizes a three-dimensional environment and integration virtual reality into the product
Text editor	revises all of the text-related elements
Multimedia architect (Program authoring specialist)	responsible for integrating all the multimedia elements (graphics, text, audio, music, video, photos and animation) using authoring programs
Computer graphic artist	responsible for the graphic elements of the program - such as backgrounds, buttons and photo collages - and the manipulation and editing of pictures, 3-D objects, logos and animatic
Audio-video specialist	<ul style="list-style-type: none">▪ responsible for recording and editing narration, selection, recording, sound effects and music▪ responsible for video capturing, editing and digitizing
Computer programmer	Responsible for programming of code lines or scripts in the authoring language

Activity 4.4

Discuss the following activities in a group.

1. Explain the influence of multimedia products in our daily lives.
2. Describe different stages of multimedia production.
3. Summarize people who involve in multimedia production.

KEY CONCEPTS

- 👉 **Multimedia production** is any sort of production that uses imagery and a combination of text, audio and graphics to tell a story. This story might be the sale of a product or the narration of an event. It can be educational, artistic or both, or all of the above.
- 👉 Multimedia production begins with gathering content elements that fulfill the purpose of **higher layer components**, followed by **integration** of these elements to create a meaningful presentation. Content gathering refers to collecting appropriate multimedia content such as text, photo and video.

4.5 Multimedia Authoring and Authoring Tools

Brainstorming

1. What do you think is *multimedia authoring*?
2. Can you mention any tool that can be used to create interactive applications?
3. What are multimedia authoring tools?

4.5.1 Multimedia Authoring

Multimedia authoring is the process of assembling different types of media contents like text, audio, image, animations and video as a single stream of information with the help of various software tools available in the market. The following are five fundamental stages of multimedia authoring:

1. **Analysis:** Decide what you need to do and what you use to do it.
2. **Design:** Create storyboards to tell the story of the project.
3. **Development:** Incorporate data and set it up as a prototype or model.
4. **Evaluation:** When the prototype application works the way you want it to, test it again, fine-tune it, make it attractive and then review your work.
5. **Distribution:** When it is ready to go (after the evaluation phase), make it real, pack and distribute it.

4.5.2 Multimedia Authoring Tools

Multimedia authoring tools are the tools that provide capability for creating a complete multimedia presentation including interactive user control, which are called authoring tools/programs.

Multimedia authoring tools give an integrated environment for joining different elements of multimedia production together. The authoring can be described as creating highly interactive applications in which the information can flow in both directions, i.e. from application to user and from user to application.

Multimedia packages and authoring tools help us to create higher-quality audio and video applications with little expertise.

Some multimedia authoring packages are:

- a. Macromedia Authorware
- b. Adobe Premier
- c. Macromedia Flash
- d. Everest Authoring System
- e. Icon Author
- f. ImageQ

Some multimedia authoring tools are:

- a. Computer
- b. Scanner
- c. Digital camera
- d. Sound recorder

Activity 4.5

Answer the following activities individually.

1. Discuss the term *multimedia authoring*.
2. Analyze the advantages of multimedia authoring and authoring tools.

Screen elements of multimedia application

We should open a multimedia application for having a look at the screen elements. Here, we are using Macromedia Flash.

To open Macromedia Flash,

Click Start → All Programs → Macromedia → Macromedia Flash MX.

Figure 4.12 shows the Macromedia Flash screen elements.

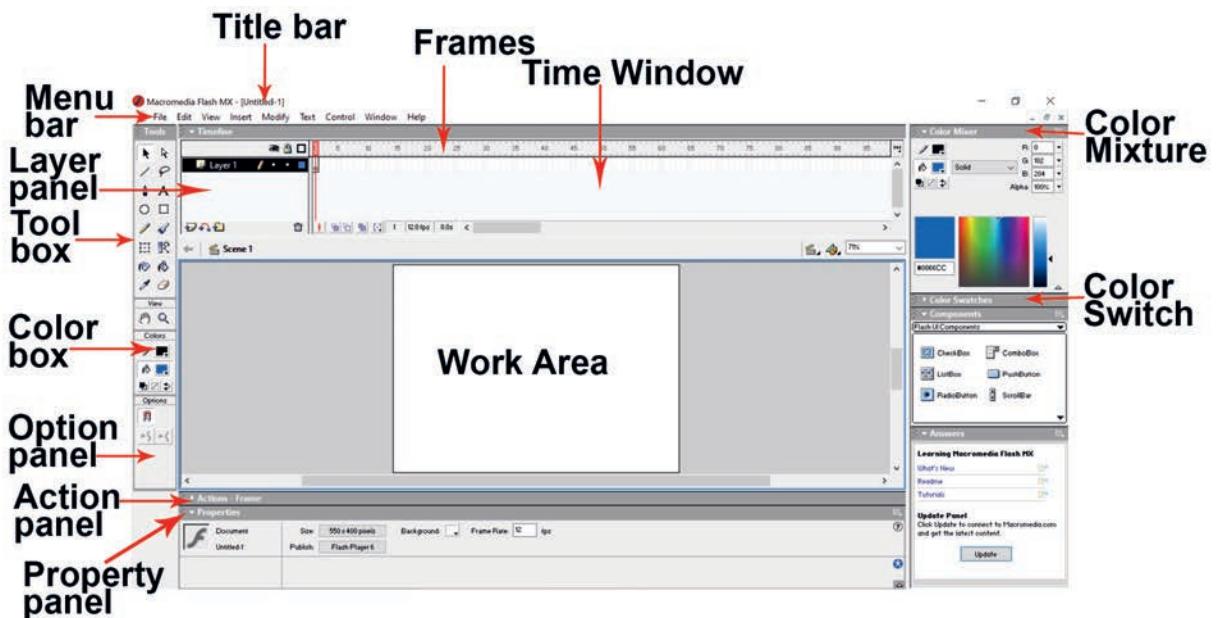


Figure 4.12 Macromedia Flash screen elements

Some Screen elements of Macromedia Flash MX are described in Table 4.2 below.

Table 4.2 Macromedia Flash MX screen elements

Screen Element	Description
Menu bar	contains various menus for commands
Timeline window	controls when things happen during the playback of the movie, for example playback, time, frame rate, etc.
Work area	consists of the Flash stage (white area in the middle of the Work area) and Workspace (grey area)
Layer panel	controls the layers (the transparent overlays on the stage where different object scans are placed). It is an integral part of the timeline
Toolbox	contains all the tools you need for drawing or selecting objects

Panels	Flash makes extensive use of panels (different parts of the screen), for example, options panel, action panel, properties panel, etc.
--------	---

Creating a new Project

To create a new project,

Click File → New.

It will open a new project file.

Your new project can be in the form of drawing, shape or even an animation.

Let us start with a simple project, i.e. drawing a rectangle and filling it with colors.

Building a basic piece

You can draw a basic drawing piece in the work area by using various drawing tools (Line Tool, Rectangular Tool, Oval Tool, etc.) from the toolbox.

To insert a rectangular box, perform the following steps:

1. Click on Rectangle Tool.
2. Draw a rectangle box in the work area.
3. Click on the Paint Bucket Tool and select the desired color from Color Swatches.
4. Click inside the rectangle box and fill in the color (See Figure 4.13).

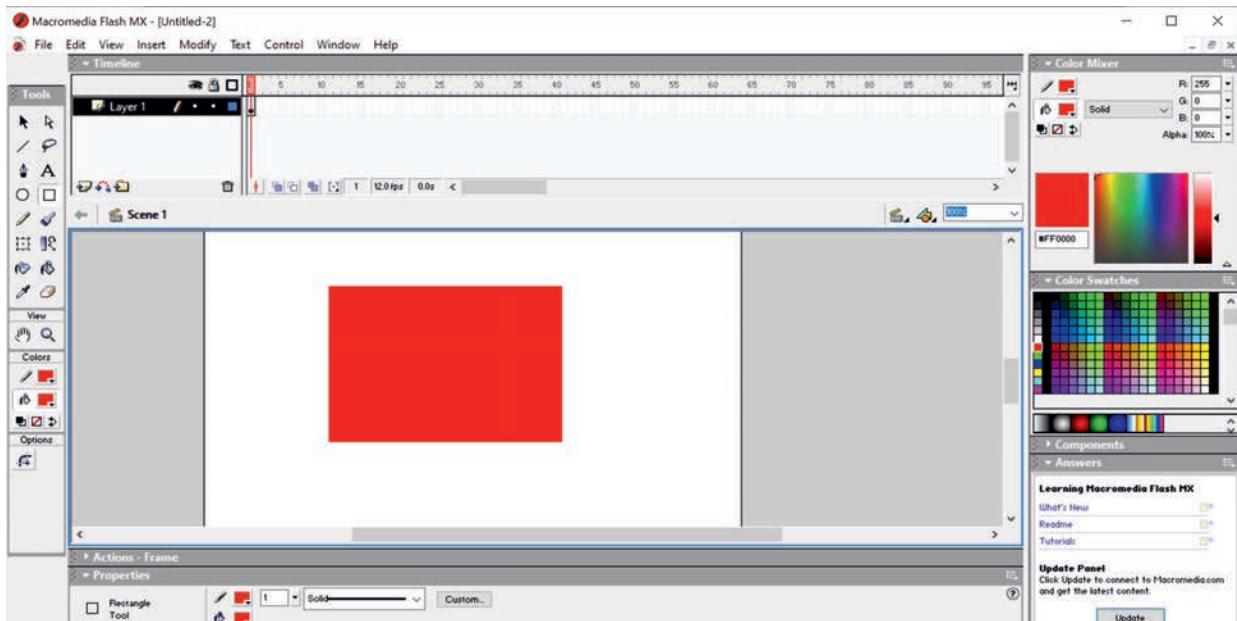


Figure 4.13 Building a basic piece

Now save your basic piece with a suitable file name.

To save the file,

Click File → Save or press Ctrl+S.

Another type of project which can be created using multimedia is animation. For this, we can rotate the figure at different angles. When we run the project, we get the impression of animation.

To apply the animation to the basic piece, perform the following steps.

1. Click the first frame in the layer you want to frame.
2. Place the object you want to animate or just insert an image from the clipart.
3. Click the next frame in the Timeline window.
4. Add a key frame. Flash inserts a key frame that duplicates the previous frame's contents.
5. Change the object slightly; change it to 90° to the right.
6. Repeat steps 4 and 5. This time the image will turn face down.
7. Now again repeat the same steps, turning the figure to 270° so that it now faces to the left. This way you can change the angle to a smaller degree and make frames if you want to have real fun.
8. Click on the first key frame in the layer and press Enter key to see the animation.

Your animation will be shown on the screen (See Figure 4.14).

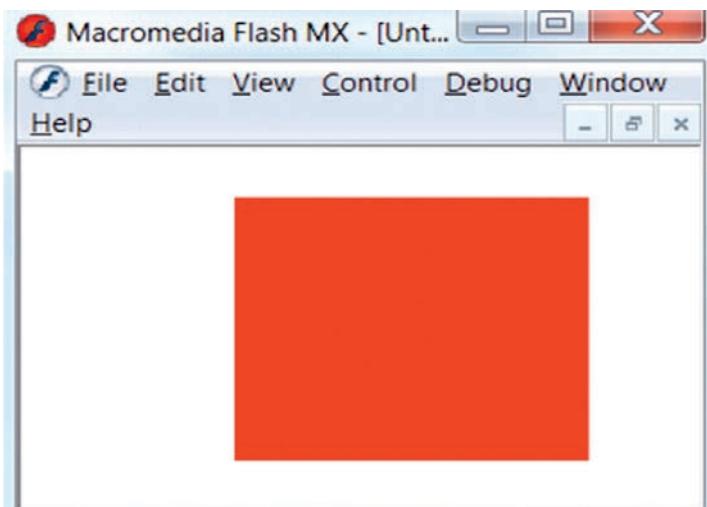


Figure 4.14 Showing an animation



To preview the animated test movie, click Control → Test Movie or Ctrl + Enter.

Editing an icon

An icon is an element (graphical, textual, audio or video) that we can see or listen to using Graphical User Interface (GUI). In other words, an icon is a broad term associated with multimedia elements.

During the creation of multimedia projects, it is necessary to modify properties like appearance, placement, size, time duration and other animation-related items. It is known as editing an icon.

To edit an icon, perform the following steps.

1. Select the icon by clicking on it.
2. Now you can see the properties of the selected icon at the bottom of the screen in the properties panel.
3. Change the displayed properties like contents, sound, color, etc. as per your need.
4. After making the changes, you can run and pause the project to see the edited icon. If you are still not satisfied with the modifications, you can re-edit the icon.

Activity 4.6

Answer the following activities in a group.

1. Explain the term icon.
2. Summarize the basic software that is available in the market for multimedia authoring.
3. Explains how much multimedia projects are interactive.

KEY CONCEPTS

- ✍ **Multimedia authoring** is the process of assembling different types of media contents like text, audio, image, animations and video as a single stream of information with the help of various software tools available in the market.
- ✍ **Authoring** is the process of creating multimedia applications.
- ✍ **Multimedia authoring tools** give an integrated environment for joining different elements of a multimedia production together. It gives the framework for organizing and editing the components of a multimedia

4.6 Multimedia Editing

Brainstorming

1. What do you think is multimedia editing?
2. What is the role of a multimedia editor?

Multimedia editing is a broad term that covers the creation and manipulation of **digital audio-visual files such as image, audio and video files**. It can also include elements such as animation and graphics.

4.6.1 Inserting and Editing Text

Inserting display icons

Display icons are those icons that display some images or graphics. These are available in the form of various items such as symbols, tools, figures and text. These are available individually or in combinations, so you can use them the way you want. The processes of inserting display and graphic icons are similar.

Inserting text into a text field

To insert a text, perform the following steps.

1. Open a new project file.
2. Click on the Text Tool button.
3. Click and drag a text field in the work area.

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- Type the desired text and click anywhere in the work area to deactivate the text field.

Figure 4.15 shows a text inserted in the new project.

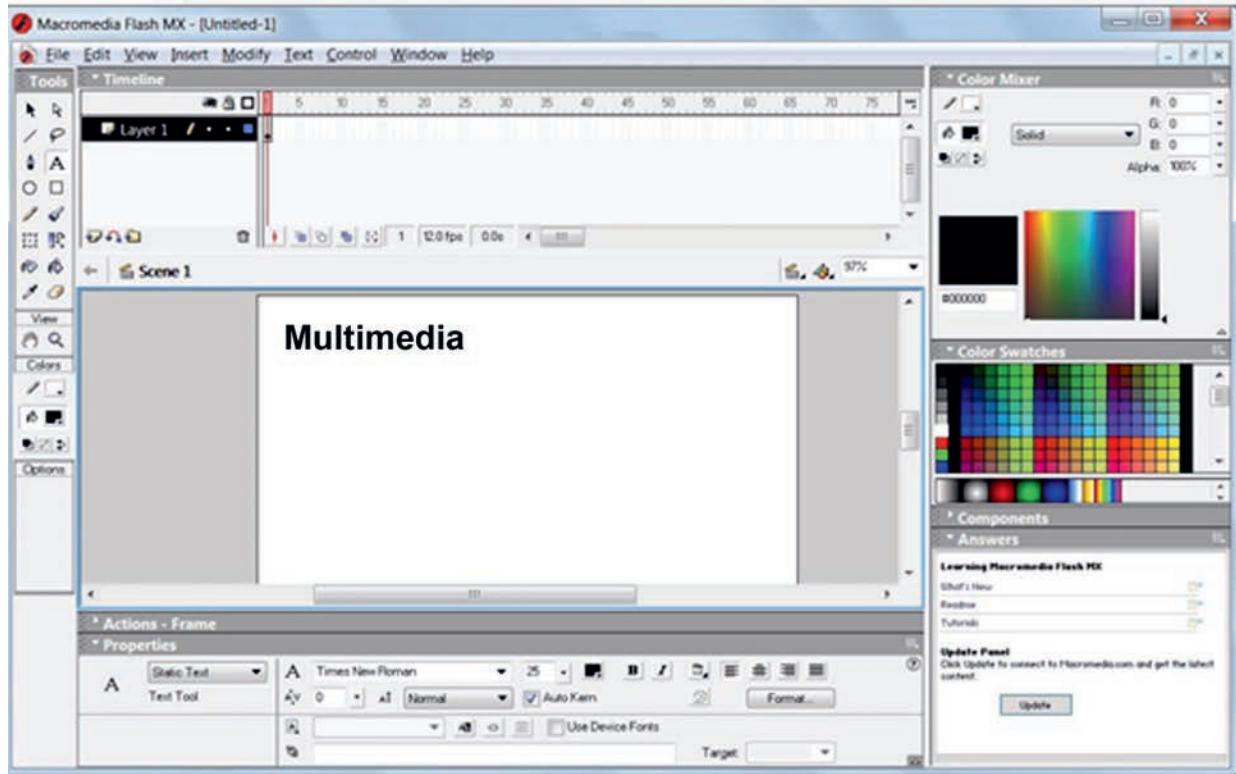


Figure 4.15 Inserting text

Importing and pasting text

To import a file, perform the following steps.

- Open a new project.
- Click File → Import. The Import dialog box opens.
- Select the desired file and click Open.
- The selected file will be imported into the work area.

To paste the text, perform the following steps.

- Open a new project.
- Select and copy the desired text from the document you want.
- Now return to your project file and click Edit → Paste or press Ctrl + V.

The selected text will be pasted into the project file.

Defining and applying text style

To define and apply text style, perform the following.

1. Click on the Text Tool button.
2. From the Properties tool panel (See figure 4.16) lying below the work area, set your desired Text type, character position, Character Spacing, etc.



Figure 4.16 Properties tool panel

3. Now, draw the text field by using click and drag, and enter your text. The text style will be applied to the text.



If the Properties panel is not displayed, then select the Text Tool, right-click on the work area and click on Properties.

Editing and formatting text as required

To edit and format a text, perform the following steps.

1. Click on the text field and edit the text you want.
2. Select the text entered in the text field and set the desired font, alignment, color, etc. from the Properties tool panel (See figure 4.17).

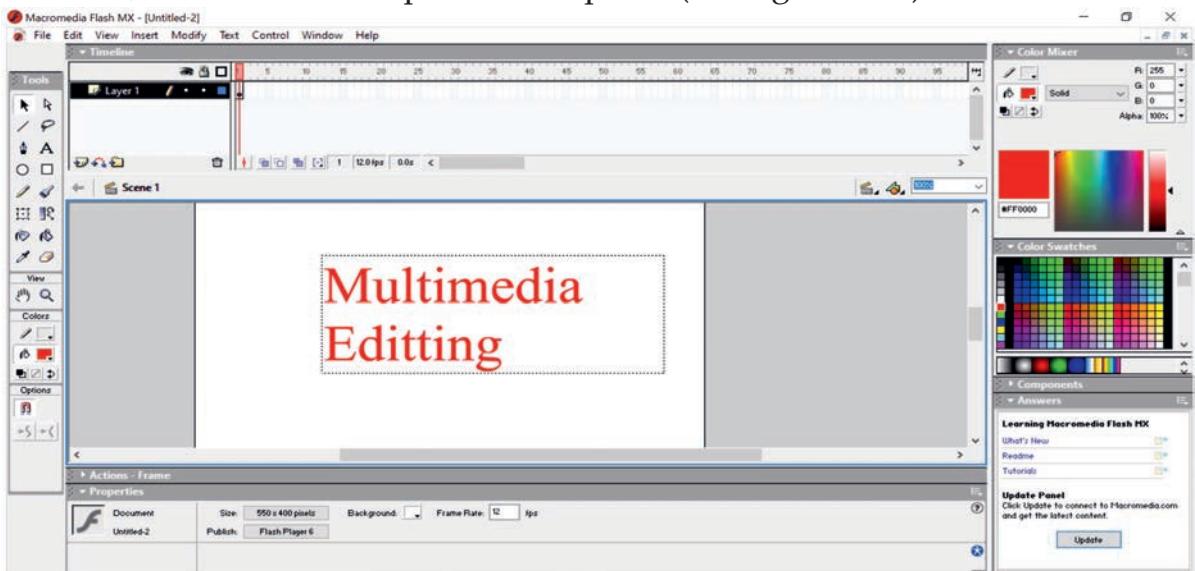


Figure 4.17 Editing and formatting text

4.6.2 Working with Images and Graphics

In this sub-unit, we will learn about working with images and graphics.

Importing and pasting image or graphic

To import an image, perform the following steps.

1. Click on File → Import.
2. The Import dialog box opens.
3. Select the image you want to import and click Open. The image file will be imported to your project (See figure 4.18)

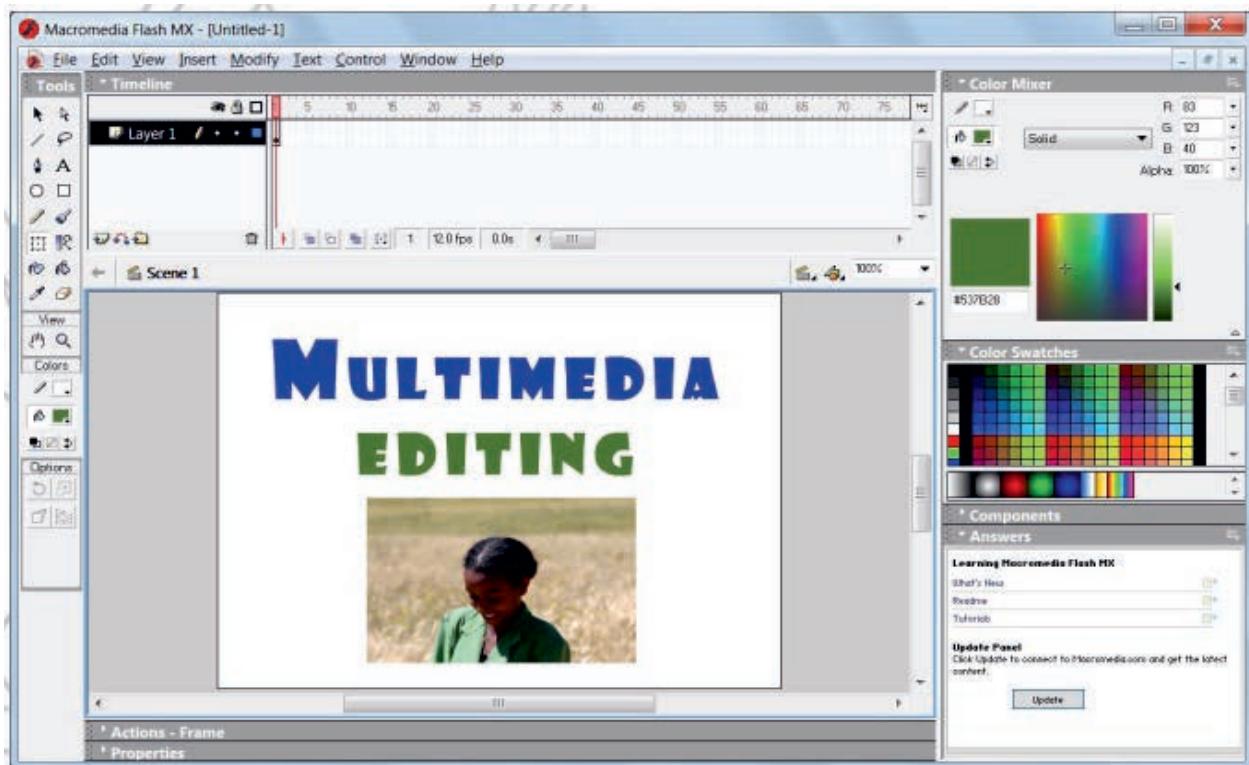


Figure 4.18 Importing an image

To paste an image, perform the following steps.

1. Copy the desired image you want to paste.
2. Click Edit → Paste or Press Ctrl+V to paste the image.
3. The image will be pasted into your project.

Modifying an image or graphic

To modify the image or graphic, perform the following steps.

1. Select the image by clicking on it.
2. Click on Free Transform Tool button in the toolbox. A boundary box will be applied to the image or graphic.
3. Now, in the options panel, select the operation (Rotate and Skew, Scale, Distort or Envelope). The desired operation will be applied to the image or graphic.

Practical Exercise 4.1

Complete the following exercises.

1. Record any event in your local area and edit it using a relevant multimedia editing tool. Then save it on C drive with the name My Video.
2. Write half page of your biography and edit it using a text editor. Save it on the desktop with the name Bio and observe its file extension.
3. Capture your selfie image and edit it using an image editor and save it on your desktop with the name Selfie.

4.6.3 Page Transitions, Positioning and Motion icon

In this sub-unit, we will discuss page transitions, positioning and motion icons. Here, we will use Adobe Premiere Elements 9. It is one of the premier software for working with sounds and digital movies.

To open Adobe Premiere Elements 9,

Click Start → Programs → Adobe Premiere Elements 9

Figure 4.19 shows the opening screen of Adobe Premiere Elements 9.

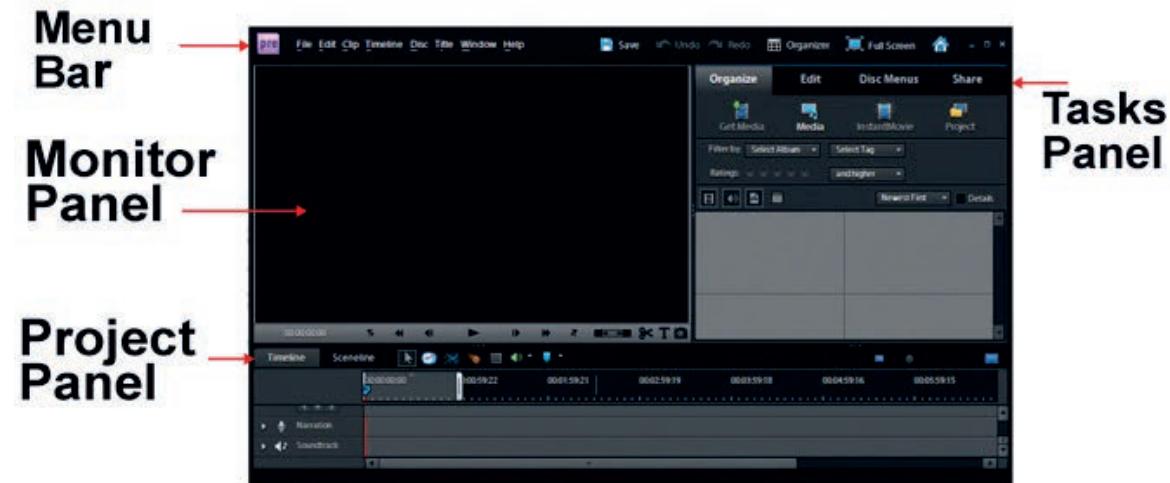


Figure 4.19 Opening screen of Adobe Premiere Elements 9

a. Transitions

Transitions let you add effects to phase out one clip and phase in the next, and then preview the transition before applying it. You can customize audio and video transitions as gradual fades or have one clip replace another.

Using transitions, you can phase out one clip while phasing in the next or you can stylize the beginning or end of a single clip. A transition can be as subtle as a cross dissolve or emphatic such as a page turn or spinning pinwheel.

You generally place transitions on a cut between two clips, creating a double-sided transition. However, you can also apply a transition to just the beginning or end of a clip, creating a single-sided transition such as a fade to black. When a transition shifts from one clip to the next, it overlaps frames from both clips. The overlapped frames can either be frames previously trimmed from the clips (frames just past the In or Out point at the cut) or existing frames repeated on either side of the cut. It is important to remember that you do not delete frames when you trim a clip; instead, the resulting In and Out points frame a window over the original clip. A transition uses the trimmed frames to create the transition effect or the transition repeats frames if the clips do not have trimmed frames.



To see if a transition is single-sided or double-sided or has repeated frames, select it and click Edit Transition in the Transition view of the Task panel to view it in the Properties view.

Selecting transitions

There are many transitions to choose from that come with Adobe Premiere Elements 9. First-time filmmakers tend to overuse this feature. They only add a transition when it makes sense; otherwise, they tend to distract from the video. Add transitions after editing and before adding the soundtrack.



Figure 4.20 Selecting transitions

You can select the desired transition effect by clicking Edit → Transitions. Figure 4.20 shows various types of transitions effects.

b. Positioning objects

You have full flexibility in adjusting an object's position, rotation, scale and opacity - attributes collectively referred to as transform properties. To transform an object, you can drag it into the Monitor panel or choose a command from the title menu.

Types of position

You can choose among different types of positions of transition effect like Start, End, Centre, etc. from the Transition properties window. It can be opened by clicking on the Edit Transition button.

Types of motion

We can customize different types of motion by using different drawing tools such as Line Tool, Oval Tool, Rectangle Tool and Lasso Tool. Figure 4.21 shows zig-zag motion.

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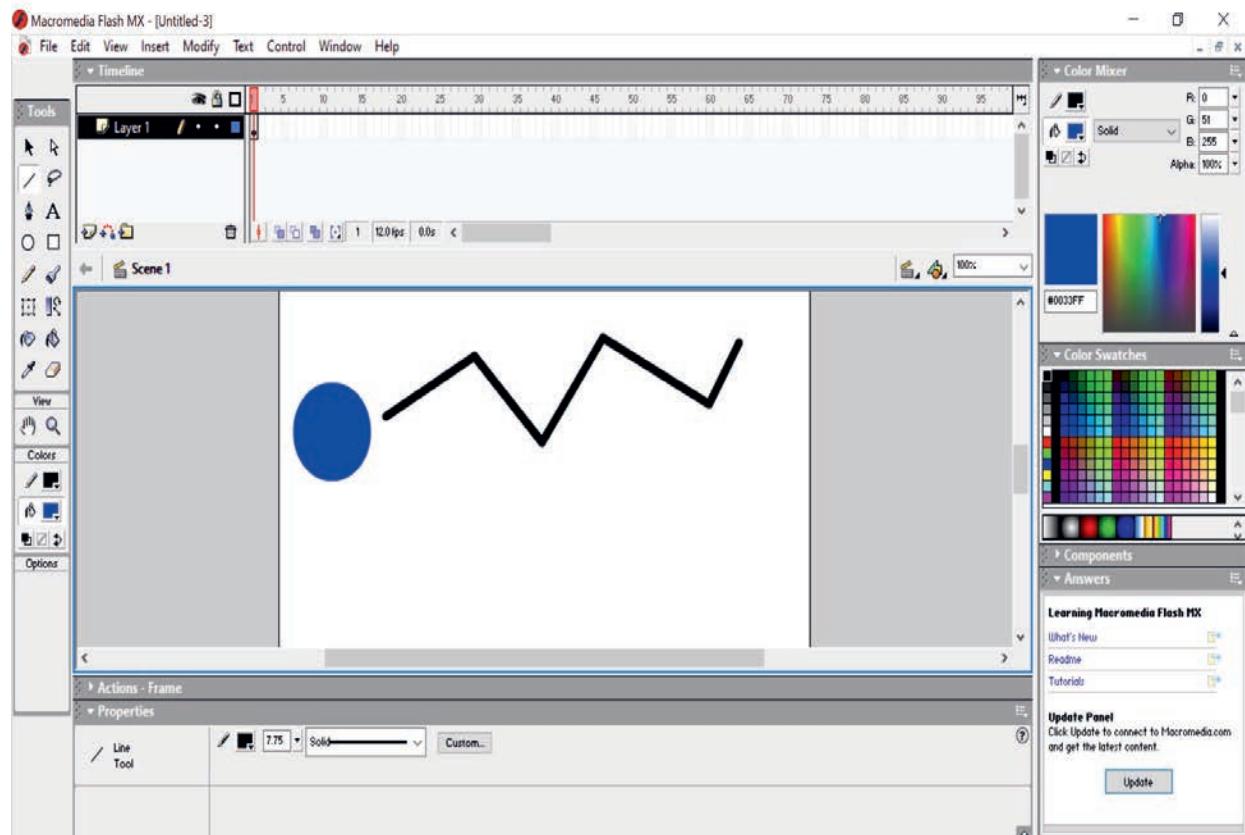


Figure 4.21 Zig-zag motion using Line Tool

c. Using motion Icon

Motion is a special layer effect that an object shows during its movement. Creating a motion is quite simple in Macromedia Flash MX. We can generate the motion effect by creating a guide layer.

To use the motion icon in Macromedia Flash MX, perform the following steps.

1. Create a graphic symbol or drag a pre-existing graphic symbol from the library onto the stage. Name the layer as Graphic.
2. Right-click on the Graphic label and select Add Motion Guide from the pop-up window (See Figure 4.22).

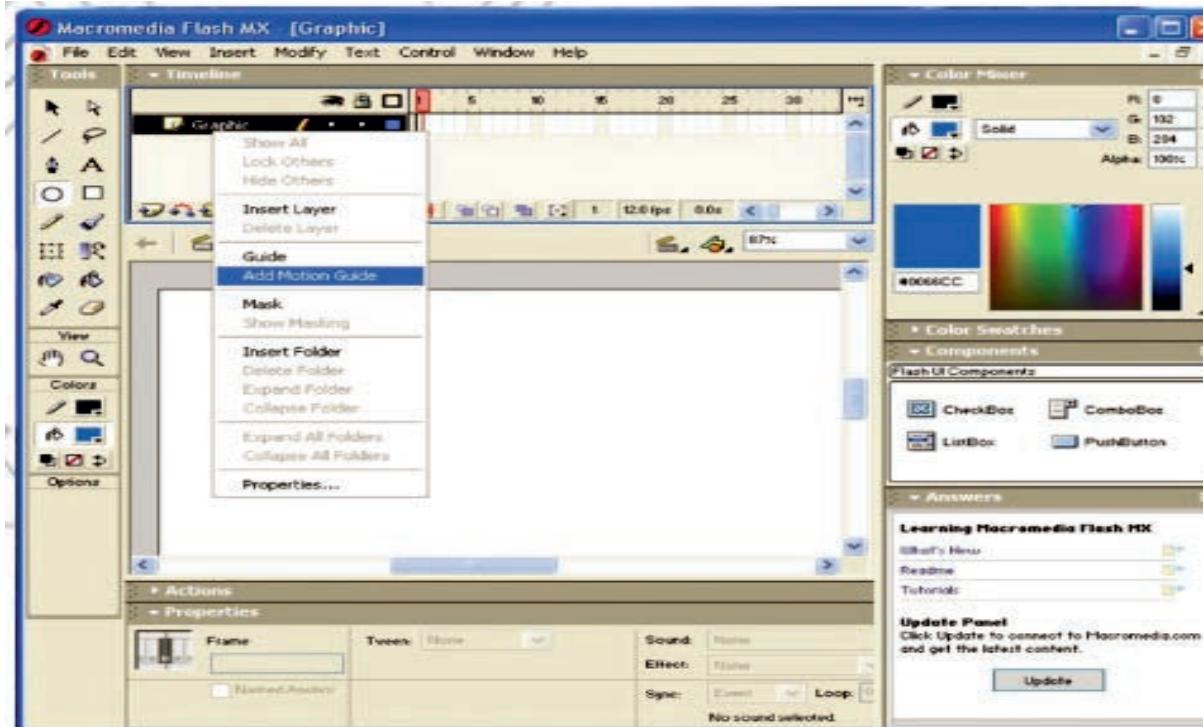


Figure 4.22 Adding motion guide to the selected layer

A new layer will appear on the top of the graphic layer with the label guide: graphic along with the guide icon.

3. Draw the path for your symbol in this new layer using a pencil or line tool.
For example, draw a circle.
4. Select frame 60 of the guide layer and press F5 to insert the frames (See Figure 4.23).

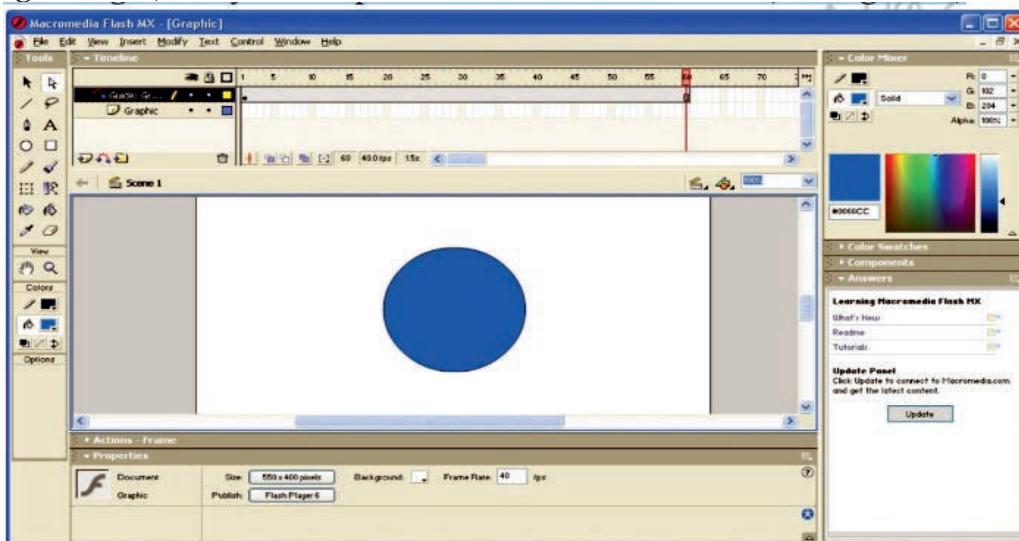


Figure 4.23 Inserting frames

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5. Now go to Frame 1 of the Graphic layer and drag your symbol to one end of your path.
6. While dragging, you will see a bubble on the symbol. That bubble should go right below the path.
7. Now go to Frame 60 of the graphic layer and press F6 to insert a new key frame.
8. Now drag your symbol to another end of your path. Again, the bubble should go right below the path.
9. Select any frame between 1 and 60 of your graphic layers. Right-click and select Create Motion Tween from the pop-up menu (See Figure 4.24).

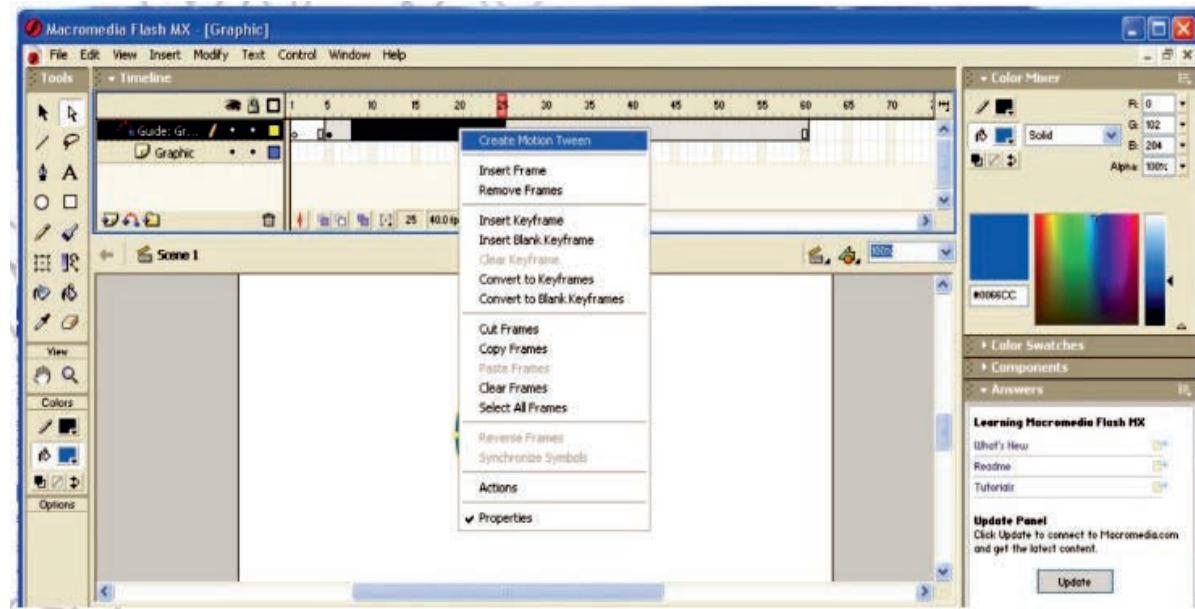


Figure 4.24 Creating Motion Tween

10. Press Ctrl + Enter to view your work.

4.6.4 Libraries

The multimedia library contains visual and audio elements (icons) required for developing new multimedia contents. The contents are often in the form of audio and video files. To ensure full access, the users must have appropriate software to view the multimedia files.

Creating

You can use the sample libraries included with Flash to add symbols, buttons or sounds to your documents. You can also create your sample libraries, which you can then use with any documents that you create.

To create a sample library for your Flash application, perform the following steps.

1. Create a Flash file with a library containing the symbols that you want to include in the permanent library.
2. Place the Flash file in the libraries folder located in the Flash application folder on your hard drive.

Saving

We can save our information to the Flash application library so that it is available for future use.

To save the information, perform the following steps.

1. Click File → Save As

The Save As dialog box opens (See Figure 4.25).

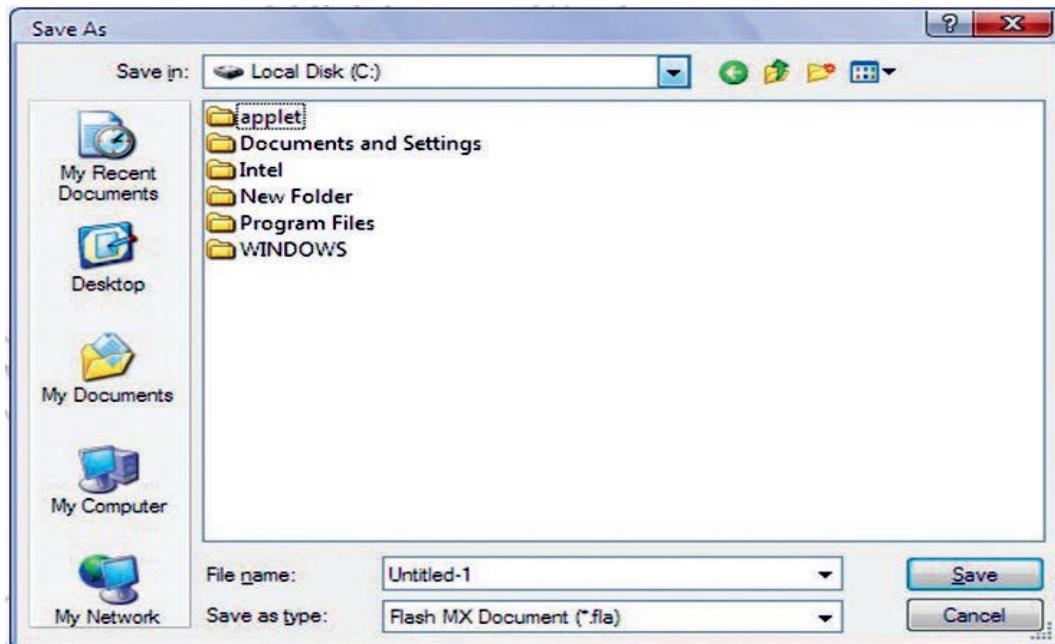


Figure 4.25 Save As dialog box

2. Identify the location where you want to save the file.
3. Give a suitable file name and click Save.

Opening and closing

Opening the Library

To open a library, perform the following steps.

1. Click File → Open as Library

The *Open as Library* dialog box appears (See Figure 4.26).

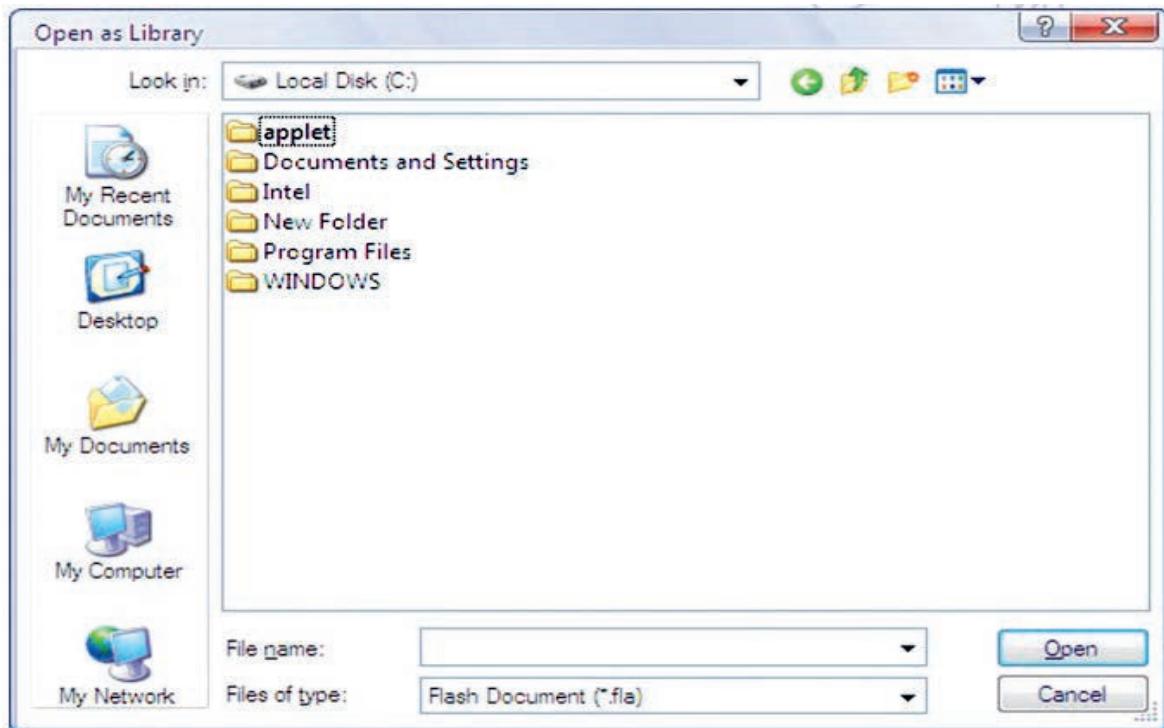


Figure 4.26 Open as Library dialog box

2. Browse the library file and click Open

Closing the library

To close the library,

Click File → Close or press Ctrl + W.

Another way of closing the library is to exit the application or opening another library file.

Selecting a library

When the Open as Library dialog box opens, you can select the desired library file.

Adding icons to the library

To add an icon to the library, perform the following steps.

1. Open a library file.
2. Click File → Import or press Ctrl + R.
3. The Import dialog box will open.
4. Choose the desired icon file and click Open.
5. An icon for that file will be added to the library

Using an icon from a library

To use an icon from a library, perform the following steps.

1. Open the library file.
2. Select the desired icon from the library by double-clicking it.

4.6.5 Working with Sound and Digital Movies

Sound icon

The sound icon is the graphical representation of inserted or available audio files in a project or library. Figure 4.27 shows a sound icon.



Figure 4.27 Sound icon

Importing sound

You can import various sounds into the project.

To import a sound file, perform the following steps.

1. Click Organize → Get Media → Files and Folders.

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The Add Media dialog box opens.

2. Browse the audio file you want to import and click Open.
3. The selected audio file will be imported into the project (See Figure 4.28).

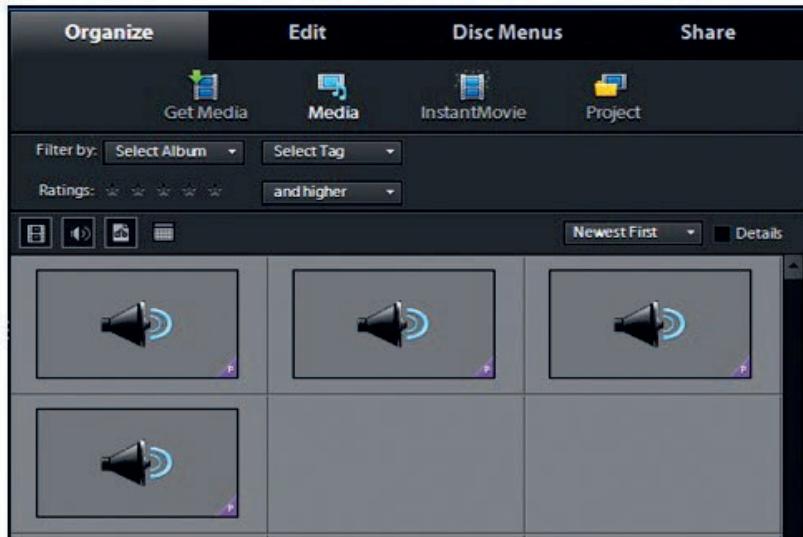


Figure 4.28 Imported sound

Changing sound's play speed

To change a sound's play speed, perform the following steps.

1. Drag the imported audio file to the Timeline (See Figure 4.29).

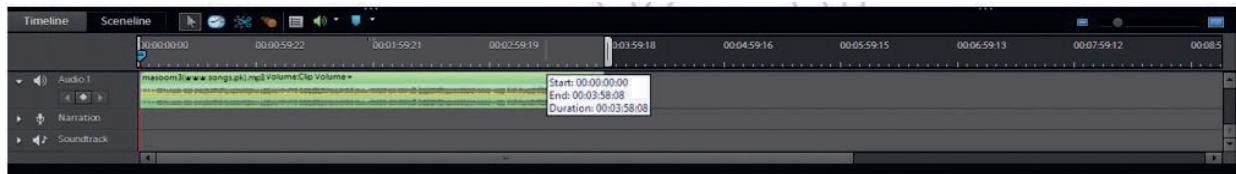


Figure 4.29 Dragging sound to the Timeline

2. Right-click on the imported sound waveform and click Time Stretch.
3. The Time Stretch dialog box opens (See Figure 4.30).

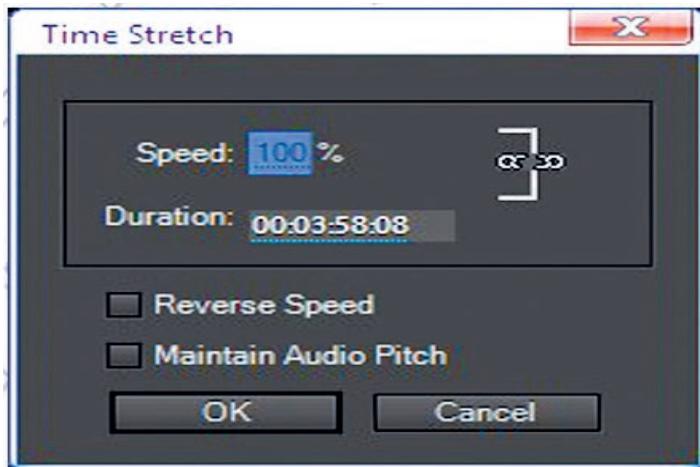


Figure 4.30 Time Stretch dialog box

- Set the playback speed and click OK.

Working with digital movies

Digital video is a type of video recording system that works by using a digital rather than an analog video signal. We can work on digital movies using Adobe Premiere. It allows various operations such as trimming, motion audio enhancing and adding transition effect.

File formats

Adobe Premiere supports several file formats for audio and video files such as MP3, MP4, AVI, MPG, WAV and WMV.

Importing digital movie

To import a digital movie, perform the following steps.

- Import your digital media clip or movie by clicking Organize → Get Media → Files and Folders.
- Browse the video file and click Open.
- The selected video file will be imported to your project (See Figure 4.31).

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Figure 4.31 Imported video

Setting playback conditions

We can set various playback conditions from the audio properties such as Fade In, Fade Out, Bypass, Balance, Time Duration, Toggle, Repeat and Clip Volume. To open an audio properties dialog box, right-click on the dragged audio file in Timeline and click Show Properties (See Figure 4.32).

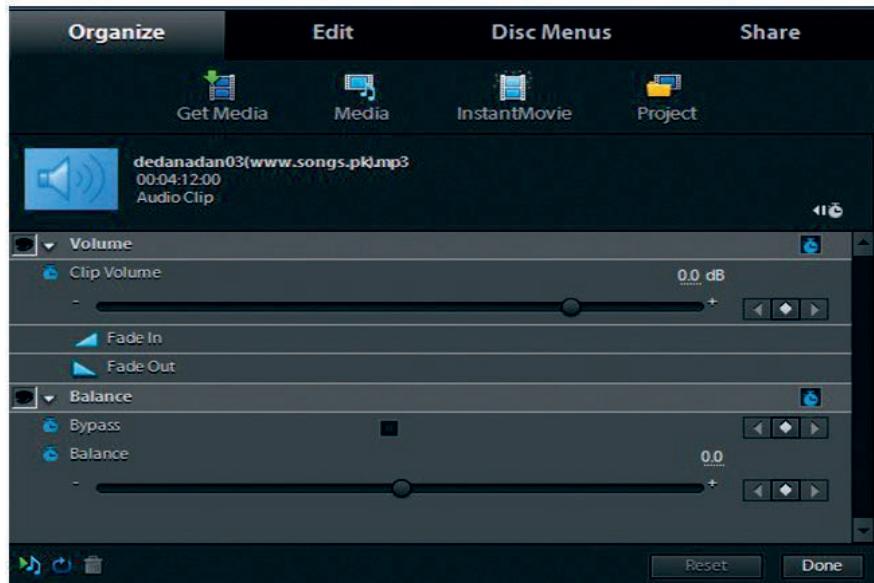


Figure 4.32 Setting playback conditions

Turning sounds off

To turn a sound off, perform the following steps.

1. Open the audio properties dialog box by right-clicking on the dragged audio file in Timeline and clicking Show Properties.
2. Toggle the Volume effect by clicking on the toggle button (See Figure 4.33).



Figure 4.33 Turning the sound off

4.6.6 Overview of Film Editing

Basics of film editing

The process of editing clips includes previewing and trimming them to eliminate unnecessary material. It also includes revising clip properties such as speed, direction and duration. You can edit media clips generated by other programs in their original applications, within Adobe Premiere elements.

Trimming video clips

You can create a refined good-quality video file by removing unwanted and low-quality sections. Adobe Premiere Elements 9 enables you to efficiently deal with blurred, shaky and unwanted low-quality and low-interest sections of your video file. You can easily and quickly edit and fine-tune the video files.

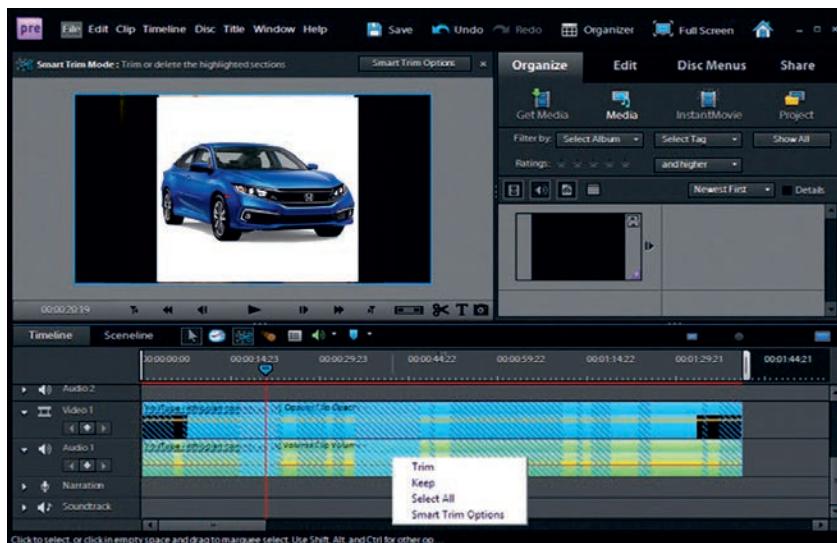


Figure 4.34 Trimming a video clip

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Smart trimming enables you to trim the low-quality sections of a video file. Smart trim can be done manually and automatically. You can trim clips from the Timeline view or scene line view. However, you can trim only one clip at a time from the scene line view. Smart trimming is of two types: manual and automatic.

- Manual smart trimming is the default mode. In this mode, you can specify the options that determine the trimmable sections.
- In the automatic smart trim mode, the adobe premiere elements automatically determine the trimmable sections and you can choose to delete them or retain them. Figure 4.34 shows the trimming of a video clip.

Changing clip speed and duration

Changing clip speed

To create a fast- or slow-motion effect, we can change clip speed. Changing clip speed changes, the clip's duration. Speeding up a clip removes frames, thus shortening the clip duration. In the same way, slowing down a clip repeats frames and thus adds to the length of a clip. For audio clips, the change in speed also changes its pitch. The time-stretch command includes an option to maintain the original pitch of an audio-clip at any speed.

You can change a clip's speed using the Timeline only - not the Scene line.



When you change the speed of a clip containing interlaced fields, you may need to adjust how adobe premiere elements process the fields, especially when the speed drops below 100% of the original speed.

Setting clip duration

The duration of a video or audio clip is the length of time it plays from its first frame (in point) to its last frame (out point). The initial duration of a clip is the same as it was when the clip was imported or captured. Most often, you change a clip's duration by trimming frames from either ends. But you can also trim the end of a clip by designating a specific duration.

Unlike video, still, images are not limited to the length of the original clip. You can set their duration to any length.

Freezing and holding frames

Exporting a video frame

You can grab a single frame from a video clip to use as a still image in your current movie or save it as a still on your hard drive for use elsewhere. For example, you can use a still image in your movie to show a character starting an action, but then stopping mid-action, frozen on the screen.

Playing and holding a frame

To make the video started as a still image and then begin to play, you need to click the Freeze Frame button in the Monitor panel to create a still image from a frame, and then insert that still image at the location of the original frame. Figure 4.35 shows a freeze-frame.

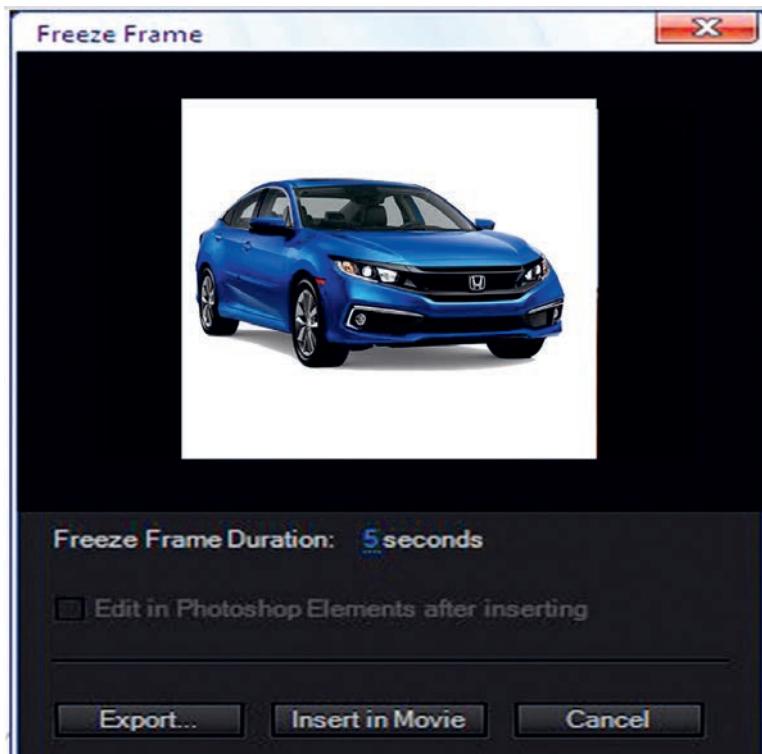


Figure 4.35 Freeze frame

Practical Exercise 4.2

Practice the following exercises in a group.

1. Create any video clip you like.
2. Trim your video clip.
3. Set duration of a clip.
4. Freeze frame and demonstrate it to your class.

Multimedia and hypermedia

Multimedia is a much broader form of digital media defined as an integration of different forms of content such as text, pictures, graphics, audio, animations and video where the information is processed digitally. In simple terms, it is the representation of content using multiple forms of media through computer software and hardware.

Hypermedia, on the other hand, is a more diverse, non-linear form of digital media. It is an extension of the term hypertext in a non-linear way, meaning it is multimedia presentation of non-linear forms of media which are linked together by a hypertext program. The best example of hypermedia is **World Wide Web**.

Activity 4.7

Answer the following activities accordingly in a group.

1. Explain and demonstrate the difference between multimedia and hypermedia.
2. Describe forms of computer animation.
3. Explain some of the animation software.
4. Draw any figure you like and animate it using an animation tool: then save it on your desktop with the name Animation.
5. Discuss the advantages of computer animation.

KEY CONCEPTS

- ✍ Multimedia authoring involves collating, structuring and presenting information in the form of digital multimedia, which can incorporate text, audio, and still and moving images.
- ✍ Multimedia authoring tools are the tools that are used for creating various types of multimedia applications.
- ✍ Display icons are the ones that display some images or graphics.
- ✍ The wait icon provides a way to pause or delay any onscreen action. Delay can be a set time interval or may require a mouse click to continue.
- ✍ The multimedia library contains visual and audio elements (icons) required for developing a new multimedia content.
- ✍ The process of editing clips includes previewing and trimming them to eliminate unnecessary material and revising clip properties such as speed, direction and duration.

4.7 Unit Summary

Multimedia is a representation of information attractively and interactively with the use of a combination of text, audio, video, graphics and animation. Multimedia is very useful in education, training, marketing, advertising, product demos, databases, catalogs, entertainment, and networked communications.

Multimedia authoring involves collating, structuring and presenting information in the form of digital multimedia which can incorporate text, audio, and still and moving images. Multimedia authoring tool is a program that helps you write hypertext or multimedia applications. Authoring tools usually enable you to create a final application merely by linking together objects such as a paragraph of text, an illustration or a song.

Most authoring systems support a scripting language for more sophisticated applications. Authoring tools require less technical knowledge to master and are used exclusively for applications that present a mixture of textual, graphical and audio data.

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Multimedia files can be presented in several formats such as text, image, and digital audio and video. Multimedia editing is a broad term that covers the creation and manipulation of digital audio-visual files such as image, audio and video files. It can also include elements such as animation and graphics.

Computer animation is the art of creating moving images via the use of computers. It is a subfield of computer graphics and animation. Computer animation is essentially a digital successor to the art of stop-motion animation motion of 3D models and frame-by-frame animation of 2D illustrations.

4.8 Unit Review Exercise

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

1. The text can have various types of fonts and sizes to suit the professional presentation of the multimedia software.
2. A Multimedia application is an application that uses a collection of single and unique media sources.
3. Multimedia authoring is the process of assembling different types of media contents, like text, audio, image, animation and video, as a single stream of information.
4. In multimedia packages, using pre-stored libraries, creating libraries, and adding and using icons is not possible.
5. Macromedia Authorware, Adobe Premier, and Macromedia Flash are multimedia packages.

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

1. _____ is a computerized method of presenting information combining textual data, audio, visuals (video), graphics and animations.
 - A. Multimedia
 - B. Multiprocessor
 - C. Multithreading
 - D. Word processor

2. Which one of the following is not feature of multimedia authoring tools?
 - A. Editing
 - B. Organizing
 - C. Interactivity
 - D. Complex branching
3. Which of the following is the common area of applications of multimedia?
 - A. Marketing and advertising
 - B. Entertainment
 - C. Home
 - D. All of the above.
4. TIFF stands for _____.
 - A. Transitional Image File Format
 - B. Total Inclusion File Format
 - C. Tagged Interchange File Format
 - D. Temporary Instruction File Format
5. Which of the following hardware is used in the multimedia authoring tools?
 - A. Computer
 - B. Scanner
 - C. Sound recorder
 - D. All of the above.
6. _____ is a broad term that covers the creation and manipulation of digital audio-visual files such as image, audio and video.
 - A. Multimedia authoring
 - B. Multimedia production
 - C. Multimedia presentation
 - D. All of the above.

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7. _____ is the most popular format for storing and downloading music.
- A. AIFF (Audio Interchange File Format)
 - B. MPEG Layer-3
 - C. WMA (Windows Media Audio)
 - D. RA (Real Audio)
8. _____ is the art of creating and moving images via the use of computers.
- A. Computer animation
 - B. Computer image edition
 - C. Computer graphics
 - D. Computer movie maker
9. The best example of hypermedia is _____.
- A. world wide web
 - B. hardware
 - C. printout
 - D. None of the above.

Part III: Discuss the following questions.

1. Define multimedia and explain its components.
2. List and explain the stages of multimedia authoring.
3. Explain the role of the multimedia editor.
4. Discuss the benefits of multimedia edition.
5. Identify screen elements of the multimedia application Macromedia Flash shown in Figure 4.36.

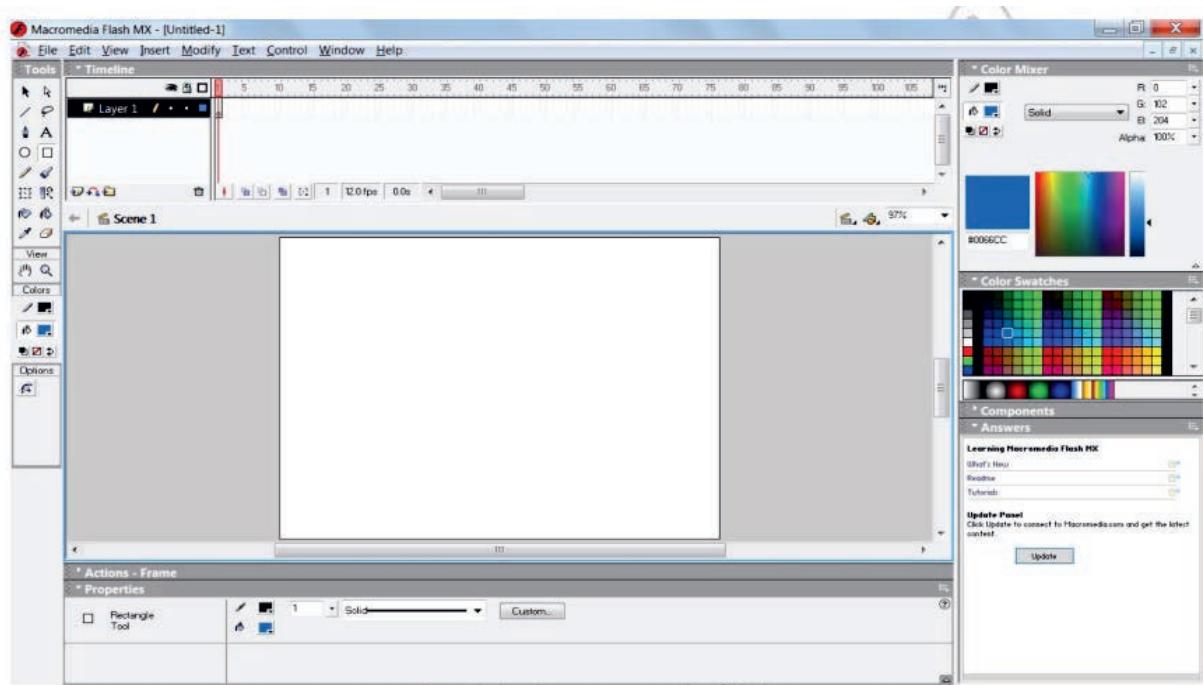


Figure 4.36 Macromedia flash

6. Stretch the steps used to import sound files.
7. Write a short note on the basics of film editing.

UNIT

5

INFORMATION AND COMPUTER SECURITY

UNIT OUTCOMES

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

- Explain information security.
- Apply steps to install antivirus software.
- Create and change user account in their computers.
- Explain privacy and security.
- Analyze cyber security.

5.1 Unit Overview

In grade 9, you learned basic concepts of information and computer security. You know that computer viruses can corrupt and damage computers. Viruses can also open security breaches on a computer that allows yet another threat, hackers, into the computer system. It is known that simply by the fact of having our school or home computers connected to a network and on the Internet are exposed to several information and computer security risks. Figure 5.1 show that networking of computers exposes information and computer security.



Figure 5.1 Networking of computers

In this unit you are going to learn advanced concepts on information security, computer security, impact of information and computer security on society, privacy and security, threat prevention strategies and cyber security.

5.2 Information and Computer Security

Brainstorming

1. What does it mean by information security?
2. Why do you think we need to secure our data and computers?

Information Security

Information security is one of the most important and exciting career paths today all over the world. Information security is simply referred to as **InfoSec**, which is the practice of defending information from unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction.

Computer Security

Computer security, also known as cyber security, is about information security as applied to computing devices such as computers and smartphones as well as computer networks such as private and public networks including the whole Internet. It is a method for ensuring data that has been stored in computer systems could not be read or compromised by any individuals without authorization. Traditionally, information technology (IT) facilities have been protected for three reasons:

- To prevent theft of or damage to the hardware.
- To prevent theft of or damage to the information.
- To prevent disruption of service.

Activity 5.1

Answer the following activities individually.

1. Summarize the problems of unsecured information and computer.
2. Explain how computer network relates to information and computer security risks.

3. Describe what will happen if your school network lacks availability?
4. Explain the advantages of protecting information technology (IT) resources in school.

5.3 Impact of Information and Computer Security on Society

Brainstorming

1. What does it mean by information or computer security?
2. Where do information and security risks arise from?

Information and computer security risks arise from the intentional or unintentional misuse of computers and network resources as well as the Internet. These risks may result in the loss of or damage to computer hardware, software, confidential information and data integrity as well as network and Internet availability.

Hackers can do several things from stealing your passwords to controlling your computer through remote access. So, every student and another computer user must know about information and computer security. Remember that violation of information and computer security is punishable.

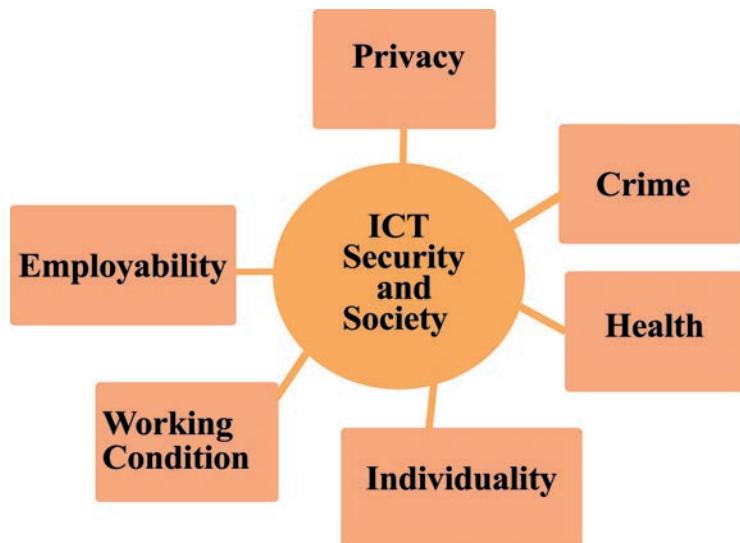


Figure 5.2 Impacts of information and computer security on a society

All of us must make sure that we are aware of the security risks and develop the ability to know what to do in different situations. Figure 5.2 shows the impact of information and computer security on society.

Activity 5.2

Discuss the following activities in a group.

1. Discuss how information and computer security influence community.
2. Discuss the consequences of violation of information and computer security.
3. Explain the importance of securing your computer.

KEY CONCEPTS

- ☞ **A Hacker** is a person who uses computers to gain unauthorized access to data.
- ☞ **Information security (referred to as InfoSec)** is the practice of defending information from unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction.
- ☞ **Computer security** is concerned with information security as applied to computing devices such as computers, smart phones and computer networks such as private and public networks, including the whole Internet.
- ☞ **Information and computer security risks** arise from intentional or unintentional misuse of computers, network resources and the Internet. These risks may result in the loss of or damage to computer hardware, software, confidential information and data integrity as well as network and Internet availability.

5.4 Privacy and Security

Brainstorming

1. Can you state what is meant by privacy?
2. Do you think that security and privacy are related to each other?

Unit 5 : Information and Computer Security

Privacy is concerned with safeguarding and respecting people's rights to manage their data in a broader sense. Individuals should have the right to access – if they ask for it – as well as the opportunity to modify or erase erroneous information about themselves that firms maintain in databases according to privacy activists.

Privacy, like security, is crucial because it prevents data. Security is concerned with information leaks caused by malware infections and data breaches whereas privacy is concerned with personal data rights in terms of how information is acquired, utilized and maintained as well as who has access to it.

5.4.1 Data Privacy

Data privacy or information privacy is concerned with proper handling, processing, storage and usage of personal information. It is all about the rights of individuals concerning their personal information.



Figure 5.3 Data privacy

5.4.2 Data Security

Data security is concerned with measures that an individual or organization is taking to prevent any third party from unauthorized access.



Figure 5.4 Data security

Activity 5.3

Answer the following activities accordingly in a group.

1. Compare and contrast privacy and security.
2. Visit computer laboratory or any computer in use in your school. Observe the security mechanisms applied and report to your class.
3. Explain types of computers and information privacy.
4. Explain data privacy and security.
5. Discuss the practice of data privacy or security in a Google Gmail account.

KEY CONCEPTS

- ✍ **Privacy** is concerned with safeguarding and respecting people's rights to manage their personal data in a broader sense.
- ✍ **Security** is concerned with information leaks caused by malware infections and data breaches whereas **privacy** is concerned with personal data rights in terms of how information is acquired, utilized and maintained as well as who has access to it.
- ✍ **Data privacy** or information privacy is concerned with proper handling, processing, storage and usage of personal information whereas **data security** is concerned with policies, methods and means to secure personal data.

5.5 Computer Security Threats

Brainstorming

1. Can you describe the term security threat?
2. Can you mention any computer threat you have heard of before?

A **security threat** is a malicious act that aims to corrupt or steal data or disrupt school or organization systems. Security event refers to an occurrence during which school data or its network may have been exposed. An event that results in a data or a network breach is called a security threat. Some of the computer security threats are **computer viruses**, **computer worms**, **Trojan horses**, **spyware**, **adware** and **ransomware**.

Activity 5.4

Answer the following activities.

1. Explain the term *malware*.
2. Analyze types of computer security threats.
3. Summarize how your school or personal computers are exposed to malware.
4. Discuss the difference between computer viruses and computer worms.
5. Explain mechanisms to protect the computer security threat.

KEY CONCEPTS

- ✍ **Security threat** is a malicious act that aims to corrupt or steal data or disrupt a school's computer network or organization's systems. It is an event that results in a data or a network breach.
- ✍ **Security event** refers to an occurrence during which school data or its network may have been exposed.
- ✍ **Computer virus** is a malicious program which replicates itself and infects the files and programs of your PC and can make them non-functional.
- ✍ **Computer worm** is self-replicating computer program that spreads malicious codes using computer networks.

5.6 Threat Prevention Strategies

Brainstorming

1. Can you explain threat prevention?
2. Do you think that taking a backup of data is related to threat prevention strategies?

Several defensive strategies and tools have been developed to assist in preventing threats. These include encryption, firewalls, anti-virus software, biometric security, user identification and passwords, security monitors and disaster recovery.

Hence, threat prevention strategies could be categorized into two: **technical and non-technical**. Table 5.1 shows basic technical prevention strategies.

5.6.1 Technical Prevention Strategies

Table 5.1 Technical prevention strategies

Technical Prevention Strategy	Description
Taking data backup	Creating multiple copies of data to recover in case of any data loss using the external hard drive, CD, Flash memory or online data backup site, such as the cloud, in case of any data loss.
Installing protective electrical devices	Installing devices such as Uninterruptible Power Supply (UPS) that can provide battery backup in case of a power outage.
Installing antivirus and antispyware programs	When using the Internet, you might encounter spyware or virus, which causes great damage to your computer. It is important to install an antivirus and antispyware program that can prevent and remove the viruses.
Installing firewall	A firewall system prevents unauthorized access to a private network from network traffic. A firewall system forms a barrier between trusted and untrusted websites from threats like hackers and worms.
Encrypting data	Preventing lost, stolen or hacked documents and files from being seen.
Installing anti-virus software	Antivirus software is a type of program designed and developed to protect computers from malware like viruses, computer worms and spyware.
Creating and changing user account	A user account is a collection of settings and permissions specific to a user that determines what a user can and cannot do on the computer.

MS Windows computer has come up with a backup system.

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In Window, the path to locate the backup data option could be : Right click on the Start button → click on Control Panel → click on System and Security → click Backup and Restore → click Backup now

Activity 5.5

Discuss the following activities in a group.

1. Explain data backup mechanisms.
2. Explain the advantages of data backup.
3. Summarize online backup on the cloud.
4. Discuss advantages of online backup over other physical or external storages.
5. Explain the mechanisms of backup used in MS Windows and any saved data on your school computer.

KEY CONCEPTS

- ✍ **Cloud backup** is the service in which data and applications on a business's servers are backed up and stored on a remote server.
- ✍ **Spyware** is any software that installs itself on your computer and starts covertly monitoring your online behavior without your knowledge or permission. Spyware is a kind of malware that secretly gathers information about a person or an organization and relays this data to other parties.
- ✍ **Malware** (short for malicious software) is a file or code, typically delivered over a network, that infects, explores, steals or conducts any behavior an attacker wants virtually.

Firewall

A firewall is a network security device that monitors incoming and outgoing network traffic and decides whether to allow or block specific traffic based on a defined set of security rules.

A firewall program does not protect you from all viruses, so it is necessary to install an antivirus or antimalware application. Windows defender can help

you protect against viruses that the firewall does not protect from. Practice the following on your school or home computer.

1. Turn the Microsoft defender firewall on or off.
2. It is important to have Microsoft Defender Firewall on, even if you already have another firewall on. It helps you protect yourself from unauthorized access.
3. Select the **Start** Windows logo  button → **Settings**  Gear-shaped Settings icon → **Update & Security**  Circular arrows Sync icon → **Windows Security** and then **Firewall & network protection**. Open Windows Security settings.
4. Select a network profile.
5. Under **Microsoft Defender Firewall**, switch the setting to **on**. If your device is connected to network, network policy settings might prevent you from completing these steps. For more info, contact the computer's administrator.
6. To turn it off, switch the setting to **off**. Turning off Windows Defender Firewall could make your device (and network, if you have one) more vulnerable to unauthorized access. If there is an application you need to use that is being blocked, you can allow it through the firewall, instead of turning the firewall off.

Note: If you get errors or if the setting will not turn on, you can use the troubleshooter and then try again.

Activity 5.6

Briefly discuss the following activities in a group.

1. Discuss advantages of installing an antivirus program.
2. Explain ways of protecting your computer from malware.
3. Summarize the steps required to install firewalls on your computer.
4. Discuss the term encryption of data.
5. Explain the mechanism to encrypt data.
6. Mention stages to install antivirus software.
7. Explain the types of accounts that can be organized on your computer.

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Antivirus Software

Antivirus software is a type of program designed and developed to protect computers from malware like viruses, computer worms and spyware. Antivirus programs function to scan, detect and remove viruses from your computer.



Figure 5.5 Examples of antivirus software

Creating and changing user account

A user account is a collection of settings and permissions specific to a user that determines what a user can and cannot do on the computer. These settings are also used to protect the user's files and folders from access by another non-authorized person. In particular, a user account will determine **the files and folders a user can access and the changes a user can make to the computer**.

Types of User Account

Three types of user accounts that are available in Windows are described in Table 5.2 below.

Table 5.2 Types of user account

User Accounts	Description
Administrator	Administrators have access to everything on the computer, and can make changes to anything, such as installing software and changing security settings. When you first install Windows 10, the initial user account will be an administrator account. The administrator account can also create new users and manage user accounts.

Standard	Standard users will have limited ability to make changes to the computer, except for personalizing the computer, such as applying a screen saver or changing a theme. Standard users will not have access to other users' personal files and folders. Most computer users will be allocated a standard account.
Guest	Guest accounts exist for temporary users of a computer and only one guest account can exist on a computer. Guest accounts are similar to standard accounts, except there is no privacy, as anybody can log onto a guest account. The guest account provides access to installed programs but does not have permission to access data in other users' personal folders. Guest accounts are often used in internet cafes.

Checking User Account on Windows

Modification of user and administrator accounts can be done in Control Panel. Icons and language may differ slightly depending on the build version of Windows you are using.

- **Step 1 :** Click on the Windows icon and type Control Panel and click on the **Control Panel** application.
- **Step 2 :** Click User Accounts.

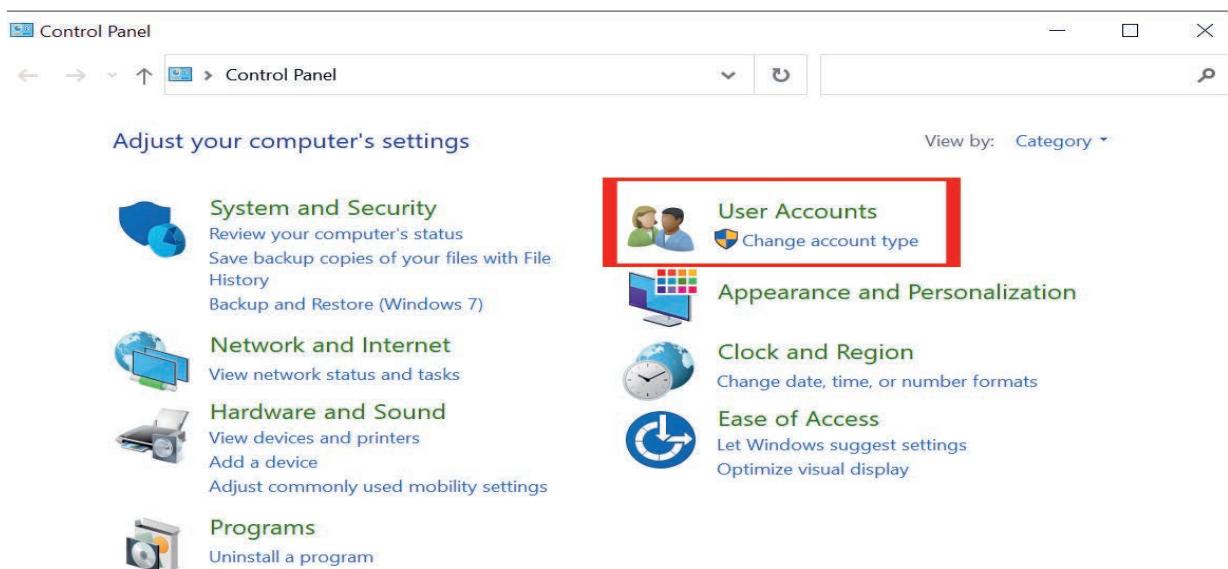


Figure 5.6 User accounts

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Note that you will need to be on or have access to an administrator account to make any of these changes. If you do not have access to this account or it is managed by a service provider, please contact the relevant local administrator or your service provider.

■ Step 3 : Select Add or Remove User Accounts options

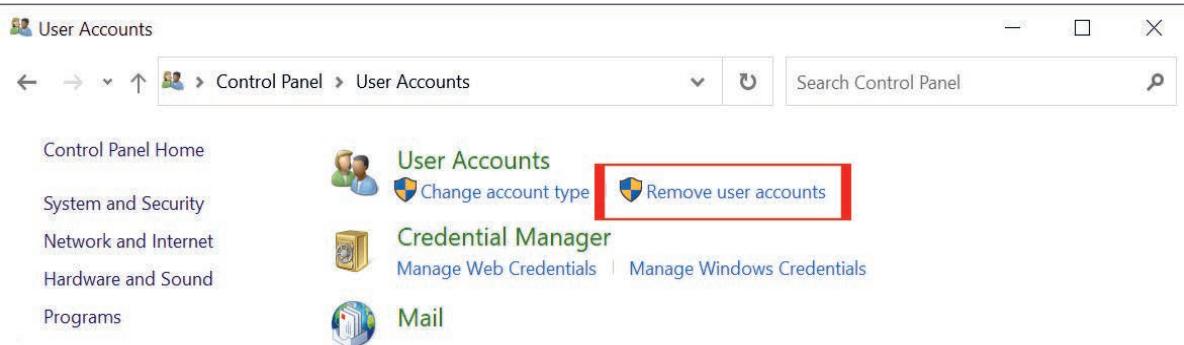


Figure 5.7 Add or remove account type

■ Step 4 : Check the existing accounts on your PC. You should only have one administrator account and your daily use account should not be the administrator account. All next steps start from here.

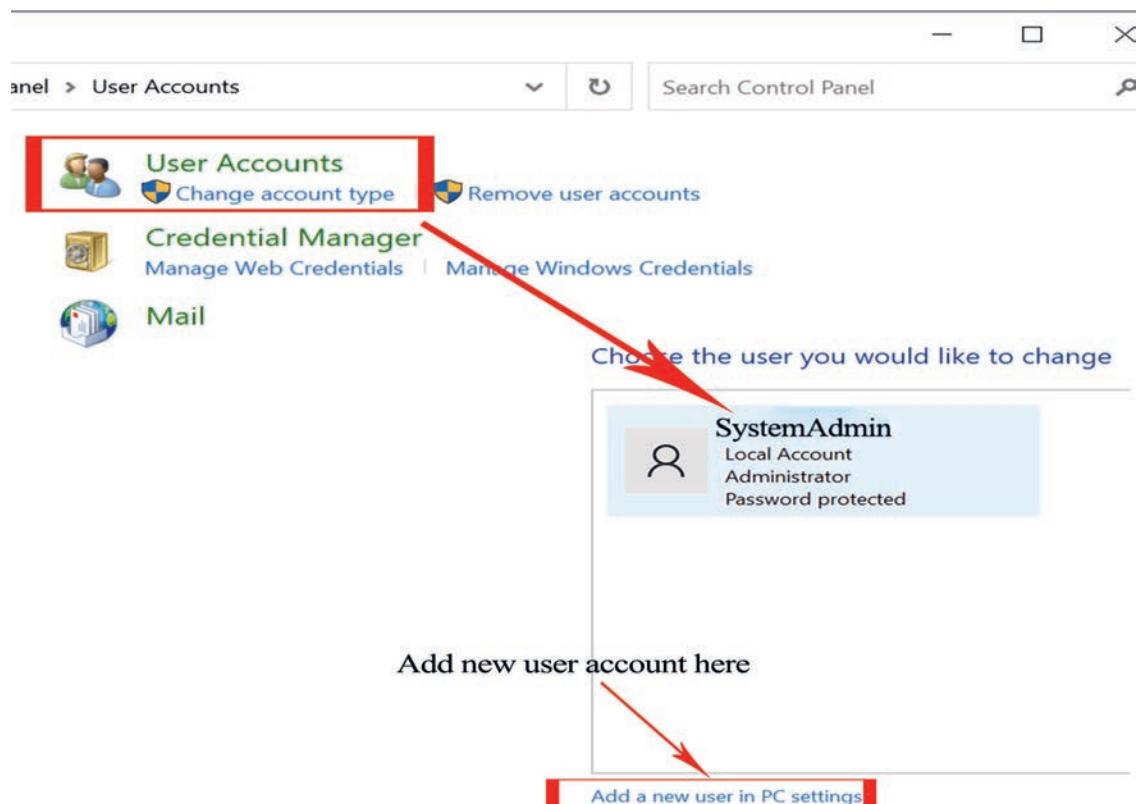


Figure 5.8 Administrator account

Create a New Account

To create a new account on your PC, follow the following steps.

- Click on Add a new user in PC setting, as shown in Figure 5.9.

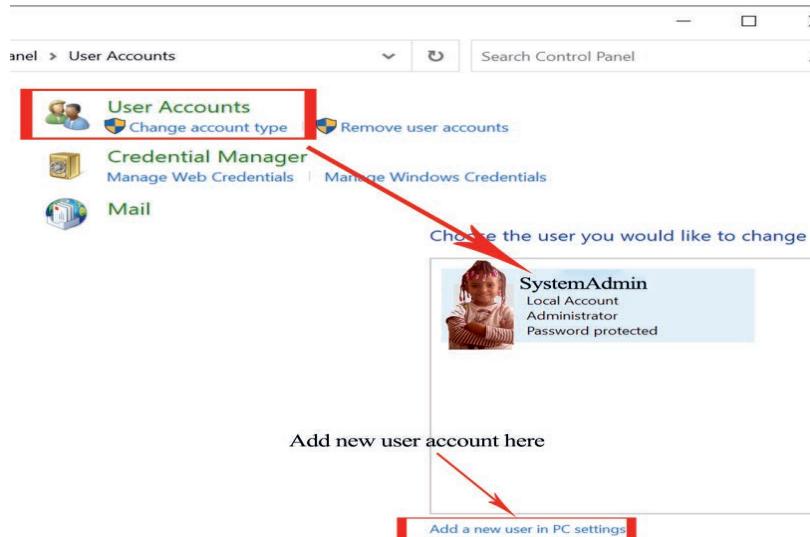


Figure 5.9 Add new user

- Scroll down and click on Add someone else to this PC.

Family & other users

Your family

Sign in with a Microsoft account to see your family here or add any new members to your family. Family members get their own sign-in and desktop. You can help kids stay safe with appropriate websites, time limits, apps, and games.

[Sign in with a Microsoft account](#)

Other users

Click Add someone else to this PC button

Allow people who are not part of your family to sign in with their own accounts. This won't add them to your family.



Figure 5.10 Add someone else to this pc

- Enter the username, passphrase and security questions and answers.
- Click next; by default, this new user will not have administrator access. You can also **create** a new user account using a Microsoft account; however, you must be connected to the Internet.

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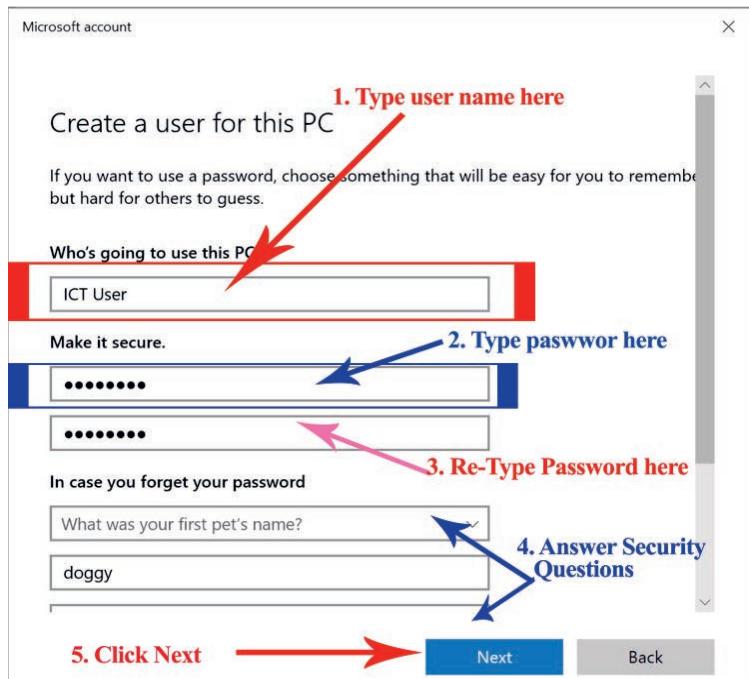


Figure 5.11 Create an account

- Click on the Next button. This will create a new account.



Figure 5.12 Created account

5.6.2 Non-technical Prevention Strategies

It is impossible to prevent natural disasters, but it is possible to reduce the damage they inflict through careful planning. Some measures can be taken to reduce their impact. The measures that you can take to protect your data and computer from natural threats could be keeping your computer in a secure location, storing data safely and protecting programs and data.

Activity 5.7

Answer the following activities in a group.

1. Explain non-technical prevention strategies used for your computer and data.
2. Explain the mechanisms used to protect programs and data.
3. Visit computers in your school and summarize antiviruses used in them.
4. Analyze how copied data or programs can be protected on computers.

KEY CONCEPTS

- ✍ **Data backup** involves creating multiple copies of your data. Making a backup helps you recover your data using external hard drive, CD, Flash memory or online data backup site such as cloud in case of any data loss.
- ✍ A **firewall system** prevents unauthorized access to a private network from network traffic by forming a barrier between trusted and untrusted websites to protect from threats like hackers and worms.
- ✍ **Antivirus software** is a type of program designed and developed to protect computers from malware like viruses, computer worms, spyware, botnets, rootkits and key loggers.
- ✍ A **user account** is a collection of settings and permissions, specific to a user that determines what a user can and cannot do on the computer.

5.7 Cyber Security

Brainstorming

1. What does it mean by cyber security?
2. Have you ever experienced cyber-attacks?

Cyber security is the application of technologies, processes and controls to protect systems, networks, programs, devices and data from cyber-attacks. Cyber security aims to reduce the risk of cyber-attacks and protect against the unauthorized exploitation of systems, networks and technologies.

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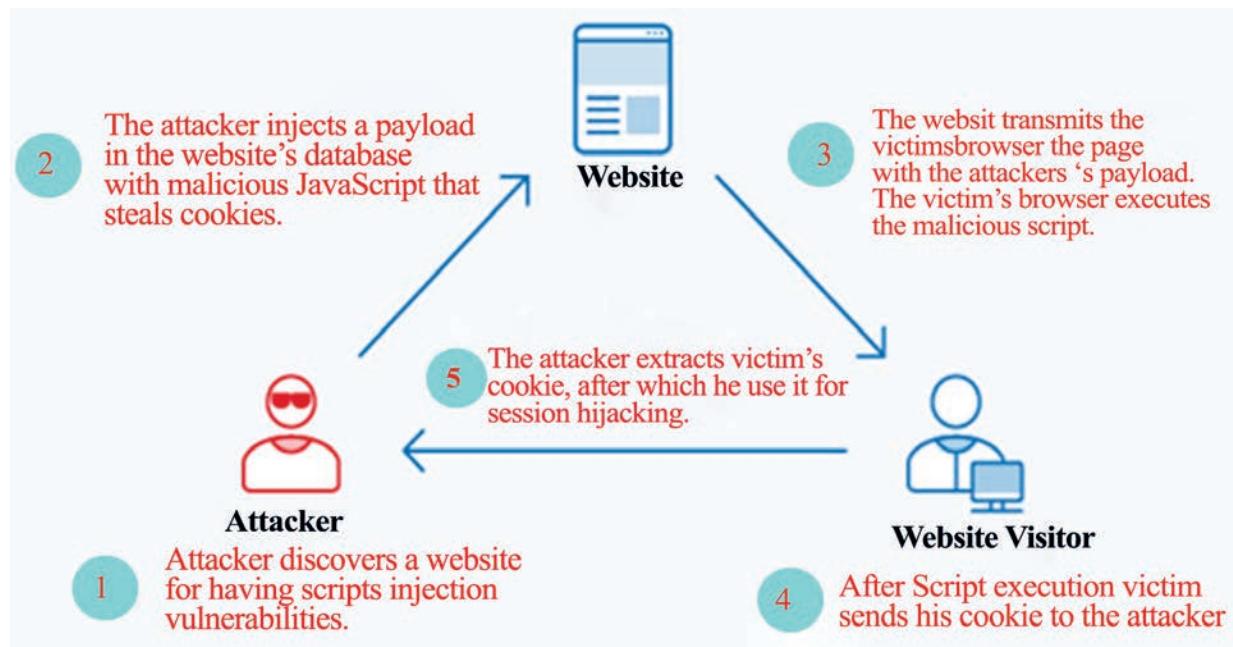


Figure 5.14 Cyber-attack

Cyber-attacks can cause electrical shutdowns, failure of military equipment and breaches of national security secrets. They can result in theft of valuable, sensitive data like medical records. They can disrupt phone and computer networks or paralyze systems, making data unavailable. Figure 5.14 shows an example of a cyber-attack.

Cyber security applies in a variety of contexts, from business to mobile computing, and can be divided into a few common categories. Such as network security applications, information security, operational security, disaster recovery and end-user education. Common ways of cyber-attack prevention can be outlined as follows.

1. Use strong passwords
2. Secure your computer
3. Be social-media savvy
4. Secure your mobile devices
5. Install the latest operating system updates
6. Protect your data
7. Secure your wireless network

8. Protect your e-identity

9. Avoid being scammed

On top of all these outlined, call the right person for help. If you encounter illegal Internet content or suspect a computer crime, identity theft or a commercial scam, report to your local police. If you need help with maintenance or software installation on your computer, consult your service provider or certified computer technician.

Activity 5.8

Briefly discuss the following activities

1. Explain the reason for cyber-attack.
2. Analyze the impact of cyber-attack on society.
3. Compare and contrast cyber-attack and cyber-crime.
4. Analyze cyber security threats across the globe in general and in Ethiopia in particular.
5. Discuss common categories of cyber security.
6. Explain each of the cyber security prevention mechanisms.

5.8 Unit Summary

Computer Security is control put in place to provide confidentiality, integrity and availability for all components of computer systems. These components include data, software, hardware and firmware. Information security is applied to computing devices such as computers and smartphones as well as computer networks, such as private and public networks, including the whole Internet.

Privacy is concerned with safeguarding and respecting people's rights to manage their data in a broader sense. Data privacy or information privacy is concerned with proper handling, processing, storage and usage of personal information. It is all about the rights of individuals concerning their personal information.

Lack of confidentiality is an unauthorized disclosure of data or unauthorized access to a computer system or a program. A failure of integrity results from

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unauthorized modification of data or damage to a computer system or program. Lack of availability of computing resources results in what is called denial of service. An act or event that has potential to cause failure of a computer security is called a threat.

A user account is a collection of settings and permissions specific to a user that determines what a user can and cannot do on the computer. These settings protect the user's files, programs and folders from being accessed by other non-authorized people.

Antivirus software is computer software used to prevent, detect and remove malware including computer viruses, worms and Trojan horses. Some examples of anti-virus software are Avast, McAfee, Norton and Kaspersky.

Cyber security is the practice of defending computers, servers, mobile devices, electronic systems, networks and data from malicious attacks. It is also known as information technology security or electronic information security. The term applies in a variety of contexts, from business to mobile computing, and can be divided into a few common categories.

Cybercrime is any criminal activity that involves a computer, networked device or a network. While most cybercrimes are carried out to generate profit for the cybercriminals, some cybercrimes are carried out against computers or devices directly to damage or disable them.

5.9 Unit Review Exercise

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

1. The term information security is used to describe the protection of computer and non-computer equipment, facilities, data and information from misuse by unauthorized parties.
2. Information security threats can be internal as well as external and they can be accidental as well as intentional.
3. The objective of confidentiality of information is to make data or information available to those who are authorized to use it.
4. An information security risk is a potential undesirable outcome of a breach of information security by an information security threat.
5. Firewalls do not act as filters and barriers that restrict the flow of data to and

from the firm and the World Wide Web.

6. Cyber security is the application of technologies, processes and controls to protect systems, networks, programs, devices and data from cyber-attacks.
7. Cybercrime, also called non-computer crime, is the use of a computer as an instrument to further illegal ends.

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

1. Firewalls are used to protect _____ attacks.
 - A. virus
 - B. fire
 - C. data-driven
 - D. unauthorized
2. When changes are made to the firm's information and software data, the type of information security risk it encounters is _____.
 - A. unauthorized disclosure and theft.
 - B. unauthorized use
 - C. unauthorized modification
 - D. unauthorized restriction
3. Antivirus software needs to be continuously updated because _____.
 - A. the list of potential threats grows and changes daily.
 - B. the antivirus companies need to look at your computer to see what you are doing.
 - C. the speed of your Internet connection needs to be regularly tested.
 - D. the antivirus companies make money from you on each update.

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4. You should keep your machine updated with the latest operating system patches because:
 - A. Hackers might write a virus to take advantage of a known weakness or bug.
 - B. Your machine will not run without the latest software.
 - C. If you do not have the latest software, your system may force you to reboot.
 - D. Downloading the latest software will make your machine faster.
5. A computer detects a virus by _____.
 - A. reporting
 - B. duplicating
 - C. scanning
 - D. following
6. _____ is a type of software designed to help the user's computer detect viruses and avoid them.
 - A. Malware
 - B. Adware
 - C. Antivirus
 - D. Both B and C
7. Data cannot be changed without proper authorization; this is an example of _____.
 - A. confidentiality
 - B. integrity
 - C. availability
 - D. None of the above.
8. Backup and data encryption are components of _____.
 - A. data security
 - B. data privacy
 - C. security
 - D. None of the above.

9. Which one of the following is a key function of a firewall?

- A. Copying
- B. Moving
- C. Deleting
- D. Monitoring

10. Which of the following is not a type of cybercrime?

- A. Data theft
- B. Forgery
- C. Damage to data and systems
- D. Installing antivirus for protection

Part III: Discuss the following questions.

1. Define computer security.
2. Describe the three elements of computer security.
3. List threats related to information security.
4. Discuss the reasons for taking backup regularly.
5. Express the term firewall.
6. Explain cyber-attacks.

UNIT OUTCOMES

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

- Explain concepts of algorithms.
- Describe the representation of algorithms.
- Discuss Integrated Development Environment (IDE).

6.1 Unit Overview

As it was defined and discussed in grade 9, problem-solving steps are used to solve day-to-day problems and make strategies to handle different situations which keep arising in day-to-day life. One method of solving problems in computer science is using algorithms. In this unit, you are going to learn basics of algorithm, definition of algorithm, characteristics of algorithm, algorithm representation and introduction to Integrated Development Environment (IDE).

6.2 Basics of Algorithm

Brainstorming

1. What do you recall by the term algorithm?
2. How do you verify problem solving concept?

Algorithm is a step-by-step process of solving a well-defined computational problem. In practice, to solve any complex real-life problems, first we have to define the problem and then design an algorithm to solve it. Writing and executing a simple program may be easy; however, for executing a bigger one, each part of the program must be well organized. In short, algorithms are used to simplify the program implementation.

Computers are dumb machines because they do only what they are asked to do. In computers, programs are developed to solve some problems. These programs can be written using some computer programming languages like Basic, C, C++, Java and Python.

In this section, you will develop your understanding of problem-solving and its approaches.

To solve the problem using computers, we must follow the steps described below.

- a. The problem must be analyzed thoroughly.
- b. Solution method is broken down into a sequence of small tasks.
- c. Based on this analysis, an algorithm must be prepared to solve the problem.
- d. The algorithm must be expressed in precise notation.
- e. In viewing algorithm, a computer program has to be designed in any high-level language.
- f. The computer program is fed into the computer.
- g. The instruction in the program executes one after another and outputs the expected result.

For example, calculate the sum of two numbers, A and B, and store the sum in C; here A and B are the inputs, addition is the process and C is the output of the program, as shown in Figure 6.1.

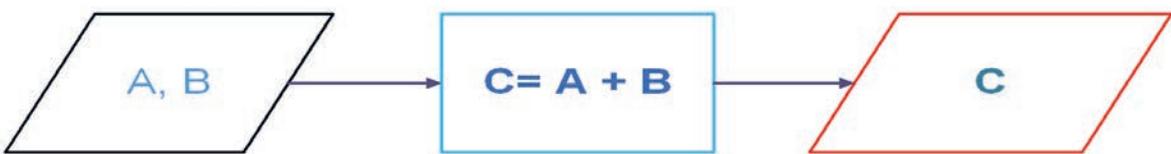


Figure 6.1 Sum of two numbers

Activity 6.1

Answer the following activities accordingly.

1. Write the steps you may follow to do an everyday activity. It could be riding a bike, making a sandwich or cooking “shiro wot”.
 - ii. Discuss the steps you have written with your friend.
 - iii. Can you provide the name for the steps you have written above?

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2. Explain the relationship between problem solving and algorithms.
3. Describe the steps for solving a problem in computers.

6.3 Definition of Algorithm

Brainstorming

1. Explain the term algorithm?
2. Can you state the benefits of using algorithms?

An algorithm is a precise method of solving a problem. It consists of a sequence of unambiguous, step-by-step instructions. A program is an algorithm that has been converted into program code so that it can be executed by a computer. A well-written algorithm should be free from logic errors and easy to code in any high-level language. Some of the most widely used definitions of an algorithm are described hereunder.

- An algorithm is a set of rules for carrying out calculations either by hand or a machine.
- An algorithm is a finite step-by-step procedure to achieve a required result.
- An algorithm is a sequence of computational steps that transform the input into the output.

Let us conceptualize the concept of an algorithm by taking the example of cooking “doro wot” for the first time as a **new recipe**. To cook a new recipe, one reads the instructions and steps, and executes them one by one in the given sequence. The result, thus, obtained is that the new dish cooked perfectly. Similarly, algorithms help to do a task in programming to get the expected output. The algorithms designed are language-independent; that is, they are just plain instructions that can be implemented in any programming language and yet the output will be the same. The components of an algorithm are described in Figure 6.2 below.

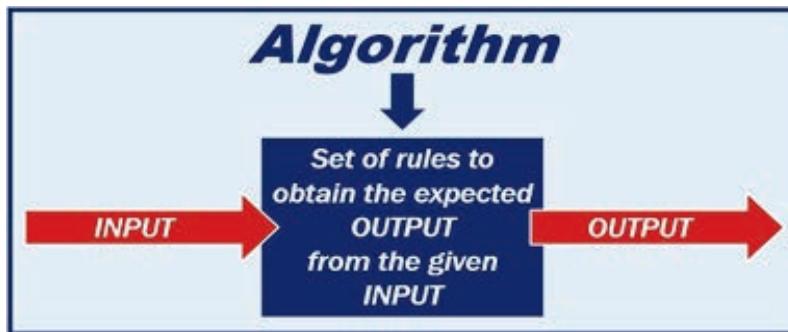


Figure 6.2 Description of the algorithm

Before a computer can be put to any meaningful use, the user must be able to define a unit sequence of operations or activities which are logically ordered as an unambiguous method of solving a problem or finding a solution to it, which is termed as an algorithm.

The term algorithm means “**a process or set of rules to be followed in calculations or other problem-solving operations**”. Therefore, algorithm refers to a set of rules/instructions that define step-by-step how a work is to be executed to get the expected results.

6.4 Characteristics of Algorithm

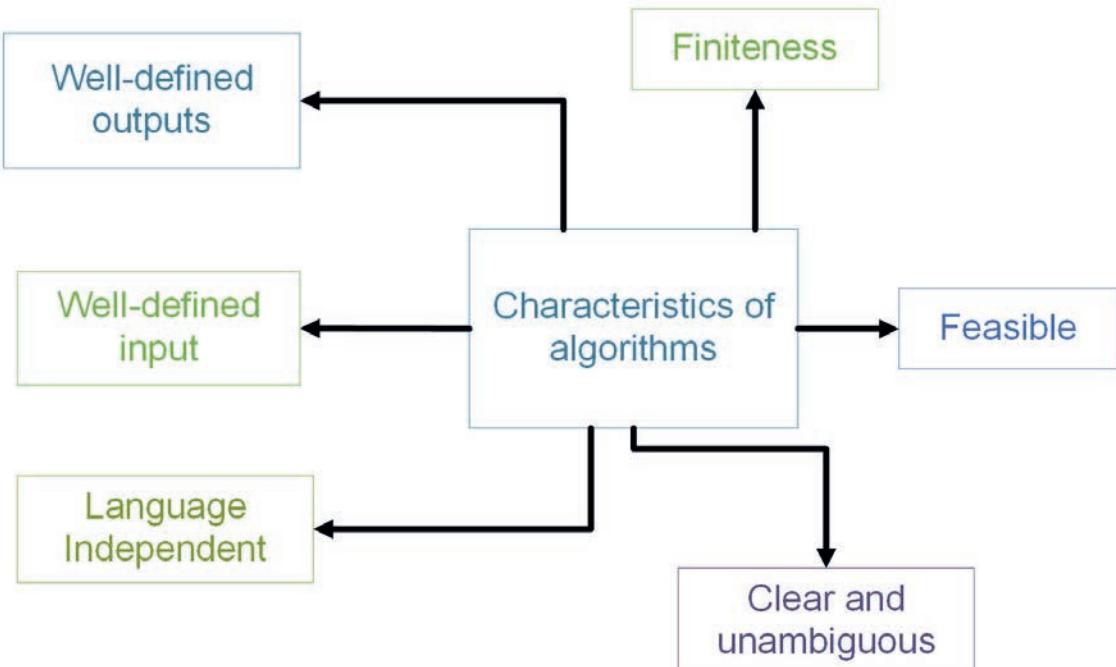


Figure 6.3 Characteristics of algorithm

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One would not follow any written instructions to cook a recipe, but only the standard one. Similarly, every written instruction for programming is not an algorithm. For some instructions to be an algorithm, they must have the following characteristics. It should be:

- **Clear and unambiguous:** The algorithm should be unambiguous. Each of its steps should be clear in all aspects and must lead to only one meaning.
- **Well-defined inputs:** If an algorithm says to take inputs, they should be well-defined.
- **Well-defined outputs:** The algorithm must clearly define what output will be yielded and it should be well-defined as well.
- **Finiteness:** The algorithm must be finite, i.e. it should not end up in infinite loops or similar.
- **Feasible:** The algorithm must be simple, generic and practical so that it can be executed upon the available resources. It must not contain some future technology or anything.
- **Language independent:** The algorithm designed must be language-independent, i.e. it must be just plain instructions that can be implemented in any language, and yet the output will be the same as expected.

Activity 6.2

Do the following activities in a group.

1. Establish a group of three and choose problems that can be solved stepwise.
2. Relate the steps you have identified to the components of an algorithm.
3. Discuss the characteristics of an algorithm.

Advantages of algorithm

- It is easy to understand.
- Algorithm is a stepwise representation of a solution to a given problem.

- In the algorithm the problem is broken down into smaller pieces or steps; hence, it is easier for the programmer to convert it into an actual program.

Disadvantages of algorithm

- Writing an algorithm takes a long time, so it is time-consuming.
- Branching and looping statements are difficult to show in algorithms.

Examples of algorithm

Let us consider a few examples of creating an algorithm for a given problem.

Example 1: Algorithm for the sum of two numbers

- Step 1: Take the first number from the user (input).
- Step 2: Take the second number from the user (input).
- Step 3: Add the two numbers to get the sum (process).
- Step 4: Display the sum on the screen (output).

Example 2: Write an algorithm to check whether the entered number is positive, negative or zero.

- Step 1: Take the number from the user.
- Step 2: If the number is less than 0, then display that the entered number is negative.
- Step 3: If the number is greater than 0, display that the entered number is positive.
- Step 4: Otherwise, display that the entered number is zero.

Example 3: Calculate the sum of ten natural numbers.

The formula for the sum of ten natural numbers is $sum = \sum_{i=1}^{10} number\ i$

- Step 1: Let the sum be initially set to 0.
- Step 2: Let i will be initially 1.
- Step 3: Take the ith number from the user.

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- Step 4: Add the ith number to the sum.
- Step 5: Increase the value of i by 1.
- Step 6: Check if the value of i is less than 10; then go to step 4. Otherwise, go to step 7.
- Step 7: Output the sum.

KEY CONCEPTS

- ✍ An **algorithm** is a precise method of solving a problem. It consists of a sequence of unambiguous, step-by-step instructions.
- ✍ An **algorithm** is described in terms of input, process and output activities.
- ✍ The **characteristics** of an algorithm include well defined input, well defined output, clarity and unambiguity, fineness, language independence and feasibility.
- ✍ A **program** is a set of instruction written to carry out a particular task so that computer can follow them.
- ✍ Using algorithms for solving problems has both advantages and disadvantages.
 - Some of the advantages of using **algorithm** are easy to solve a problem, practice step wise representation of problems and convert the algorithm into actual program or code the programmer.
 - The disadvantages of using algorithms are time consuming for designing and difficulty to show branching and looping statements

6.5 Algorithm Representation

Brainstorming

1. How do you think algorithms are represented?
2. Discuss with your classmate what is meant by the flowchart.
3. State the benefits of using algorithms.

In computer programming, we wish to be able to create algorithms in a way that will allow for easy translation to programming languages. Natural languages are too imprecise to be used in algorithms that are to be used in computer programming.

We need a way to describe our algorithms in a precise manner with a well-defined syntax and clear, unambiguous semantics. There are two main ways in which algorithms can be represented; they are flowcharts and pseudo code.

6.5.1 Flowchart Method

An algorithm can be described using many techniques and tools. One tool for designing an algorithm is by using a flowchart. A flowchart is a graphical or schematic representation of the major steps of work in a process. It displays the essential steps of the program in separate boxes and shows the directions of information flow using arrows. The boxes are most often referred to as illustrative symbols and may represent documents, machines or actions taken during the process. The area of concentration is on where or who does what, rather than on how it is done. A flowchart can also be said to be a graphical representation of an algorithm; that is, it is a visual picture that gives steps of an algorithm and flow of control between the various steps.

Basic Flowchart Symbols

Flowcharts are drawn with the help of symbols. The following are the most commonly used flowchart symbols and their functions as shown in Figures 6.4 below



Oval: Start or end of program



Parallelogram: Input or Output of program



Rectangle: Process to be carried out



Diamond: Decision making and branching

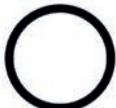
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Procedure call: Predefined computational steps



Flow line: Shows direction of program logic flow



On-page connector: Connector of two of a program

Figure 6.4 Flowchart symbols

Example 1: Consider a simple general flowcharting technique as shown in Figure 6.5 below. Let us start drawing a flowchart for a given problem.

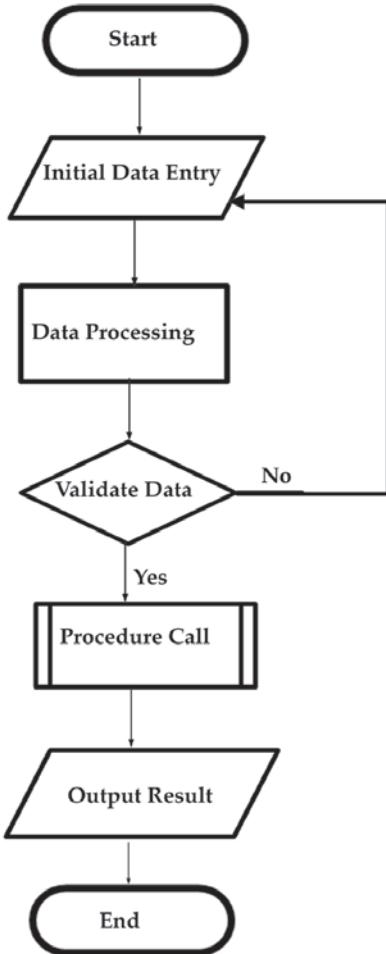


Figure 6.5 Flowchart techniques

Here different flowchart symbols are shown and are interconnected by the flow line; start, input, processing, decision, predefined process, output and terminator are interconnected.

Example 2: Draw a flow chart of an algorithm to add two numbers and display their result.

Solution:

Algorithm description:

- a. Read the rules of the two numbers (A and B).
- b. Add A and B.
- c. Assign the sum of A and B to C.
- d. Display the result (C).

A flowchart is a picture of the separate steps of a process in sequential order. It is a generic tool that can be adapted for a wide variety of purposes and can be used to describe various processes such as manufacturing, administrative or service and project plan.

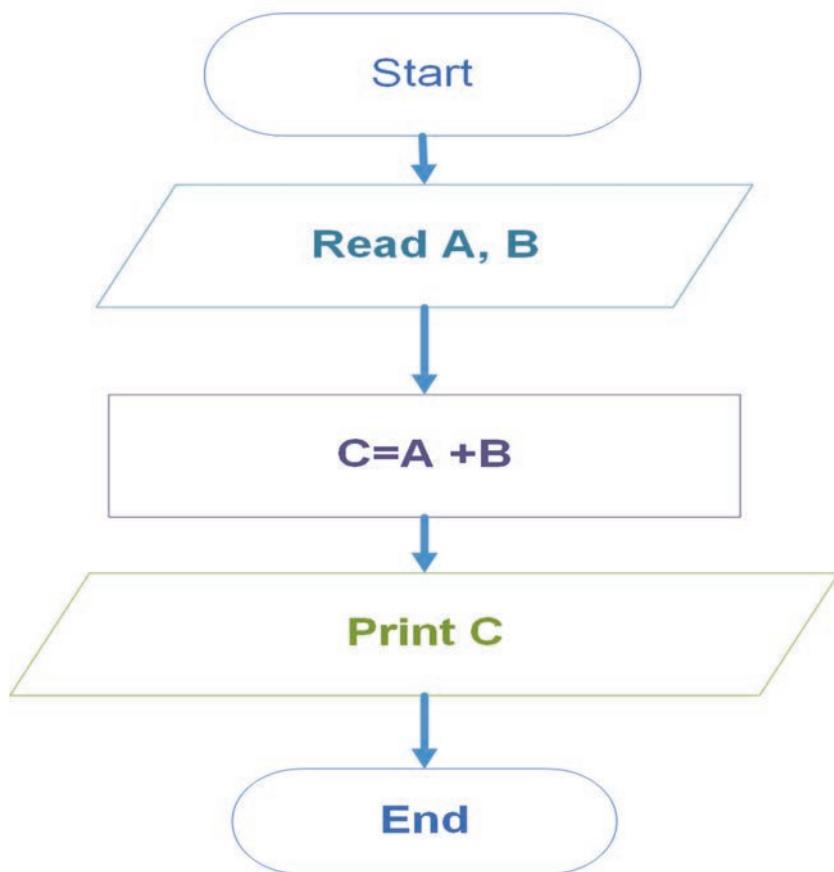


Figure 6.6 Flow chart of an algorithm to add two numbers and display their result

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Example 3: Draw a flowchart to check if a given number is positive or negative.

Solution:

Algorithm description

- a. Read a number x.
- b. If x is less than zero, write a message negatively; otherwise write a message that is not negative.

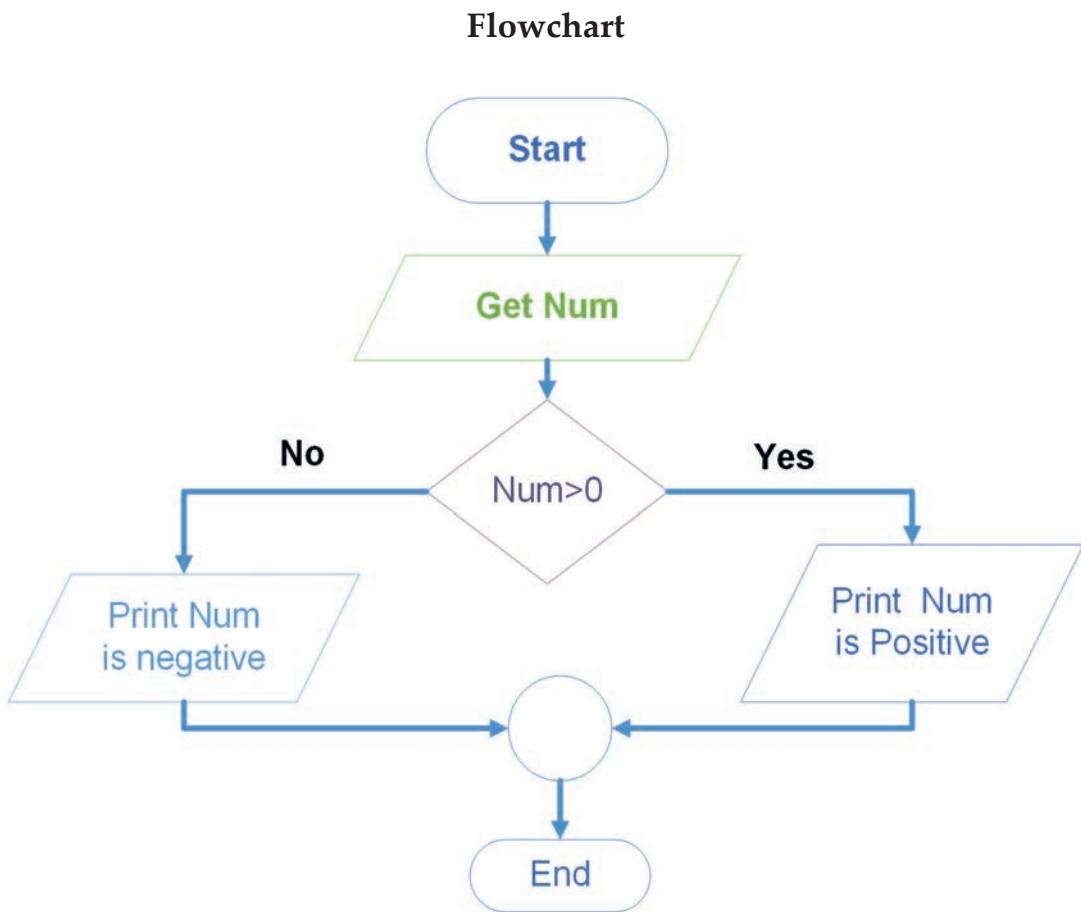


Figure 6.7 Flowchart that checks whether a given number is positive or negative

Sometimes there are conditions in which it is necessary to execute a group of statements repeatedly until some condition is satisfied. This condition is called a loop. Loop is a sequence of instructions that is repeated until some specific condition occurs. A loop normally consists of four parts. These are:

- **Initialization:** Setting of variables of the computation to their initial values and setting the counter for determining to exit from the loop.
- **Computation:** Processing

- **Test:** Every loop must have some way of exiting from it or else the program would endlessly remain in a loop.
- **Increment:** Re-initialization of the loop for the next loop.

Example 3: Write the algorithmic description and draw a flowchart to find the sum of the first 50 natural numbers as stated: $\text{Sum} = 1+2+3+\dots + 50$

Solution:

Algorithmic description

1. Initialize sum to zero (0) and counter to 1.
 - 1.1 If the counter is less than or equal to 50,
 - Add counter to sum.
 - Increase counter by 1.
 - Repeat the above steps.
 - 1.2 Else Exit
2. Write the sum

Flowchart

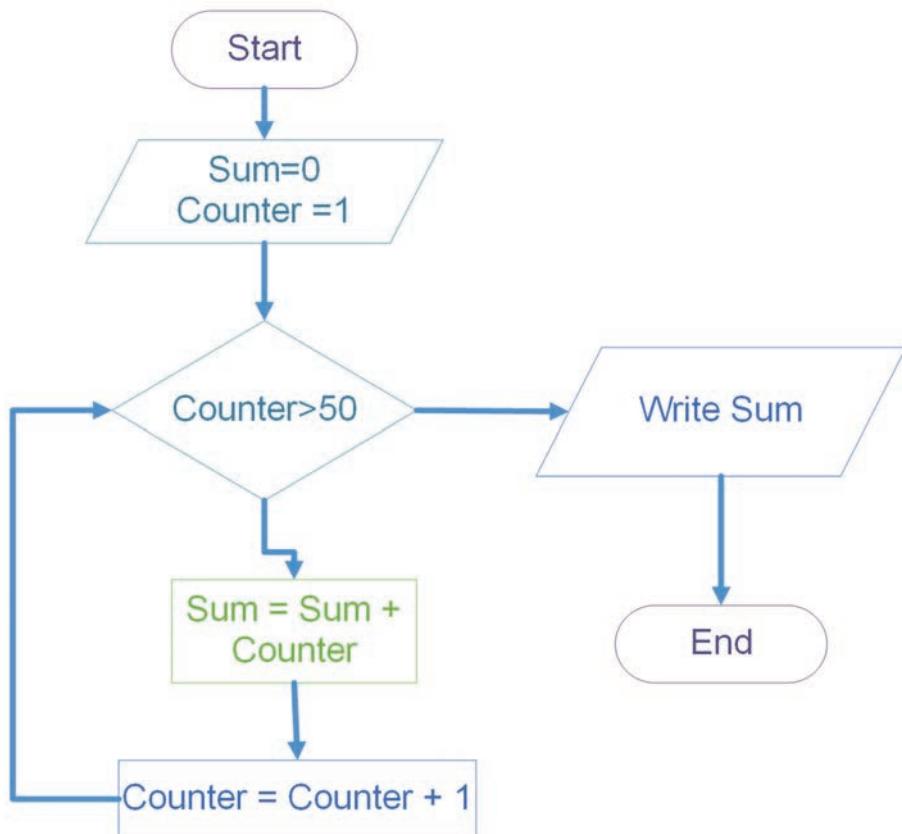


Figure 6.8 Flowchart showing the sum of the first 50 natural numbers

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In this example, we can draw a simple flowchart for the sum of the first 50 natural numbers. Therefore, we need flowchart symbols for input, output, process, decision, start and end. The first and the last symbols are starting and end of the flowcharting respectively. An initial sum of numbers is assumed to be zero which is inputted in the input symbol.

The sum is added to the number, which is initialized as zero. The decision block used in the flowchart takes the decision when the number is equal to 50 if not then the natural number is incremented by one and added to the sum. This process continues until the number counter goes up to 50. If the number is 50, then the final sum will be calculated and displayed using the output symbol.

Activity 6.3

Answer the following activities in a group in a class.

1. Discuss the use of a flowchart.
2. List symbols used in the flowchart diagram with their description.
3. Describe the flow chart symbol used to indicate the decision.

6.5.2 Pseudocode

Pseudocode is a program design aid that serves the function of a flowchart in expressing the detailed logic of a program. Sometimes a program's flowchart might be inadequate for expressing the control flow and logic of the program.

Using pseudocode, the program's algorithm can be expressed as English-language statements. These statements can be used both as a guide when coding the program in a specific language and as documentation for review by others. Because there is no rigid rule for constructing pseudocodes, the logic of the program can be expressed in a manner without confronting any particular programming language. A series of structured words are used to express major program functions. Let us see examples of pseudocode.

Example 1: Write the pseudocode to find the sum of two numbers.

```

Begin
    Numeric nNum1, nNum2, nSum
    Display "Enter First Number:"
        Accept nNum1
    Display "Enter Second Number:"
        Accept nNum2
    Compute nSum =nNum1 +nNum2
    Display "Sum of these numbers:" nSum
End

```

Figure 6.9 Pseudocode for finding the sum of two numbers

Activity 6.4

Answer the following activities individually.

1. Explain the benefits of using pseudocode in problem-solving.
2. Describe the pseudocode for area and perimeter of a circle.
3. Demonstrate how the pseudocode method relates to flowchart design.

KEY CONCEPTS

- ✍ An **algorithm** can be described using many techniques and tools. The two main tools of designing algorithm are using **flowchart** and **pseudocode**.
- ✍ A **flowchart** is a graphical or a schematic representation of the major steps of work in a process. A flowchart symbols include start, input, process, decision, terminators and flow line.
- ✍ **Pseudocode** is a program design aid that serves the function of a flowchart in expressing the detailed logic of a program.

6.6 Integrated Development Environment(IDE)

Brainstorming

1. Can you explain what an IDE is?
2. Describe the benefits of using an IDE.

Software is a large component of our lives these days. If you do not agree, just look around. Software is in the computers that sit on our desks in schools. It is in our televisions and stereos. It is even in the mobile devices we carry around like phones and tablets. These items have computers in them and computers need software to run. In a technology-based world such as ours, it is inescapable. Therefore, it should not come as a surprise that we need some means to create this software. An introduction to Integrated Development Environment (IDE) is a means to do this that puts everything we need at our fingertips.

An IDE enables programmers to consolidate different aspects of writing a computer program. IDEs increase programmer productivity by combining common activities of writing software into a single application: editing source code, building executable, and debugging. In the next section, you learn the formal definition of an IDE.



Figure 6.10 IDE for Java and Python programming

6.6.1 Definition of an IDE

An integrated development environment (IDE) is an application that facilitates application development. IDEs are designed to encompass all programming tasks in one application. Therefore, IDEs offer a central interface featuring all the tools a software developer needs, including the following functionalities as shown in Figure 6.11.



Figure 6.11 Functionalities of an IDE

Common Features of Integrated Development Environments

An IDE typically contains a code editor, a compiler or interpreter, and a debugger accessed through a single graphical user interface (GUI). The user writes and edits source code in the code editor. The compiler translates the source code into a readable language that is executable for a computer. The debugger tests the software to solve any issues or bugs. The fundamental features of IDE are discussed in the following.

- **Code editor :** This feature is a text editor designed for writing and editing source code. Source code editors are distinguished from text editors because they enhance or simplify the writing and editing of code.



VScode



Sublime



Bracket



Atom

Figure 6.12 Code editor

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- **Text editors** : Virtually every IDE will have a text editor designed to write and manipulate source code.



Figure 6.13 Text editors for IDE

- **Debugger** : This tool is used during testing to help debug application programs.
- **Build automation tools** : These tools automate common developer tasks. In addition, some IDEs might also include the following:
 - **Class browser**: This tool is used to examine and reference the properties of an object-oriented class hierarchy.
 - **Object browser**: This feature is used to examine the objects instantiated in a running application program.
- **Class hierarchy diagram**: This tool allows the programmer to visualize the structure of object-oriented programming code.

Note that IDE may be a stand-alone application or may be included as part of one or more compatible applications.

Activity 6.5

Discuss the following activities in a group.

1. Describe the need for an IDE.
2. Explain three names of code and text editors you have learned.
3. Compare and contrast code and text editors.

6.6.2 Benefits of Using IDEs

The overall goal and main benefit of an integrated development environment are improved developer productivity. IDEs boost productivity by reducing setup time, increasing the speed of development tasks, keeping developers up to date and standardizing the development process.

- **Faster setup :** Without an IDE interface, developers would need to spend time configuring multiple development tools. With the application integration of an IDE, developers have the same set of capabilities in one place, without the need for constantly switching tools.
- **Faster development tasks:** Tighter integration of all development tasks improves developer productivity. For Example, code can be parsed and syntax checked while being edited, providing instant feedback when syntax errors are introduced. Developers do not need to switch between applications to complete tasks. In addition, the IDE's tools and features help developers organize resources, prevent mistakes and take shortcuts.
- Further, IDEs streamline development by encouraging holistic thinking. They enforce developers to think of their actions in terms of the entire development lifecycle, rather than as a series of discrete tasks.
- **Continual learning:** Staying up to date and educated is another benefit. For instance, the IDEs topics are constantly being updated as well as new samples, project templates, etc. Programmers who are continually learning and with current best practices are more likely to contribute value to the team and the enterprise, and boost productivity.
- **Standardization:** The IDE interface standardizes the development process which helps developers work together more smoothly and helps new hires get up to speed more quickly.

6.6.3 Different Types of IDE

There are a variety of different IDEs, catering to many different ways developers work and different types of code they produce. Some IDEs are designed to work with one specific language, cloud-based IDEs, IDEs customized for the development of mobile applications or HTML and IDEs meant specifically for Apple development or Microsoft development.

Multi-language IDE

Multi-language IDEs such as Eclipse, NetBeans and Komodo support multiple programming languages.

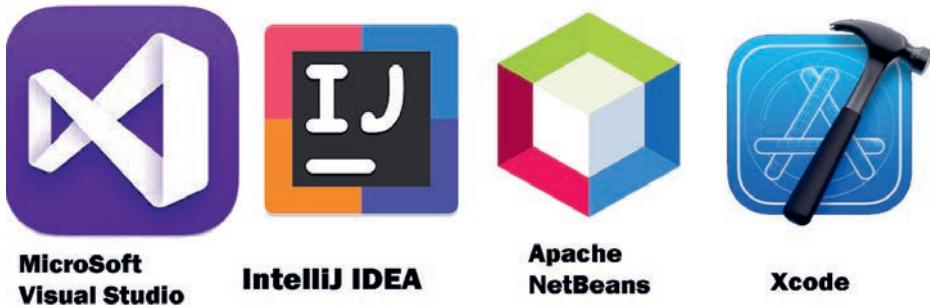


Figure 6.14 IDE software

- **Eclipse:** Supports C++, Python, PHP, Java and more. This free and open-source editor is model for many development frameworks. The eclipse began as a Java development environment and has expanded through plugins. Eclipse is managed and directed by the Eclipse.org Consortium.
- **NetBeans:** Supports Java, JavaScript, PHP, Python, Ruby, C, C++ and more. This option is also free and open source. All the functions of the IDE are provided by modules that each provide a well-defined function. Support for other programming languages can be added by installing additional modules.

IDE for a specific application

- **IDE for mobile development:** There are IDEs specifically used for mobile development, for instance, Android Studio and Visual Studio.
- **HTML IDE:** Some of the most popular IDEs are those for developing HTML applications. For Example, IDEs such as HomeSite, DreamWeaver or FrontPage automate many tasks involved in website development.
- **Cloud-based IDE:** Cloud IDEs give developers access to their code from anywhere. For Example, **Nitrous** is a cloud-based development environment platform that supports more than 40 languages including PHP, Ruby, Python, JavaScript with Node.js and Go.

KEY CONCEPTS

- ✍ An **Integrated Development Environment (IDE)** is an application that facilitates application development. IDEs are designed to encompass all programming tasks in one application.
- ✍ An IDE typically contains a **code editor**, a compiler or interpreter and a debugger which is accessed through a single **graphical user interface (GUI)**.
- ✍ **Code editor:** This feature is a text editor designed for writing and editing source code.
- ✍ **Text editors:** Text editor in IDEs are designed to write and manipulate source code.
- ✍ **Source code editors** are distinguished from text editors because they enhance or simplify the writing and editing of code.
- ✍ **Compiler:** This is a tool that transforms source code written in a human readable or writable language into a form executable by a computer.
- ✍ **The benefits of using IDEs** are faster setup, fast development tasks, continuous learning and standardization of the development process.
- ✍ **Multiple IDEs** such as Eclipse, NetBeans and Komodo support multiple programming languages whereas IDEs for specific applications are IDEs for mobile development, for instance Android Studio, Visual Studio, HTML IDEs such as HomeSite, DreamWeaver or FrontPage, and Cloud-based IDE such as PHP, Ruby, Python, JavaScript with Node.js and Go.

6.7 Unit Summary

Flowcharts, decision tables, pseudocodes and algorithms are essential ingredients to the writing of good programs. If they are done properly, they lead to a reduction of errors in programs. They help minimize the time spent in debugging. In addition, they make logic errors easier to trace and discover.

A flowchart is a graphical representation of the major steps of work in the process. It displays the essential steps of the program in separate boxes and shows the directions of information flow using arrows. Pseudocode is a program design aid that serves the function of a flowchart in expressing the detailed logic of a program.

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An algorithm is a precise method of solving a problem. It consists of a sequence of unambiguous, step-by-step instructions. A program is an algorithm that has been converted into program code so that it can be executed by a computer. A well-written algorithm should be free from logic errors and easy to code in any high-level language.

An IDE, or integrated development environment, enables programmers to consolidate the different aspects of writing a computer program. It increases programmer productivity by combining common activities of writing software into a single application: editing source code, building executables and debugging. The overall goal and main benefit of an integrated development environment are improved developer productivity. IDEs boost productivity by reducing setup time, increasing the speed of development tasks, keeping developers up to date and standardizing the development process.

Eclipse supports C++, Python, PHP, Java and more. This free and open-source editor is model for many development frameworks. The eclipse began as a Java development environment and has expanded through plugins. NetBeans supports Java, JavaScript, PHP, Python, Ruby, C, C++, and more. This option is also free and open source. All the functions of the IDE are provided by modules that each provide a well-defined function.

6.8 Unit Review Exercise

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

1. A sequence of instructions given to a computer is known as a program.
2. Branching and looping structures are well described using an algorithm.
3. An algorithm is a precise method of solving a problem.
4. Flowchart method is a verbal description of an algorithm.
5. NetBeans is a text editor.

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

1. Which one is **not** a characteristic of an algorithm?

- A. Ambiguity
- B. Simplicity
- C. Correctness

D. Precision

2. In the flowchart diagram, which one of the following symbols is used to indicate a decision step?

- A. An oval shape.
- B. A rectangle.
- C. A diamond shape.
- D. A parallelogram.

3. Which one of the following is incorrect about an algorithm?

- A. It has well-defined steps.
- B. It has to be unambiguous.
- C. It should terminate after a few computational steps.
- D. It is dependent on a particular programming language.

4. A step-by-step method for solving a problem using the English Language is _____.

- A. program
- B. flowchart
- C. statement
- D. algorithm

5. A set of statements executed based upon conditional test is called _____.

- A. looping
- B. selective
- C. sequence
- D. None of the above.

6. A set of statements is executed again and again based upon a conditional test.

- A. Looping
- B. Selective
- C. Sequence
- D. Conditional

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7. The graphical representation of algorithm is _____.
 - A. program
 - B. flowchart
 - C. statement
 - D. algorithm
8. All instructions are executed one after the other.
 - A. Looping
 - B. Selective
 - C. Sequence
 - D. None of the above
9. The correct order of executing algorithms is _____.
 - A. input → process → output
 - B. input → output → process
 - C. output → process → input
 - D. process → input → output
10. The part of a loop structure that describes processing is called _____.
 - A. initialization
 - B. computation
 - C. testing
 - D. increment
11. An abbreviation IDE stands for _____.
 - A. individually determined environment
 - B. indented development entity
 - C. integrated development environment
 - D. integrated dynamic entity

Part III: Discuss the following questions.

1. Define the term algorithm.
2. Discuss a flowchart.
3. Explain pseudocode.

4. Summarize the symbols of the flowchart.
5. Write an algorithm description and draw a flow chart for the sum of the first ten natural numbers.
6. Write an algorithm to find the greatest three numbers of given numbers.
7. Write an algorithm to check whether the given integer value is prime or not.
8. Draw a flowchart to find the roots of the quadratic equation $ax^2 + bx + c = 0$.
9. Write an algorithm to read values for three variables u, v and w and find the value for the result from the formula: $\text{result} = (u+v^2)/w$. Draw also the flowchart.