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Fundamentals Of Computer & IT

Notes as per IKGPTU Syllabus

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Information technology (IT) is the use of any computer, storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms audio video text image of electronic data.

DEFINITION: THE USE OF COMPUTER, HARDWARE AND SOFTWARE TO STORE, RETRIEVE AND MANIPULATE INFORMATION

ADVANTAGES

SPEED

RELIABILITY

CONSISTENCY

COMMUNICATION

STORAGE

DISADVANTAGES

VIOLATION OF PRIVACY

PUBLIC SAFETY

IMPACT TO LABOUR FORCE

HEALTH RISK

IMPACT ON ENVIROMENT

CATEGORIES OF COMPUTERS

SUPERCOMPUTER

SIZE: OCCUPY A FULL ROOM OF EQUIPMENT

SPEED: TENS OF THOUSANDS OF PROCESSORS

STORAGE: EXTREMELY LARGE (3.1 PB)

MAINFRAME

SIZE: PARTIAL ROOM TO A FULL ROOM OF EQUIPMENT

SPEED: DOZENS OF PROCESSORS

STORAGE: VERY LARGE & ADDABLE STORAGE (4.6 TB)

PERSONAL COMPUTER

SIZE: FITS ON THE DESK

SPEED: SINGLE PROCESSOR (1.5-2.5Ghz)

STORAGE: LARGE (500GB)

MOBILE COMPUTER

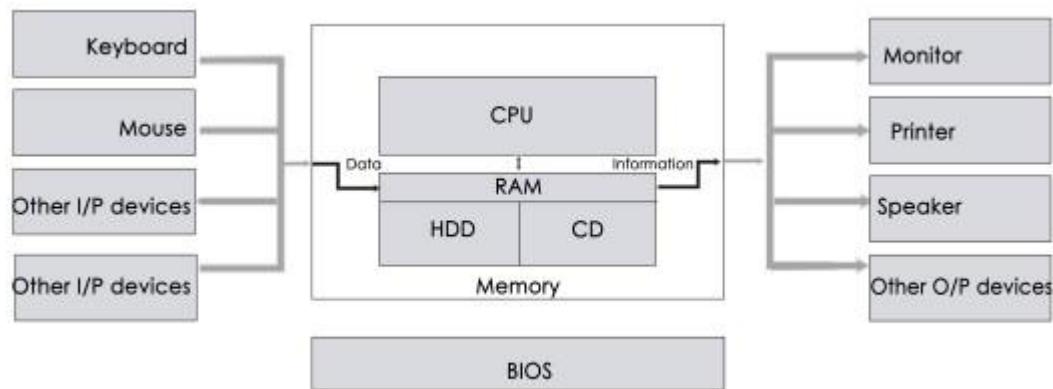**SIZE: FIT ON YOUR LAP OR ON YOUR HAND**

MOBILE DEVICES

Hardware

Hardware refers to the physical elements of a computer. This is also sometime called the machinery or the equipment of the computer. Examples of hardware in a computer are the keyboard, the monitor, the mouse and the **central processing unit**. However, most of a computer's hardware cannot be seen; in other words, it is not an external element of the computer, but rather an internal one, surrounded by the computer's casing (tower). A computer's hardware is comprised of many different parts, but perhaps the most important of these is the **motherboard**. The motherboard is made up of even more parts that power and control the computer.

In contrast to software, *hardware is a physical entity*. Hardware and software are interconnected, without software, the hardware of a computer would have no function. However, without the creation of hardware to perform tasks directed by software via the central processing unit, software would be useless.

Hardware Components

Computer hardware is a collection of several components working together. Some parts are essential and others are added advantages. Computer hardware is made up of CPU and peripherals as shown in image below.

Software

Software, commonly known as programs or apps, consists of all the instructions that tell the hardware how to perform a task. These instructions come from a software developer in the form that will be accepted by the *platform* (operating system + CPU) that they are based on. For example, a program that is designed for the Windows operating system will only work for that specific operating system.

A set of instructions that drives computer to do stipulated tasks is called a program. Software instructions are programmed in a computer language, translated into machine language, and executed by computer.

Software is capable of performing many tasks, as opposed to hardware which can only perform mechanical tasks that they are designed for. Software provides the means for accomplishing many different tasks with the same basic hardware

Software can be categorized into two types –

- **System software**
- **Application software**

System Software

System software operates directly on hardware devices of computer. It provides a platform to run an application. It provides and supports user functionality. Examples of system software include operating systems such as Windows, Linux, Unix, etc.

Application Software

An application software is designed for benefit of users to perform one or more tasks. Examples of application software include Microsoft Word, Excel, PowerPoint, Oracle, etc.

Differences between Software and Hardware are sorted out below –

Sr.No.	Software	Hardware
1	It is a collection of programs to bring computer hardware system into operation.	It includes physical components of computer system.
2	It includes numbers, alphabets, alphanumeric symbols, identifiers, keywords, etc.	It consists of electronic components like ICs, diodes, registers, crystals, boards, insulators, etc.
3	Software products evolve by adding new features to existing programs to support hardware.	Hardware design is based on architectural decisions to make it work over a range of environmental conditions and time.
4	It will vary as per computer and its built-in functions and programming language.	It is mostly constructed for all types of computer systems.
5	It is designed and developed by experienced programmers in high-level language.	The hardware can understand only low-level language or machine language.
6	It is represented in any high-level language such as BASIC, COBOL, C, C++, JAVA, etc.	The hardware works only on binary codes 1's and

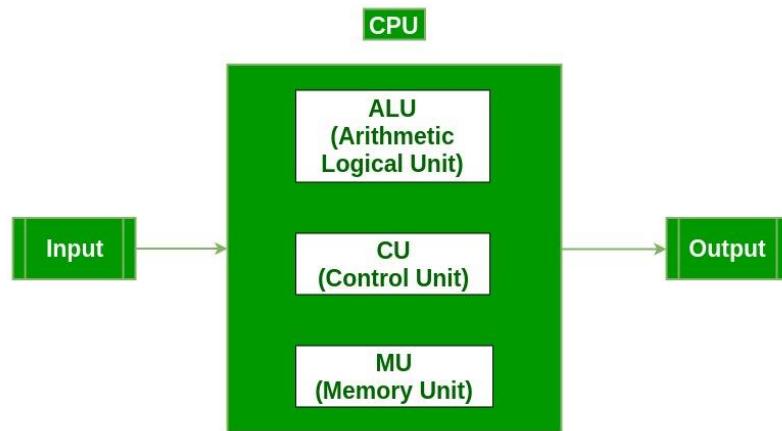|		
		0's.
7	The software is categorized as operating system, utilities, language processor, application software, etc.	The hardware consists of input devices, output devices, memory, etc.

Functional Components of a Computer

Computer: A computer is a combination of **hardware and software** resources which integrate together and provides various functionalities to the user. Hardware are the physical components of a computer like the processor, memory devices, monitor, keyboard etc. while software is the set of programs or instructions that are required by the hardware resources to function properly.

There are a few basic components that aids the working-cycle of a computer i.e. the Input-Process- Output Cycle and these are called as the functional components of a computer. It needs certain input, processes that input and produces the desired output. The input unit takes the input, the central processing unit does the processing of data and the output unit produces the output. The memory unit holds the data and instructions during the processing.

Digital Computer: A digital computer can be defined as a programmable machine which reads the binary data passed as instructions, processes this binary data, and displays a calculated digital output. Therefore, Digital computers are those that work on the digital data.

Details of Functional Components of a Digital Computer

- **Input Unit :** The input unit consists of input devices that are attached to the computer. These devices take input and convert it into binary language that the computer understands. Some of the common input devices are keyboard, mouse, joystick, scanner etc.

- **Central Processing Unit (CPU) :** Once the information is entered into the computer by the input device, the processor processes it. The CPU is called the brain of the computer because it is the control center of the computer. It first fetches instructions from memory and then interprets them so as to know what is to be done. If required, data is fetched from memory or input device. Thereafter CPU executes or performs the required computation and then either stores the output or displays on the output device. The CPU has three main components which are responsible for different functions – Arithmetic Logic Unit (ALU), Control Unit (CU) and Memory registers

- **Arithmetic and Logic Unit (ALU) :** The ALU, as its name suggests performs mathematical calculations and takes logical decisions. Arithmetic calculations include addition, subtraction, multiplication and division. Logical decisions involve comparison of two data items to see which one is larger or smaller or equal.

- **Control Unit :** The Control unit coordinates and controls the data flow in and out of CPU and also controls all the operations of ALU, memory registers and also input/output units. It is also responsible for carrying out all the instructions stored in the program. It decodes the fetched instruction, interprets it and sends control signals to input/output devices until the required operation is done properly by ALU and memory.

- **Memory Registers :** A register is a temporary unit of memory in the CPU. These are used to store the data which is directly used by the processor. Registers can be of different sizes(16 bit, 32 bit, 64 bit and so on) and each register inside the CPU has a specific function like storing data, storing an instruction, storing address of a location in memory etc. The user registers can be used by an assembly language programmer for storing
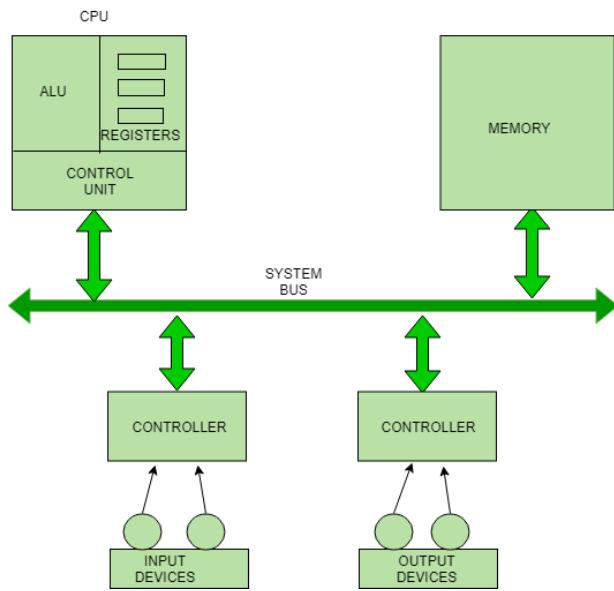
operands, intermediate results etc. Accumulator (ACC) is the main register in the ALU and contains one of the operands of an operation to be performed in the ALU.

- **Memory :** Memory attached to the CPU is used for storage of data and instructions and is called internal memory The internal memory is divided into many storage locations, each of which can store data or instructions. Each memory location is of the same size and has an address. With the help of the address, the computer can read any memory location easily without having to search the entire memory. when a program is executed, it's data is copied to the internal memory ans is stored in the memory till the end of the execution. The internal memory is also called the Primary memory or Main memory. This memory is also called as RAM, i.e. Random Access Memory. The time of access of data is independent of its location in memory, therefore this memory is also called Random Access memory (RAM). Read this for different types of RAMs

- **Output Unit :** The output unit consists of output devices that are attached with the computer. It converts the binary data coming from CPU to human understandable form. The common output devices are monitor, printer, plotter etc.

Interconnection between Functional Components

A computer consists of input unit that takes input, a CPU that processes the input and an output unit that produces output. All these devices communicate with each other through a common bus. A bus is a transmission path, made of a set of conducting wires over which data or information in the form of electric signals, is passed from one component to another in a computer. The bus can be of three types – Address bus, Data bus and Control Bus.

Following figure shows the connection of various functional components:

The address bus carries the address location of the data or instruction. The data bus carries data from one component to another and the control bus carries the control signals. The system bus is the common communication path that carries signals to/from CPU, main memory and input/output devices. The input/output devices communicate with the system bus through the controller circuit which helps in managing various input/output devices attached to the computer.

SMPS

A switched-mode power supply (SMPS) is an electronic circuit that converts power using switching devices that are turned on and off at high frequencies, and storage components such as inductors or capacitors to supply power when the switching device is in its non-conduction state.

Switching power supplies have high efficiency and are widely used in a variety of electronic equipment, including computers and other sensitive equipment requiring stable and efficient power supply.

A switched-mode power supply is also known as a switch-mode power supply or switching-mode power supply.

Advantages of switched-mode power supplies:

- Higher efficiency of 68% to 90%
- Regulated and reliable outputs regardless of variations in input supply voltage
- Small size and lighter
- Flexible technology
- High power density

Disadvantages:

- Generates electromagnetic interference
- Complex circuit design
- Expensive compared to linear supplies

INPUT OUTPUT DEVICES

The computer will be of no use unless it is able to communicate with the outside world. Input/Output devices are required for users to communicate with the computer. In simple terms, input devices bring information INTO the computer and output devices bring information OUT of a computer system. These input/output devices are also known as peripherals since they surround the CPU and memory of a computer system.
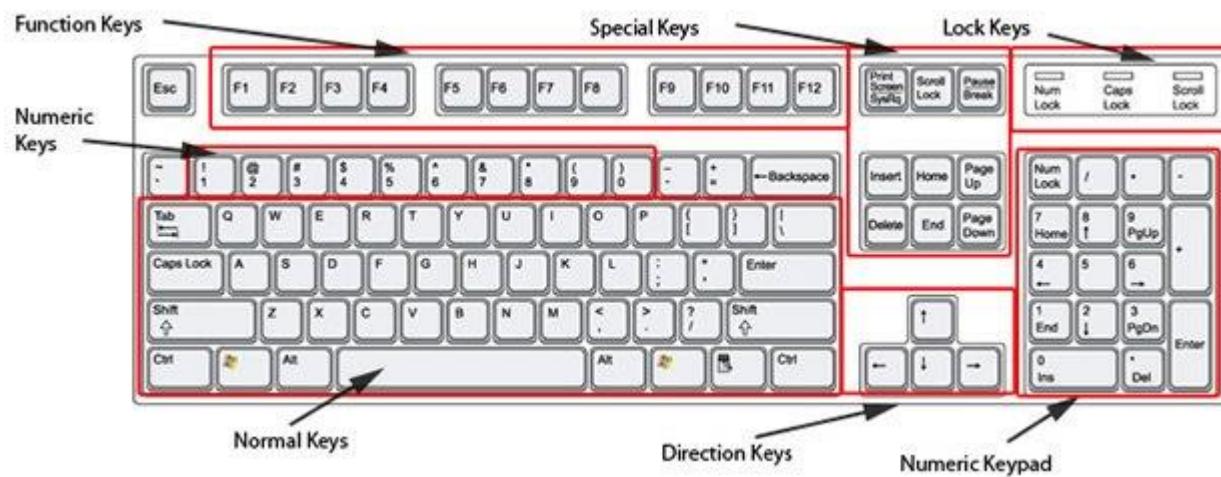
Some commonly used Input/Output devices are listed in table below.

Input Devices	Output Devices
Keyboard	Monitor
Mouse	LCD
Joystick	Printer
Scanner	Plotter
Light Pen	
Touch Screen	

I. Input Devices

(a) Keyboard

It is a text base input device that allows the user to input alphabets, numbers and other
characters. It consists of a set of keys mounted on a board

Alphanumeric keys

It consists of keys for English alphabets, 0 to 9 numbers, and special characters like +
⍰ / * ( ) etc.

Function Keys

There are twelve function keys labeled F1, F2, F3… F12. The functions assigned to these keys differ from one software package to another. These keys are also user programmable keys.

Special-function Keys

These keys have special functions assigned to them and can be used only for those specific purposes. Functions of some of the important keys are defined below.

Enter

It is similar to the 'return' key of the typewriter and is used to execute a command or program.

Spacebar

It is used to enter a space at the current cursor location.

Backspace

This key is used to move the cursor one position to the left and also delete the character in that position.

Delete

It is used to delete the character at the cursor position.

Insert

Insert key is used to toggle between insert and overwrite mode during data entry.

Shift

This key is used to type capital letters when pressed along with an alphabet key. Also used to type the special characters located on the upper-side of a key that has two characters defined on the same key.

Caps Lock

Cap Lock is used to toggle between the capital lock features. When 'on', it locks the alphanumeric keypad for capital letters input only.

Control keys

Control key is used in conjunction with other keys to provide additional functionality on the keyboard.

Alt

Also like the control key, Alt key is always used in combination with other keys to perform specific tasks.

Esc

This key is usually used to negate a command. Also used to cancel or abort executing programs.

Numeric Keypad

Numeric keypad is located on the right side of the keyboard and consists of keys having numbers (0 to 9) and mathematical operators (+ ? * /) defined on them. This keypad is provided to support quick entry for numeric data.

Cursor Movement Keys

These are arrow keys and are used to move the cursor in the direction indicated by the arrow (up, down, left, right).

(b)   **Mouse**

The mouse is a small device used to point to a particular place on the screen and select in order to perform one or more actions. It can be used to select menu commands, size windows, start programs etc.

The most conventional kind of mouse has two buttons on top: the left one being used most frequently.

Mouse Actions

Left Click : Used to select an item.

Double Click : Used to start a program or open a file.

Right Click : Usually used to display a set of commands.

Drag and Drop : It allows you to select and move an item from one location to another. To achieve this place the cursor over an item on the screen, click the left mouse button and while holding the button down move the cursor to where you want to place the ite   se it.

C) Joystick

The joystick is a vertical stick which moves the graphic cursor in a direction the stick is moved. It typically has a button on top that is used to select the option pointed by the cursor. Joystick is used as an input device primarily used with video games, training simulators and controlling robots

D) Scanner

Scanner is an input device used for direct data entry from the source document into the computer system. It converts the document image into digital form so that it can be fed into the computer. Capturing information like this reduces the possibility of errors typically experienced during large data entry.

II.Output Devices

(a) **Monitor**

Monitor is an output device that resembles the television screen and uses a Cathode Ray Tube (CRT) to display information. The monitor is associated with a keyboard for manual input of characters and displays the information as it is keyed in. It also displays the program or application output. Like the television, monitors are also available in different sizes.

(b) **Liquid Crystal Display (*LCD*)**

LCD was introduced in the 1970s and is now applied to display terminals also. Its advantages like low energy consumption, smaller and lighter have paved its way for usage in portable computers (laptops).

c) Printer

Printers are used to produce paper (commonly known as hardcopy) output. Based on the technology used, they can be classified as Impact or Non-impact printers.

Impact printers use the typewriting printing mechanism wherein a hammer

strikes the paper through a ribbon in order to produce output. Dot-matrix and Character printers fall under this category.

Non-impact printers do not touch the paper while printing. They use chemical, heat or electrical signals to etch the symbols on paper. Inkjet, Deskjet, Laser, Thermal printers fall under this category of printers.

When we talk about printers we refer to two basic qualities associated with printers: resolution, and speed. Print resolution is measured in terms of number of dots per inch (dpi). Print speed is measured in terms of number of characters printed in a unit of time and is represented as characters-per-second (cps), lines-per-minute (lpm), or pages-per-minute (ppm).

Printer uses ink to put data on paper or transparency. There are many types of printers.

1)Dot Matrix Printer

2)Ink Jet Printer

3)Daisy Wheel Printer

4) Laser Printer

Speed of the printer is measured in cps(character per second),lpm(line per minute),ppm(pages per minute). The quality of the print is measured in dpi(dots per inch). Some printers can print in color also. Dot matrix, ink jet and laser printers are most commonly used printers. Printer can be classified into two categories according to the technologies used in them. Impact printer and non-impact printer. An impact printer uses a

device to press/strike something against the ribbon to put a character on the page. Dot matrix, daisy and line printer are impact printers.

Non-impact printers print without having a mechanism to strike against a sheet of paper. Ink jet, laser and thermal printer are non-impact printer.

Dot Matrix Printer: It uses dots to form a characters on a paper. Dots are made by pins. Dot matrix printer is made up of steel pins which strike the paper through a inked ribbon to create a pattern of tiny dots. The quality of print depends upon the number of steel pins in the machine.

Daisy Wheel printer: In this type of printer, the part that puts the characters looks like a wheel. Numbers and letters are arranged in a wheel. And the daisy wheel spins until the correct letter is in position. Then hammer strikes the character against the ribbon, printing it on the paper.

Line Printer: It prints a complete line of text at a time. It uses drum or chain with all the characters in the character set on it. The drum or chain moves and prints the necessary characters in the right place.

Ink jet printer: It prints the character using fine jet of ink which comes out from the tiny nozzles onto the paper. The ink is kept in reservoir and fed into the firing chambers just below each nozzle.

Laser Printer: It uses a beam of light (laser beam) to convert binary data into print. The laser puts an electric charge in the shape of a character on the rotating drum. The dry ink or toner stick only to the drum where it has been charged. These printers are very fast. They can print a whole page at once.

Thermal Printer: It uses heat to put the characters on the paper. The paper has a spacial coating on it. The printer uses heated wires to turn the paper black. It is basically used for taking ECG in hospital or lab.

d) Plotter

Plotters are used to print graphical output on paper. It interprets computer commands and makes line drawings on paper using multicolored automated pens. It is capable of producing graphs, drawings, charts, maps etc.

Computer Aided Engineering (CAE) applications like CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing) are typical usage areas for plotters.
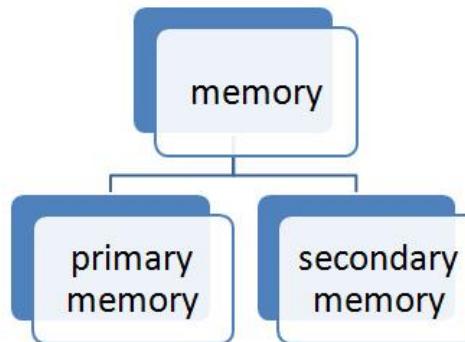

MEMORY

Memory is an internal storage area in a computer, which is availed to store data and programs either permanently or temporarily. Computer memory is broadly divided into two groups and they are:

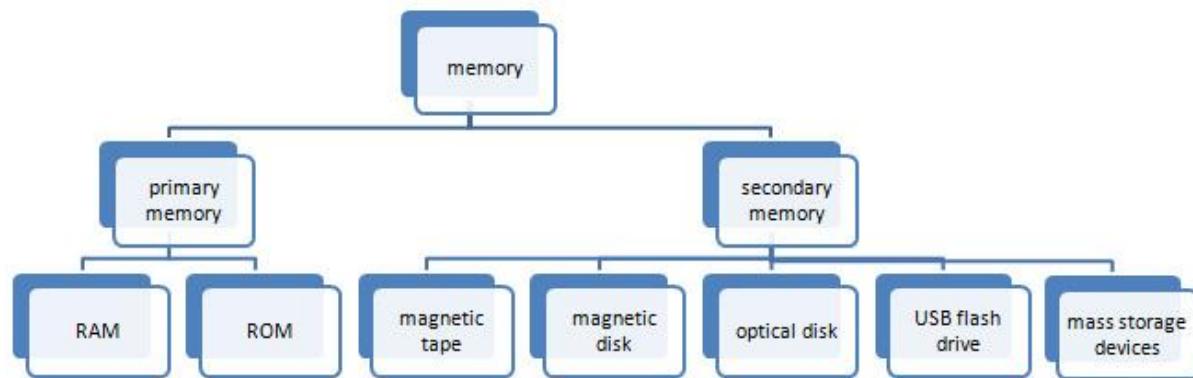- Primary memory and
- Secondary memory

The diagrammatic representation of the classification of computer memory is shown below:

Classification of the Computer Memory

When the main memory holds instructions and data when a program is executing, the auxiliary memory or secondary memory holds data and programs which are not currently in use and furnishes long term storage.

The primary memory and secondary memory are further classified into distinct groups and those are explained in the below diagram:

Classification of Primary Memory and Secondary Memory

Primary memory:

Primary memory is the only type of memory which is directly accessed by the CPU. The CPU continuously reads instructions stored in the primary memory and executes them. Any data

that has to be operated by the CPU is also stored. The information is transferred to various locations through the BUS. Primary memories are of two types. They are:

- RAM
- ROM

1. **RAM:** It stands for Random Access Memory. Here data can be stored temporarily, so this type of memory is called as temporary memory or volatile memory because when power fails the data from RAM will be erased. The information stored in the RAM is basically loaded from the computer's disk and includes information related to the operating system and applications that are currently executed by the processor. RAM is considered random access because any memory cell can be directly accessed if its address is known. RAM is of distinct types like SRAM, DRAM, and VRAM.

2. **ROM:** It stands for Read Only Memory. In this, the data will be furnished by the manufacturers regarding the system, so this information can simply be read by the user but cannot add new data or it cannot be modified. ROMs are of distinct types:

- PROM – Programmable Read Only Memory
- EPROM – Erasable Programmable Read Only Memory
- EEPROM – Electrically Erasable Programmable Read Only Memory

Secondary memory:

Secondary memory or auxiliary memory consists of slower and less expensive device that communicates indirectly with CPU via main memory. The secondary memory stores the data and keeps it even when the power fails. It is used to store or save large data or programs or other information. The secondary storage devices are explained below:

- Magnetic disks
- Magnetic tape
- Optical disk
- USB flash drive
- Mass storage devices

1.Magnetic disks: Magnetic disks are made of rigid metals or synthetic plastic material. The disk platter is coated on both the surfaces with magnetic material and both the surfaces can be used for storage. The magnetic disk furnishes direct access and is for both small and large computer systems. The magnetic disk comes in two forms:

- Floppy disks
- Hard disks

2. Magnetic tape: magnetic tape is serial access storage medium and it can store a large volume of data at low costs. The conventional magnetic tape is in reels of up to 3600 feet made of Mylar plastic tape. The tape is one-half inch in width and is coated with magnetic material on one side. The reel of tape is loaded on a magnetic tape drive unit. During any read/write operation, the tape is moved from one spool to another in the same way as in the audiocassette tape recorder. The magnetic tape is densely packed with magnetic spots in frames across its width.

3. Optical drives: optical drives are a storage medium from which data is read and to which it is written by lasers. Optical disks can store much more data up to 6GB. Optical store devices are the most widely used and reliable storage devices. The most widely used type of optical storage devices are explained below:
  - CD – ROM
  - DVD – ROM
  - CD – RECORDABLE
  - CD – REWRITABLE
  - PHOTO – CD

4. USB flash drives: USB flash drives are removable, rewritable and are physically much smaller drives, which have the weight of less than 30g. In the year of 2010, the storage capacity of the USB flash drives was as large as 256GB. Such devices are a good substitute for floppy disks and CD – ROMs as they are smaller, faster, have thousands of times more capacity, and are more durable and reliable. Until 2005, most desktop and laptop computers had floppy disk drives, but nowadays floppy disk drives have been abandoned in favor of USB ports. The USB connector is often protected inside a removable cap, although it is not likely to be damaged if unprotected. USB flash drives draw power from the computer through external USB connection. The most widely used USB flash drives are the memory cards.

5. Mass storage devices: Mass storage devices refer to the saving of huge data in a persistent manner. Mass storage machines can store up to several trillion bytes of data and hence are used to store or save large databases, such as the information of customers of a big retail chain and library transactions of students in a college. Some of the commonly used mass storage devices are explained below:
  - Disk array
  - Automated tape
  - CD – ROM jukebox
    Number System

The technique to represent and work with numbers is called **number system**. **Decimal number system** is the most common number system. Other popular number systems include **binary number system, octal number system, hexadecimal number system,** etc.

When we type some letters or words, the computer translates them in numbers as computers can understand only numbers. A computer can understand the positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

The value of each digit in a number can be determined using –

- The digit

- The position of the digit in the number

- The base of the number system (where the base is defined as the total number of digits available in the number system)

Decimal Number System

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands, and so on.

Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position. Its value can be written as

(1 x 1000)+ (2 x 100)+ (3 x 10)+ (4 x l)
$(1 \times 10^3)+ (2 \times 10^2)+ (3 \times 10^1)+ (4 \times l0^0)$
1000 + 200 + 30 + 4
1234

As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

S.No.	Number System and Description
1	**Binary Number System** Base 2. Digits used : 0, 1

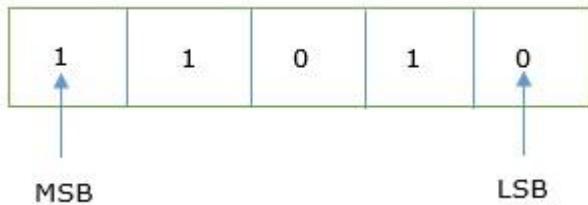| 2 | **Octal Number System** |
	Base 8. Digits used : 0 to 7
3	**Hexa Decimal Number System**
	Base 16. Digits used: 0 to 9, Letters used : A- F

Binary Number System

The easiest way to vary instructions through electric signals is two-state system – on and off. On is represented as 1 and off as 0, though 0 is not actually no signal but signal at a lower voltage. The number system having just these two digits – 0 and 1 – is called **binary number system**.

Each binary digit is also called a **bit**. Binary number system is also positional value system, where each digit has a value expressed in powers of 2, as displayed here.

2^5	2^4	2^3	2^2	2^1	2^0

In any binary number, the rightmost digit is called **least significant bit (LSB)** and leftmost digit is called **most significant bit (MSB)**.

1	1	0	1	0

MSB   LSB

And decimal equivalent of this number is sum of product of each digit with its positional value.

$11010_2 = 1×2^4 + 1×2^3 + 0×2^2 + 1×2^1 + 0×2^0$

$= 16 + 8 + 0 + 2 + 0$

$= 26_{10}$

Example

Binary Number: 10101_2

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

Note – 10101_2 is normally written as 10101.

Octal Number System

Characteristics of the octal number system are as follows –

- Uses eight digits, 0,1,2,3,4,5,6,7

- Also called as base 8 number system

- Each position in an octal number represents a **0** power of the base (8). Example 8^0

- Last position in an octal number represents a **x** power of the base (8). Example 8^x where **x** represents the last position – 1

Octal number system has eight digits – 0, 1, 2, 3, 4, 5, 6 and 7. Octal number system is also a positional value system with where each digit has its value expressed in powers of 8, as shown here –

8^5	8^4	8^3	8^2	8^1	8^0

Decimal equivalent of any octal number is sum of product of each digit with its positional value.

$726_8 = 7 \times 8^2 + 2 \times 8^1 + 6 \times 8^0$

$= 448 + 16 + 6$

$= 470_{10}$

Example

Octal Number: 12570_8

Calculating Decimal Equivalent –

Step	Octal Number	Decimal Number
Step 1	12570_8	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570_8	$(4096 + 1024 + 320 + 56 + 0)_{10}$
Step 3	12570_8	5496_{10}

Note − 12570_8 is normally written as 12570.

Hexadecimal Number System

Octal number system has 16 symbols – 0 to 9 and A to F where A is equal to 10, B is equal to 11 and so on till F. Hexadecimal number system is also a positional value system with where each digit has its value expressed in powers of 16, as shown here –

16^5	16^4	16^3	16^2	16^1	16^0

Decimal equivalent of any hexadecimal number is sum of product of each digit with its positional value.

$27FB_{16} = 2 \times 16^3 + 7 \times 16^2 + 15 \times 16^1 + 10 \times 16^0$

$= 8192 + 1792 + 240 + 10$

$= 10234_{10}$

Example

Hexadecimal Number: $19FDE_{16}$

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
Step 1	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (F \times 16^2) + (D \times 16^1) + (E \times 16^0))_{10}$
Step 2	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (15 \times 16^2) + (13 \times 16^1) + (14 \times 16^0))_{10}$
Step 3	$19FDE_{16}$	$(65536 + 36864 + 3840 + 208 + 14)_{10}$
Step 4	$19FDE_{16}$	106462_{10}

Note – $19FDE_{16}$ is normally written as 19FDE.

Conversions

There are many methods or techniques which can be used to convert numbers from one base to another. We'll demonstrate here the following –

- Decimal to Other Base System
- Other Base System to Decimal
- Other Base System to Non-Decimal
- Shortcut method – Binary to Octal
- Shortcut method – Octal to Binary
- Shortcut method – Binary to Hexadecimal
- Shortcut method – Hexadecimal to Binary

Decimal to Other Base System

Steps

- **Step 1** – Divide the decimal number to be converted by the value of the new base.

- **Step 2** – Get the remainder from Step 1 as the rightmost digit (least significant digit) of new base number.

- **Step 3** – Divide the quotient of the previous divide by the new base.

- **Step 4** – Record the remainder from Step 3 as the next digit (to the left) of the new base number.

Repeat Steps 3 and 4, getting remainders from right to left, until the quotient becomes zero in Step 3.

The last remainder thus obtained will be the Most Significant Digit (MSD) of the new base number.

Example –

Decimal Number: 29_{10}

Calculating Binary Equivalent –

Step	Operation	Result	Remainder
Step 1	29 / 2	14	1
Step 2	14 / 2	7	0
Step 3	7 / 2	3	1
Step 4	3 / 2	1	1
Step 5	1 / 2	0	1

As mentioned in Steps 2 and 4, the remainders have to be arranged in the reverse order so that the first remainder becomes the Least Significant Digit (LSD) and the last remainder becomes the Most Significant Digit (MSD).

Decimal Number – 29_{10} = Binary Number – 11101_2.

Other Base System to Decimal System

Steps

- **Step 1** – Determine the column (positional) value of each digit (this depends on the position of the digit and the base of the number system).

- **Step 2** – Multiply the obtained column values (in Step 1) by the digits in the corresponding columns.

- **Step 3** – Sum the products calculated in Step 2. The total is the equivalent value in decimal.

Example

Binary Number – 11101_2

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
Step 1	11101_2	$((1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	11101_2	$(16 + 8 + 4 + 0 + 1)_{10}$
Step 3	11101_2	29_{10}

Binary Number – 11101_2 = Decimal Number – 29_{10}

Other Base System to Non-Decimal System

Steps

- **Step 1** – Convert the original number to a decimal number (base 10).

- **Step 2** – Convert the decimal number so obtained to the new base number.

Example

Octal Number − 25_8

Calculating Binary Equivalent −

Step 1 − Convert to Decimal

Step	Octal Number	Decimal Number
Step 1	25_8	$((2 \times 8^1) + (5 \times 8^0))_{10}$
Step 2	25_8	$(16 + 5)_{10}$
Step 3	25_8	21_{10}

Octal Number − 25_8 = Decimal Number − 21_{10}

Step 2 − Convert Decimal to Binary

Step	Operation	Result	Remainder
Step 1	21 / 2	10	1
Step 2	10 / 2	5	0
Step 3	5 / 2	2	1
Step 4	2 / 2	1	0
Step 5	1 / 2	0	1

Decimal Number − 21_{10} = Binary Number − 10101_2

Octal Number – 25_8 = Binary Number – 10101_2

Shortcut method - Binary to Octal

Steps

- **Step 1** – Divide the binary digits into groups of three (starting from the right).
- **Step 2** – Convert each group of three binary digits to one octal digit.

Example

Binary Number – 10101_2

Calculating Octal Equivalent –

Step	Binary Number	Octal Number
Step 1	10101_2	010 101
Step 2	10101_2	2_8 5_8
Step 3	10101_2	25_8

Binary Number – 10101_2 = Octal Number – 25_8

Shortcut method - Octal to Binary

Steps

- **Step 1** – Convert each octal digit to a 3 digit binary number (the octal digits may be treated as decimal for this conversion).
- **Step 2** – Combine all the resulting binary groups (of 3 digits each) into a single binary number.

Example

Octal Number – 25_8

Calculating Binary Equivalent –

Step	Octal Number	Binary Number
Step 1	25_8	2_{10} 5_{10}
Step 2	25_8	010_2 101_2
Step 3	25_8	010101_2

Octal Number − 25_8 = Binary Number − 10101_2

Shortcut method - Binary to Hexadecimal

Steps

- **Step 1** − Divide the binary digits into groups of four (starting from the right).
- **Step 2** − Convert each group of four binary digits to one hexadecimal symbol.

Example

Binary Number − 10101_2

Calculating hexadecimal Equivalent −

Step	Binary Number	Hexadecimal Number
Step 1	10101_2	0001 0101
Step 2	10101_2	1_{10} 5_{10}
Step 3	10101_2	15_{16}

Binary Number − 10101_2 = Hexadecimal Number − 15_{16}

Shortcut method - Hexadecimal to Binary

Steps

- **Step 1** – Convert each hexadecimal digit to a 4 digit binary number (the hexadecimal digits may be treated as decimal for this conversion).

- **Step 2** – Combine all the resulting binary groups (of 4 digits each) into a single binary number.

Example

Hexadecimal Number – 15_{16}

Calculating Binary Equivalent –

Step	Hexadecimal Number	Binary Number
Step 1	15_{16}	1_{10} 5_{10}
Step 2	15_{16}	0001_2 0101_2
Step 3	15_{16}	00010101_2

Hexadecimal Number – 15_{16} = Binary Number – 10101_2

Applications of Information Technology

Every day, people use computers in new ways. Computers and other electronic devices are becoming increasingly affordable. They continue to be more powerful as information-processing tools as well as easier to use. Humans are continually becoming dependant on IT-enabled devices for carrying out simple tasks like remembering a phone number to complex ones like flying a fighter plane. Information Technology has applications in almost all aspects of our life. Some of the important ones are:

Science and Engineering: Scientific progress in fields like biotechnology is almost entirely dependent on the use of computers and other microprocessor-controlled devices. Using supercomputers, meteorologists predict future weather by using a combination of observations of weather conditions from many sources, a mathematical representation of the behaviour of the atmosphere, and geographic data. Computer-aided design (CAD) and computer-aided manufacturing (CAM) programs have led to improved products in many fields, especially where designs tend to be very detailed. Computer programs make it possible for engineers to analyse designs of complex structures such as power plants and space stations.

Business & **Commerce**: One of the first and largest applications of computers is keeping and managing business and financial records. Most large companies keep the employment records of all their workers in large databases that are managed by computer programs. Similar programs and databases are used in business functions like billing customers; tracking payments received and payments to be made; and tracking supplies needed and items produced, stored, shipped, and sold. In fact, practically all the information companies need to do business involves the use of computers and Information Technology. Almost all the financial transactions in the world are done electronically. Newer technologies like m-commerce have enabled almost everybody to carry out routine financial transactions on the move.

On a smaller scale, many businesses have replaced cash registers with point-of-sale (POS) terminals. These POS terminals not only print a sales receipt for the customer but also send information to a computer database when each item is sold to maintain an inventory of items on hand and items to be ordered. Computers have also become very important in modern factories. Computer-controlled robots now do tasks that are hot, heavy, or hazardous. Robots are also used to do routine, repetitive tasks in which boredom or fatigue can lead to poor quality work.

With today's sophisticated hardware, software, and communications technologies, it is often difficult to classify a system as belonging uniquely to one specific application program. Organizations increasingly are consolidating their information needs into a single, integrated

information system. Management Information System (MIS), with the Chief Information Officer (CIO) at its head, is a whole, new branch of enterprise management.

Education: The advent of Information Technology has changed the meaning of the term "literate", with computer literacy being almost as important as basic literacy in many cases. Computer education is an essential course at the primary level in most schools across the world. With more Information getting digitized every day, and the internet making it accessible to anyone across the world, students are increasingly relying on electronic sources of information rather than physical libraries for their needs. Instructional methodology has also undergone a sea change with use of images, animations, videos, presentations and e-learning to complement traditional techniques.

Governance: The concept of e-governance is one of the most novel applications of Information Technology whereby it is changing the lives of millions across the globe. Computerization of Government activities makes it easier to supervise and audit, and makes the administration more responsive to the needs of society. It also bridges the divide between the Government and the people. Technologies like touch-screen kiosks help disseminate information on land records, photo identity cards, pending bills etc. and enable even illiterate people to take more informed decisions. India is leading the world in the effective use of IT for elections.

Medicine: Information Technology plays an important role in medicine. For example, a scanner takes a series of pictures of the body by means of computerized axial tomography (CAT) or magnetic resonance imaging (MRI). A computer then combines the pictures to produce detailed three-dimensional images of the body's organs. In addition, the MRI produces images that show changes in body chemistry and blood flow. Most critical life support equipment are programmed to respond to changes in the patient's status in split-seconds, thereby reducing the response time and risk of human error. Newer concepts like robotic surgery enable specialists to perform surgeries from remote locations. Genomic studies greatly depend on supercomputing power to develop technologies for the future.

Entertainment: IT has changed the lifestyle of most people. The convergence of various technologies has created various options for entertainment like games, streaming music and video, digital television broadcasts, satellite radio, animated movies etc. which can be accessed with the help of mobile phones, PDAs, notebook computers or on television either with a cable connection or wirelessly using newer-generation WiFi, CDMA or GPRS technologies.

Information Technology plays a vital role in most of our daily activities. There is hardly anyone who has not been affected or influenced by IT. With each passing day, newer applications of IT are being developed which increase our interaction with and dependence on IT-enabled devices. Therefore, understanding this technology and using it creatively is imperative to human progress.
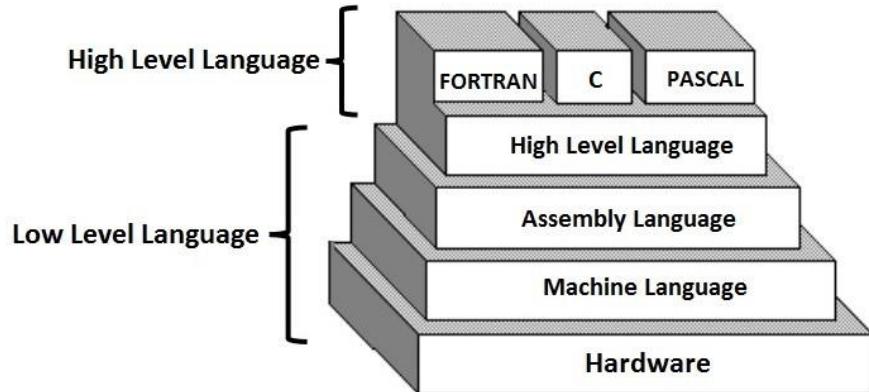
UNIT-2

Introduction:

A language is the main medium of communicating between the Computer systems and the most common are the programming languages. As we know a Computer only understands binary numbers that is 0 and 1 to perform various operations but the languages are developed for different types of work on a Computer. A language consists of all the instructions to make a request to the system for processing a task. From the first generation and now fourth generation of the Computers there were several programming languages used to communicate with the Computer. Here we will go in the detail of the Computer language and its types.

Computer Language Description:

A Computer language includes various languages that are used to communicate with a Computer machine. Some of the languages like programming language which is a set of codes or instructions used for communicating the machine. Machine code is also considered as a computer language that can be used for programming. And also HTML which is a computer language or a markup language but not a programming language. Similarly there are different types of languages developed for different types of work to be performed by communicating with the machine. But all the languages that are now available are categorized into two basic types of languages including Low-level language and High level language.

Computer Language and its Types

Low Level Language:

Low level languages are the machine codes in which the instructions are given in machine language in the form of 0 and 1 to a Computer system. It is mainly designed to operate and handle all the hardware and instructions set architecture of a Computer. The main function of the Low level language is to operate, manage and manipulate the hardware and system components. There are various programs and applications written in low level languages that are directly executable without any interpretation or translation. The most famous and the base of all programming languages "C" and "C++" are mostly used Low level languages till today. Low level language is also divided into two parts are Machine language and Assembly language.

- ▪ **Machine Language** is one of the low-level programming languages which is the first generation language developed for communicating with a Computer. It is written in machine code which represents 0 and 1 binary digits inside the Computer string which makes it easy to understand and perform the operations. As we know a Computer system can recognize electric signals so here 0 stands for turning off electric pulse and 1 stands for turning on electric pulse. It is very easy to understand by the Computer and also increases the processing speed.

The main advantage of using Machine language is that there is no need of a translator or interpreter to translate the code, as the Computer directly can understand. But there are some disadvantages also like you have to remember the operation codes, memory address every time you write a program and also hard to find errors in a written program. It is a machine dependent and can be used by a single type of Computer.

- **Assembly Language** is the second generation programming language that has almost similar structure and set of commands as Machine language. Instead of using numbers like in Machine languages here we use words or names in English forms and also symbols. The programs that have been written using words, names and symbols in assembly language are converted to machine language using an Assembler. Because a Computer only understands machine code languages that's why we need an Assembler that can convert the Assembly level language to Machine language so the Computer gets the instruction and responds quickly.

The main disadvantage of this language is that it is written only for a single type of CPU and does not run on any other CPU. But its speed makes it the most used low level language till today which is used by many programmers.

High Level Language:

The high level languages are the most used and also more considered programming languages that helps a programmer to read, write and maintain. It is also the third generation language that is used and also running till now by many programmers. They are less independent to a particular type of Computer and also require a translator that can convert the high level language to machine language. The translator may be an interpreter and Compiler that helps to convert into binary code for a Computer to understand. There is various high level programming languages like C, FORTRAN or Pascal that are less independent and also enables the programmer to write a program.

UNIT-II

Mainly there are two types of computer languages

Low Level Computer Languages

These are machine codes or close to it. Computer cannot understand instruction given in high level languages or in English. It can only understand and execute instructions given in the form of machine languages i.e. the binary number 0 and 1. There are two types of low level computer language.

Machine Language

A machine language consists of the numeric codes for the operations that a particular computer can execute directly. The codes are strings of 0s and 1s, or binary digits ("bits"), which are frequently converted both from and to hexadecimal (base 16) for human viewing and modification. Machine language instructions typically use some bits to represent operations, such as addition, and some to represent operands, or perhaps the location of the next instruction. Machine language is difficult to read and write, since it does not resemble conventional mathematical notation or human language, and its codes vary from computer to computer.

The set of binary codes which can be recognize by the computer is known as the machine code instruction set. A machine language instruction consists of an operation code one or more operands. The operation code specifies that operation that is to be performed e.g. read, record etc. the operands identify the quantities to be operated on e.g. the numbers to be added or the locations where data are stored. But, it is almost impossible to write programs directly in machine code. For this reason, programs are normally written in assembly or high level languages and then are translated in the machine language by different translators.
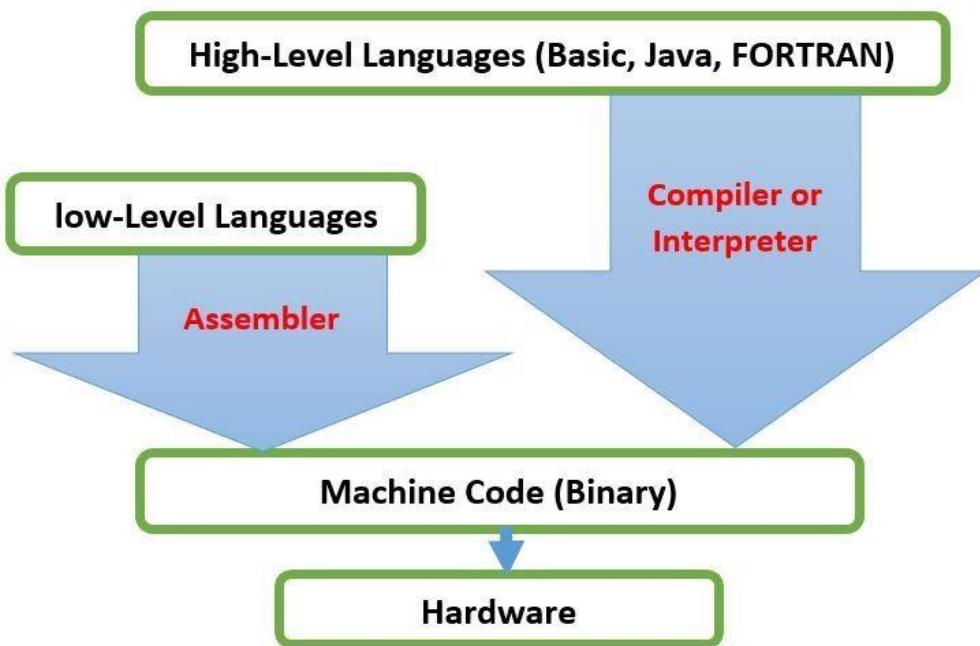
1. It makes fast and efficient use of the computer
2. It requires no translator to translate the code i.e. directly understood by the computer.
1. All operation codes have to be remembered
2. All memory addresses have to be remembered
3. It is hard to amend or find errors in a program written in the machine language
4. These languages are machine dependent i.e. a particular machine language can be used on only one type of computer.

Assembly Languages

It was developed to overcome some of the many inconveniences of machine language. This is another low level but a very important language in which operation codes and operands are given in the form of alphanumeric symbols instead of 0's and 1's. These alphanumeric symbols will be known as mnemonic codes and can have maximum up to 5 letter combinations e.g. ADD for addition, SUB for subtraction, START LABEL etc. because of this feature it is also known as "Symbolic Programming Language". This language is very difficult
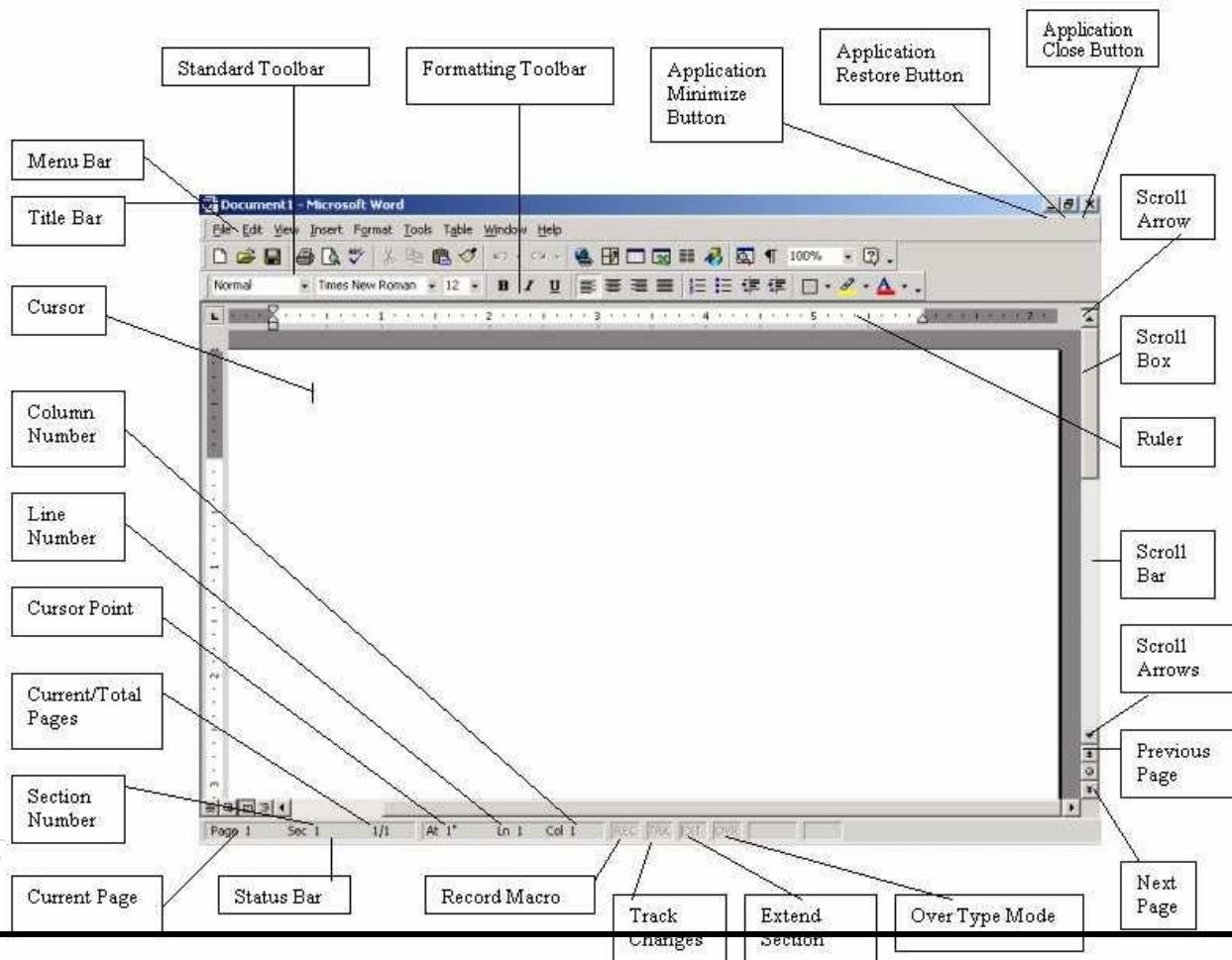
and needs a lot of practice to master it because very small English support is given. This symbolic language helps in compiler orientations. The instructions of the assembly language will also be converted to machine codes by language translator to be executed by the computer

1. It is easier to understand and use as compared to machine language
2. It is easy to locate and correct errors
3. It is modified easily
1. Like machine language it is also machine dependent
2. Since it is machine dependent, there programmer should have the knowledge of he hardware also.

WORD PROCESSING

Word processing describes the process of creating or editing a document using a word processor, such as Microsoft Word, Google Docs, or OpenOffice Writer. For example, with a word processor, a student could create a book report and then print it, save it to a disk, display it on the screen, or send it over e-mail. Also, a person looking for a job could create a résumé using a word processor, then e-mail or print and mail it to job recruiters.

Menu bar

Menu bar This is the traditional windows style drop-down menu. When you point to any menu title and click once with the mouse, the menu will open displaying all the commands available under this menu. Clicking on the desired command would tell Word to execute that command. Some commands have ellipses (…) in front of them. These commands have further sub commands. Commands appearing in dim mode cannot be executed unless the prerequisite functions required by that command have been performed, e.g. you cannot use the Copy or Cut command from the Edit menu unless you have selected a piece of text first. Many commands also have a keyboard shortcuts specified against their names.

Standard toolbar

Standard toolbar Toolbars contain buttons, drop-down menus and other controls that help you to quickly alter the appearance and arrangement of documents by executing a variety of word commands. Toolbars are very helpful and convenient in quickly executing commands without having to go through menus. The standard toolbar contains icons for basic functions like opening files, saving files, printing files, cut, copy, paste etc.

Formatting toolbar

This contains icons for changing the look of your text (called "formatting" in computer jargon); for example, there are icons for changing fonts, styles, font sizes, text alignment etc.

Ruler

The Ruler lets you make changes to margins and indents, and helps you create document as per dimensions required.

Scroll tools

These helps you travel within your document. You can go anywhere, up and down, right and left in your document mainly by two ways: Using the horizontal and vertical scroll bars with the help of the mouse; Or using the keyboard to press PgUp, PgDn, Home, End and arrow keys.

Status bar

Also called the Status Area, this is the normally the last line on your screen. This gives the following information about your work—

- Current Page
- Section Number
- Current/Total pages in the document
- Current Cursor Position (where the cursor is presently located)
- Current Line Number
- Current Column Number
- Record Macro-whether macro recording is On or not
- Track Revision-whether revisions have been made or not
- Extend Selection
- Over type mode-whether you are in Insert mode or overwrite mode

Cursor
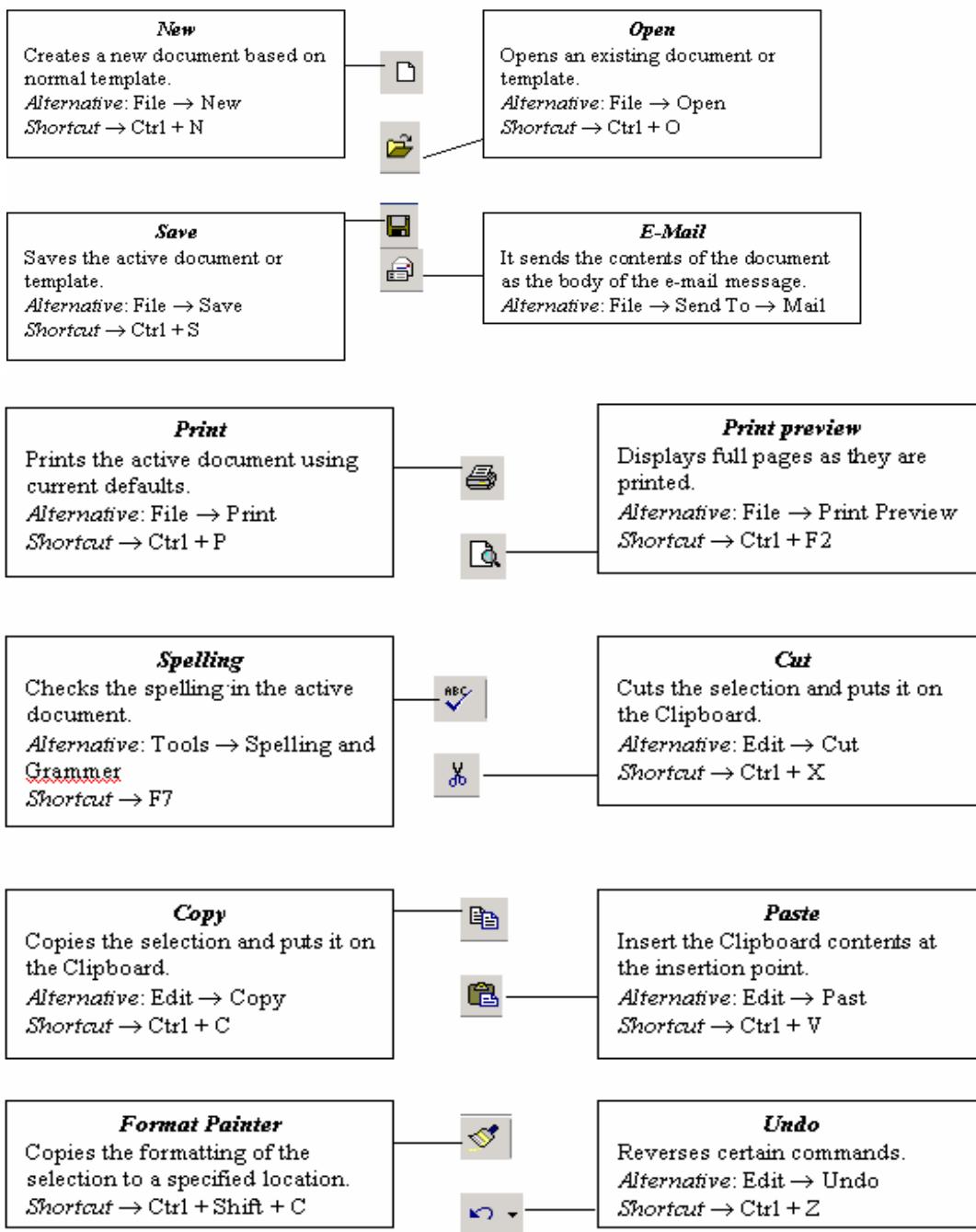
Also called the Insertion Pointer, this denotes the place where text, graphics or any other item would be placed when you type, overwrite or insert them. This looks like a tall, skinny toothpick and keeps blinking so that you can locate it easily.
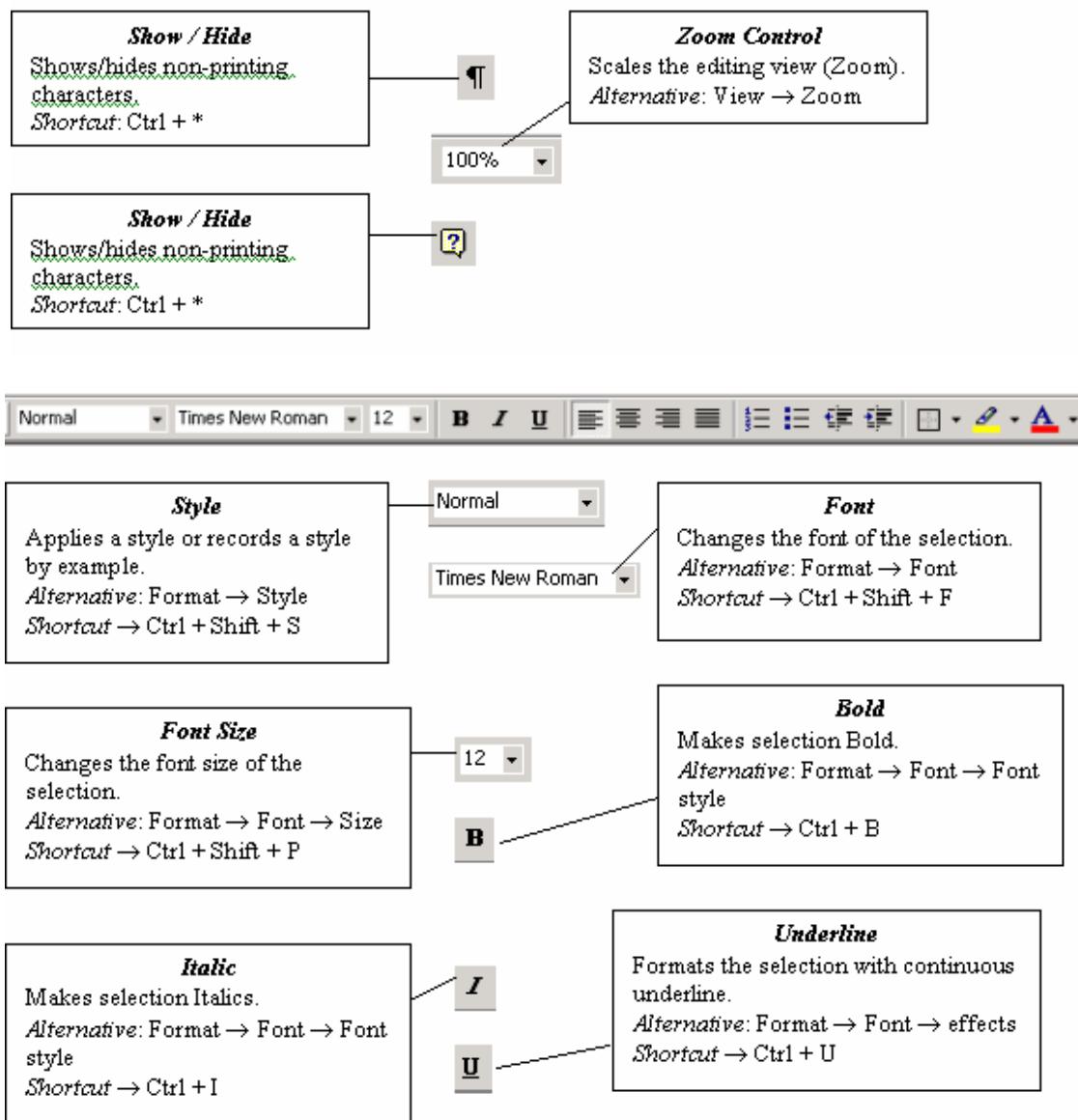
Mouse pointer
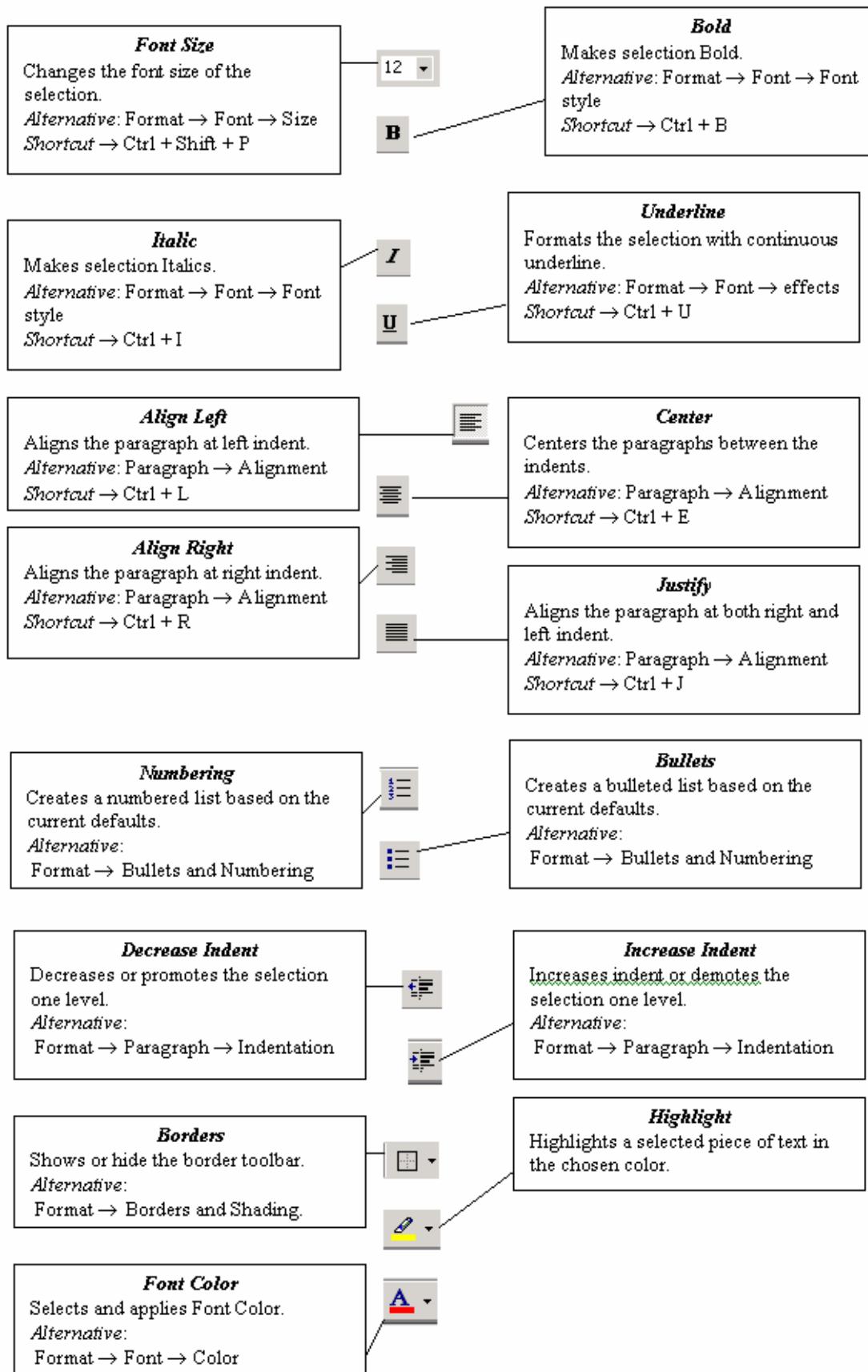
When your mouse pointer looks like an I-beam you should be able to move it freely on the screen. This is used for either placing the cursor at the desired place (take the mouse pointer there and click) or choosing any command either from the menu or from toolbars. The mouse pointer changes shape when in the process of doing certain tasks and the cursor disappears.

TOOLBARS AND THEIR ICONS

Word Standard Toolbar

New
Creates a new document based on normal template.
Alternative: File → New
Shortcut → Ctrl + N

Open
Opens an existing document or template.
Alternative: File → Open
Shortcut → Ctrl + O

Save
Saves the active document or template.
Alternative: File → Save
Shortcut → Ctrl + S

E-Mail
It sends the contents of the document as the body of the e-mail message.
Alternative: File → Send To → Mail

Print
Prints the active document using current defaults.
Alternative: File → Print
Shortcut → Ctrl + P

Print preview
Displays full pages as they are printed.
Alternative: File → Print Preview
Shortcut → Ctrl + F2

Spelling
Checks the spelling in the active document.
Alternative: Tools → Spelling and Grammer
Shortcut → F7

Cut
Cuts the selection and puts it on the Clipboard.
Alternative: Edit → Cut
Shortcut → Ctrl + X

Copy
Copies the selection and puts it on the Clipboard.
Alternative: Edit → Copy
Shortcut → Ctrl + C

Paste
Insert the Clipboard contents at the insertion point.
Alternative: Edit → Past
Shortcut → Ctrl + V

Format Painter
Copies the formatting of the selection to a specified location.
Shortcut → Ctrl + Shift + C

Undo
Reverses certain commands.
Alternative: Edit → Undo
Shortcut → Ctrl + Z

Show / Hide
Shows/hides non-printing characters.
Shortcut: Ctrl + *

¶

Zoom Control
Scales the editing view (Zoom).
Alternative: View → Zoom

100%

Show / Hide
Shows/hides non-printing characters.
Shortcut: Ctrl + *

Normal | Times New Roman | 12 | **B** *I* U

Style
Applies a style or records a style by example.
Alternative: Format → Style
Shortcut → Ctrl + Shift + S

Normal

Times New Roman

Font
Changes the font of the selection.
Alternative: Format → Font
Shortcut → Ctrl + Shift + F

Font Size
Changes the font size of the selection.
Alternative: Format → Font → Size
Shortcut → Ctrl + Shift + P

12

B

Bold
Makes selection Bold.
Alternative: Format → Font → Font style
Shortcut → Ctrl + B

Italic
Makes selection Italics.
Alternative: Format → Font → Font style
Shortcut → Ctrl + I

I

U

Underline
Formats the selection with continuous underline.
Alternative: Format → Font → effects
Shortcut → Ctrl + U

Font Size
Changes the font size of the selection.
Alternative: Format → Font → Size
Shortcut → Ctrl + Shift + P

Bold
Makes selection Bold.
Alternative: Format → Font → Font style
Shortcut → Ctrl + B

Italic
Makes selection Italics.
Alternative: Format → Font → Font style
Shortcut → Ctrl + I

Underline
Formats the selection with continuous underline.
Alternative: Format → Font → effects
Shortcut → Ctrl + U

Align Left
Aligns the paragraph at left indent.
Alternative: Paragraph → Alignment
Shortcut → Ctrl + L

Center
Centers the paragraphs between the indents.
Alternative: Paragraph → Alignment
Shortcut → Ctrl + E

Align Right
Aligns the paragraph at right indent.
Alternative: Paragraph → Alignment
Shortcut → Ctrl + R

Justify
Aligns the paragraph at both right and left indent.
Alternative: Paragraph → Alignment
Shortcut → Ctrl + J

Numbering
Creates a numbered list based on the current defaults.
Alternative:
Format → Bullets and Numbering

Bullets
Creates a bulleted list based on the current defaults.
Alternative:
Format → Bullets and Numbering

Decrease Indent
Decreases or promotes the selection one level.
Alternative:
Format → Paragraph → Indentation

Increase Indent
Increases indent or demotes the selection one level.
Alternative:
Format → Paragraph → Indentation

Borders
Shows or hide the border toolbar.
Alternative:
Format → Borders and Shading.

Highlight
Highlights a selected piece of text in the chosen color.

Font Color
Selects and applies Font Color.
Alternative:
Format → Font → Color

File management

Creating a New Document

- o Click on File Menu
- o Select and click New option
- o Otherwise click [icon] button on the standard toolbar

- Opening an Existing Document:

  - o Click File Menu
  - o Select and click Open option
  - o Otherwise click [icon] button on the Standard toolbar.
  - o Double click on the file from the open window

- Saving a Document

  - o Click File Menu
  - o Select and click Save button.
  - o Otherwise click button [icon] on the Standard toolbar.

- Moving through the document

  - o Open any word document. You can move the cursor to any location on the screen by using the arrow keys on the keyboard.
  - o Right arrow key is used to move one position to the right of the cursor
  - o Left arrow key is used to move one position to the left of the cursor.
  - o Up arrow key is used to move one position to the top of the cursor.
  - o Down arrow key is used to move one position to the down of the cursor.
  - o Page Up key is used to move down the screen at a time
  - o Page down key is used to move up the screen at a time
  - o Hold down Ctrl key and press Home to move to beginning of the

document.

    o   Hold down Ctrl key and press End to move to end of the document.
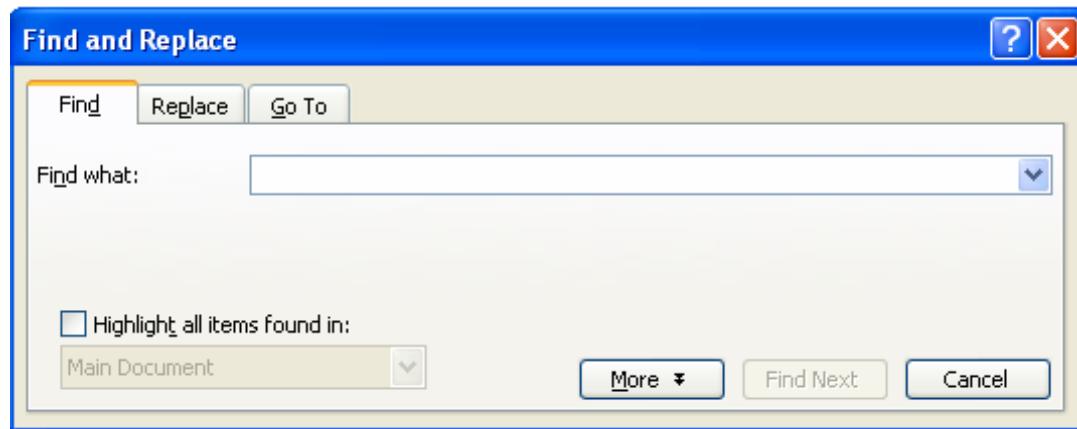
Editing Word document

- **Cut , Copy and Paste options**

  - ▪ These options will allow you to Cut or Copy a piece of text from one location and to paste at a new location.

- **To do these functions,**

  - o Place the cursor at the begining of the text to be selected. Drag the mouse pointer over the text. The text will now appear in reverse vedeo as shown below:

- Jawahar Knowledge Center

  - o Click Edit menu and then click on Cut option (or) click ✂ icon on the Standard Toolbar.   Move the cursor to the place where you want the text to be pasted.

  - o Click Edit menu and then click Paste option (or) click 📋 icon on the Standard Toolbar.

- For copying the text from one location to other location the same procedure is to be followed. The difference between Cut and Copy is that while using the Cut option the text will be removed from its original

location and pasted at a new location, where as when using Copy option a copy of the selected text is pasted at new location without disturbing the original text.

Searching text

- Open any document.
- Click Edit menu and then click Find option. You will get a screen as shown below.
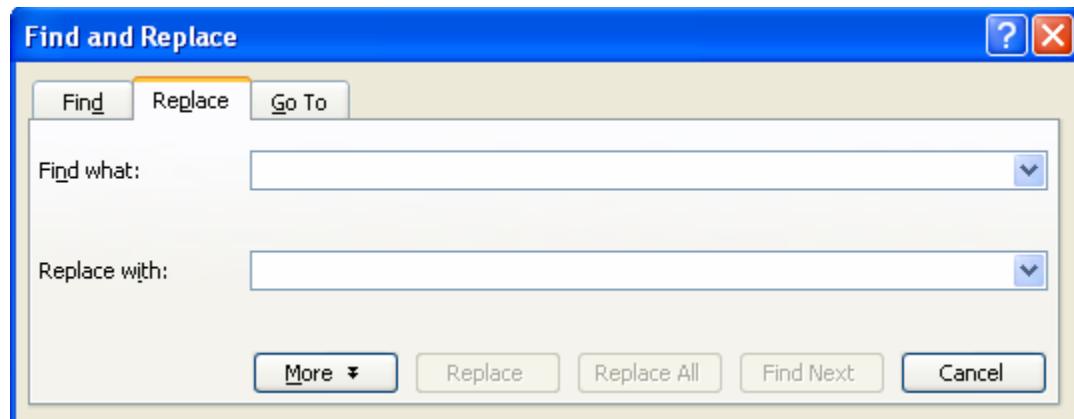
- In Find What text box type the word you want to find and then click Find Next button.
- Continue clicking Find Next button until you get the screen shown below.
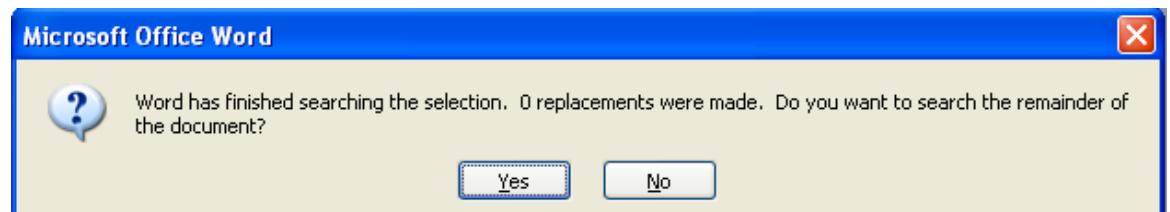
- Click OK button and then click X to close Find and Replace dialog box.

Replacing text

- Open any word document.
- Click Edit menu and then click Replace option. You will get the dialog box as shown below and type the word with which you want to replace.
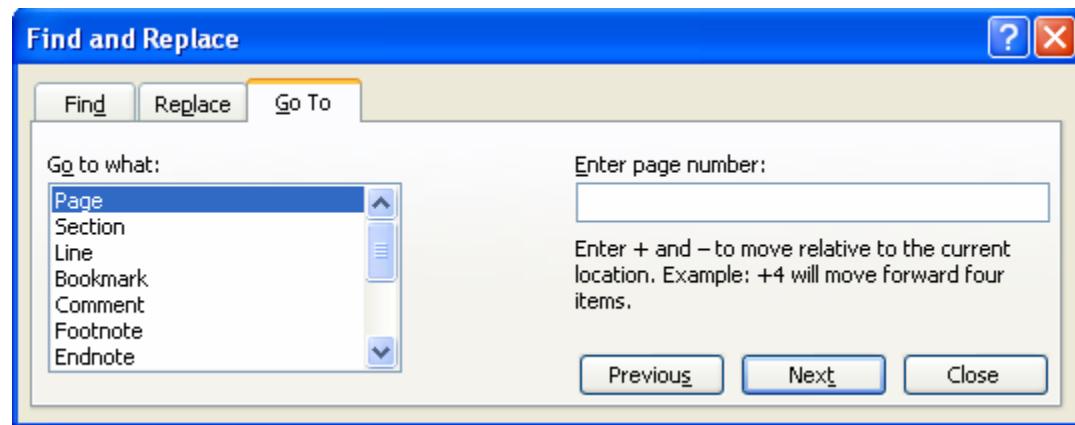
- Click ReplaceAll button once. You get the below dialog box.
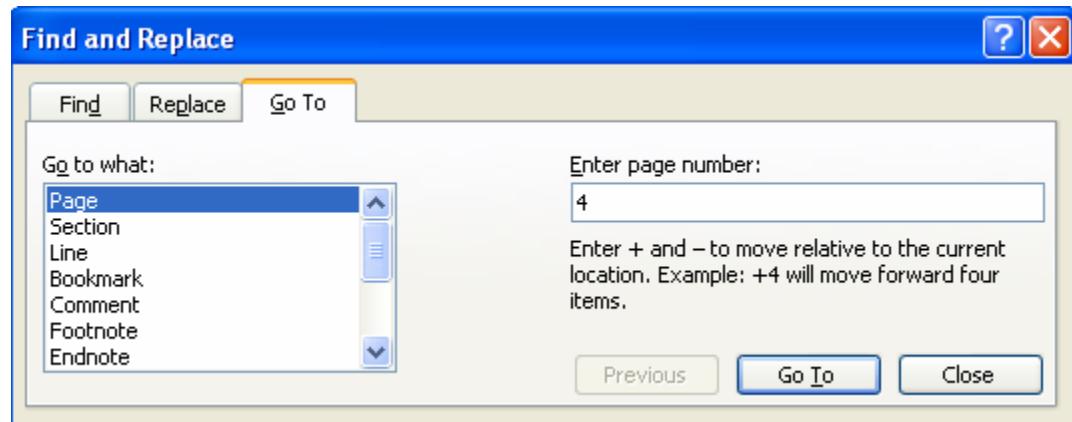
- Click OK button and then click X to close Find and Replace dialog box.

Moving the cursor to a specific page

- If your word document contains more than one page, you can directly go to specified page by clicking Edit menu and then clicking Go To option. You will get the dialog box as shown below.

Find and Replace

Find | Replace | Go To

Go to what:

Page
Section
Line
Bookmark
Comment
Footnote
Endnote

Enter page number:

Enter + and − to move relative to the current location. Example: +4 will move forward four items.

Previous   Next   Close

⬚ In the Enter page number text box, type the required page number as shown below.

Find and Replace

| Find | Replace | Go To |

Go to what:

Page
Section
Line
Bookmark
Comment
Footnote
Endnote

Enter page number:

4

Enter + and – to move relative to the current location. Example: +4 will move forward four items.

Previous   Go To   Close

⬚ Click Go To button. Cursor will immediately jump to page 4.
⬚ Click Close button to close Find and Replace dialog box.

Formatting documents

Bold, Underline and Italicize the selected text

⬚ Open a word document.
⬚ Block the text by first clicking at the start of the text and holding the left mouse button and drag to the desired position and then release the left mouse button. The selected area will be highlighted.
⬚ Move the mouse pointer to the button **B** on the Standard Toolbar and click once.
⬚ Move the mouse pointer outside your text and click to release the highlighting. Your text will now appear in BOLD FACE.
⬚ Like this you can underline or italicize the desired text by using the following buttons

I | U

Left aligning, centering , right aligning and justifying text

Left Centre Right Justify

- Open a word document.
- Block the text by first clicking at the start of the text and holding the left mouse button and drag to the desired position and then release the left mouse button. The selected area will be highlighted.
- Move the mouse pointer to Align Left button on the toolbar and click once. Your selected text will be left aligned.
- Move the mouse pointer to Align right button on the toolbar and click once. Your selected text will be right aligned.
- Move the mouse pointer to Center button on the toolbar and click once. Your selected text will be centered.
- Move the mouse pointer to Justify button on the toolbar and click once. Your selected text will be justified.

Creating Bulleted and Numberedlist

- o If a list of items are to be numbered automatically it can be done using Numbered List option

  - Ex: Microsoft Office consists of MS-Word
  - MS-Excel
  - MS-PowerPoint MS-Access
  - MS-Outlook

- o The above text is to be selected with mouse.
- o Click on the Numbered List button on the toolbar

- o Move out of the text and click to release the highlighting.
- o Your text will now look like this

  - MS-Word

- MS-Excel
- MS-PowerPoint
- MS-Access
- MS-Outlook

o Now re-select the text
o Click the Bulleted List button on the toolbar.

⬚ The numbers should be replaced with bullets as shown below
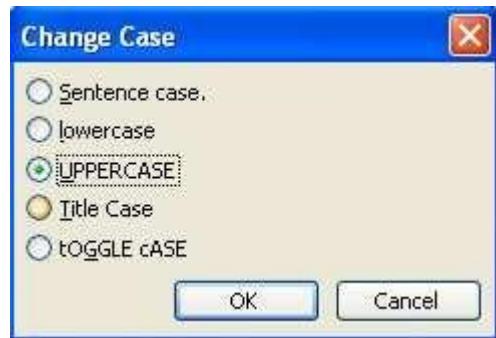
- MS-Word
- MS-Excel
- MS-PowerPoint
- MS-Access
- MS-Outlook

Indenting Paragraphs

⬚ Select a paragraph with the mouse.
⬚ Click on the Right (increase) Indent ⬚ button on the toolbar.

⬚ Leave the highlighting on and click once more on the Right Indent button.
⬚ Click once on the Left Indent ⬚ button. Your text should now be indented by one Tab stop. Each time you click, the paragraph is moved one tab stop.

Changing case of text

⬚ You can change the selected text into either UPPERCASE, lowercase, Title case or tOGGLE cASE

⬚ Highlight the text. Select the Format menu option
⬚ Choose Change Case option. You will get the dialog box shown below.

❒ From the list of options select UPPERCASE to convert lower case into uppercase

Indenting text with tabs

- ❑ Type your name and address as you would at the head of a letter, but aligned with the left margin e.g.
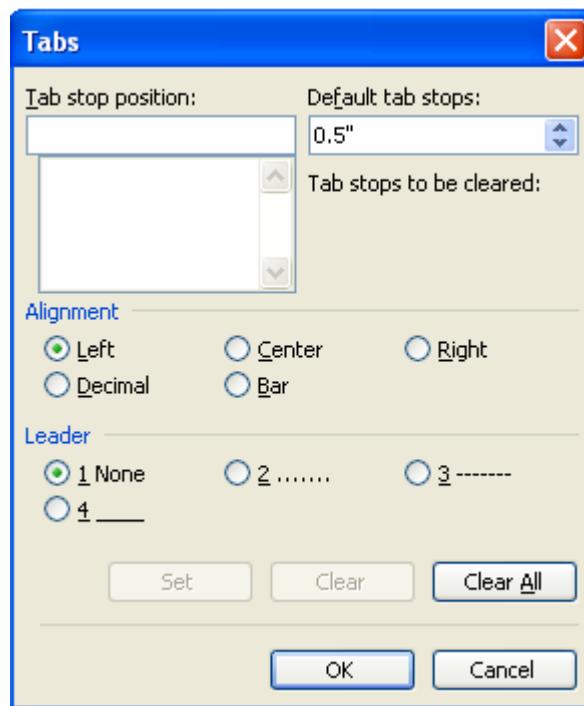
    K.Manohar H.No
    10-334/3,
    V.P. Nagar,
    Malakpet,
    Hyderabad.
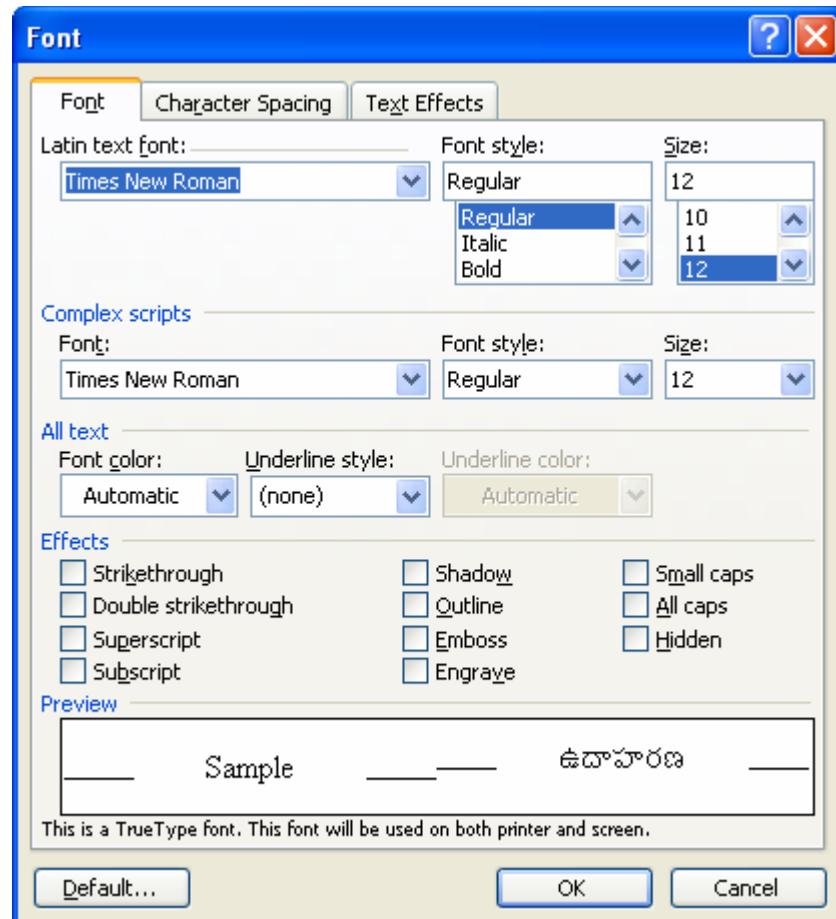
- ❑ Move the cursor to the start of each line and press the Tab key. Just as with the right indent button, your text will move right. How much it moves will depend on the tab settings, which you can change in the Format, Tabs menu as shown below.

Font Controlling

- ❑ To get different character styles we can change Font type
- ❑ Click on Format menu

⬡ Select Font option. You will get the following screen.

⬡ Select Font option. You will get the following screen.

- ▢ You can set Font type, Font Style and Font size and Color of the selected text.
- ▢ Click OK button.

Note: The above options are also available on the Formatting Toolbar

Font style   Font Type   Font size   Color

MAIL MERGE
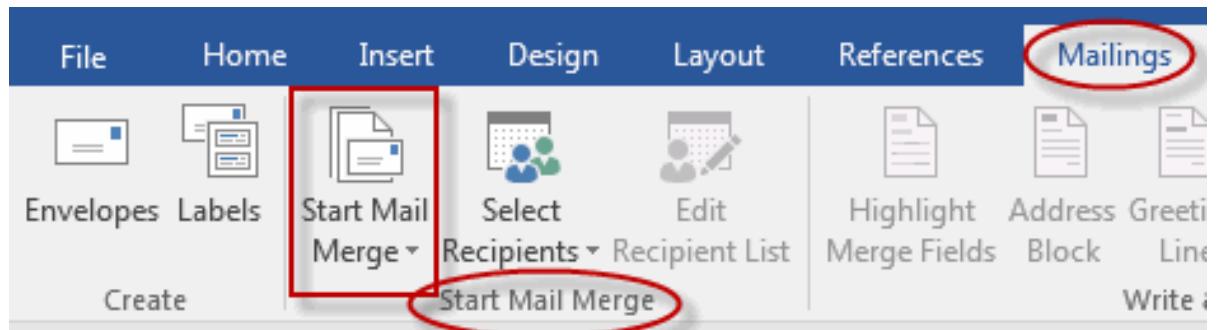
Mail merge is a feature within most data processing applications that enables users to send a similar letter or document to multiple recipients. It enables connecting a single form template with a data source that contains information about the recipient's name, address and other predefined and supported data

Mail merge primarily enables automating the process of sending bulk mail to customers, subscribers or general individuals. Mail merge works when a data file is stored that includes the information of the recipients to whom the letter is to be sent. This file can be a spreadsheet or database file containing separate fields for each different type of information to be merged within the letter.
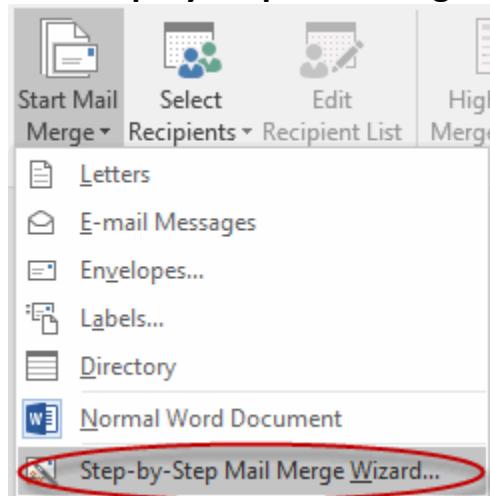
The second file is the word document or the letter template. The recipients' information on the letter template is kept empty. When the mail merge process is initiated, the recipients' data from spreadsheet or database is fetched and placed within the empty field in the letter, one by one, until all letters are created.

Steps To Perform Mail Merging
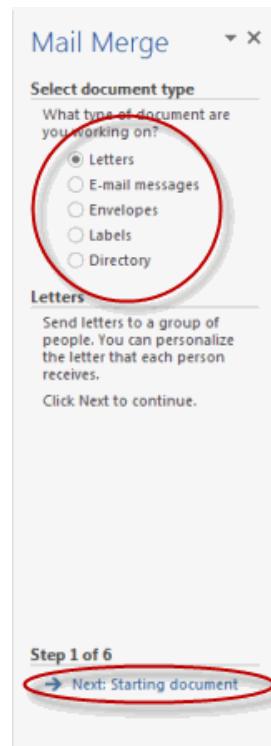
1. In a blank Microsoft Word document, click on the **Mailings** tab, and in the **Start Mail Merge** group, click **Start Mail Merge**.

1. Click **Step-by-Step Mail Merge Wizard**.

2. Select your document type. In this demo we will select **Letters**. Click **Next: Starting document**.
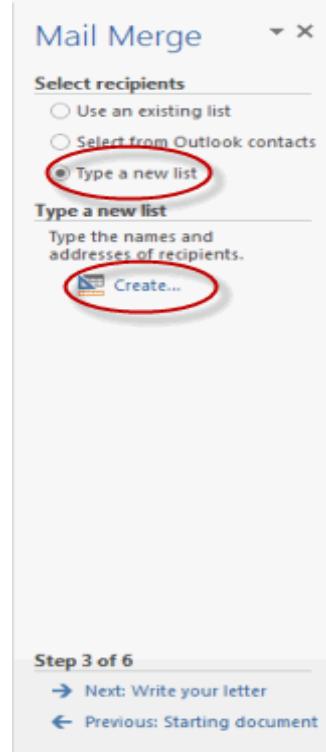
3. Select the starting document. In this demo we will use the current (blank) document. Select **Use the current document** and then click **Next: Select recipients**.
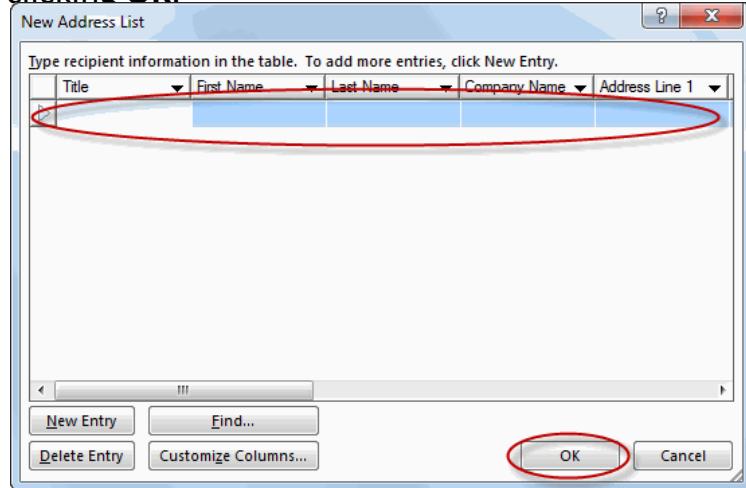
Note that selecting **Start from existing document** (which we are not doing in this demo) changes the view and gives you the option to choose your document. After you choose it, the Mail Merge Wizard reverts to **Use the current document**.

4. Select recipients. In this demo we will create a new list, so select **Type a new list** and then click **Create**.
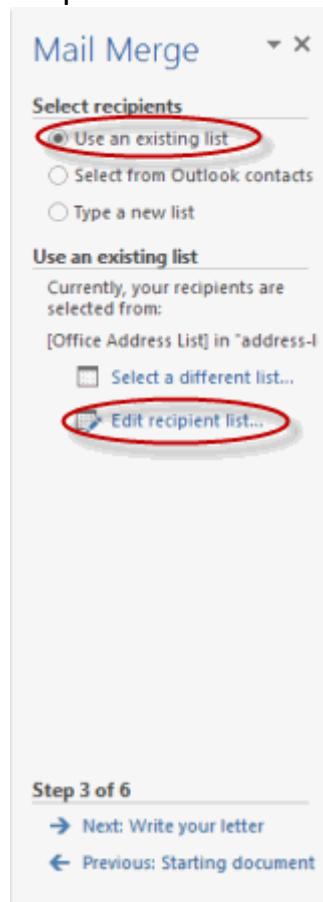
○ Create a list by adding data in the **New Address List** dialog box and clicking **OK**.
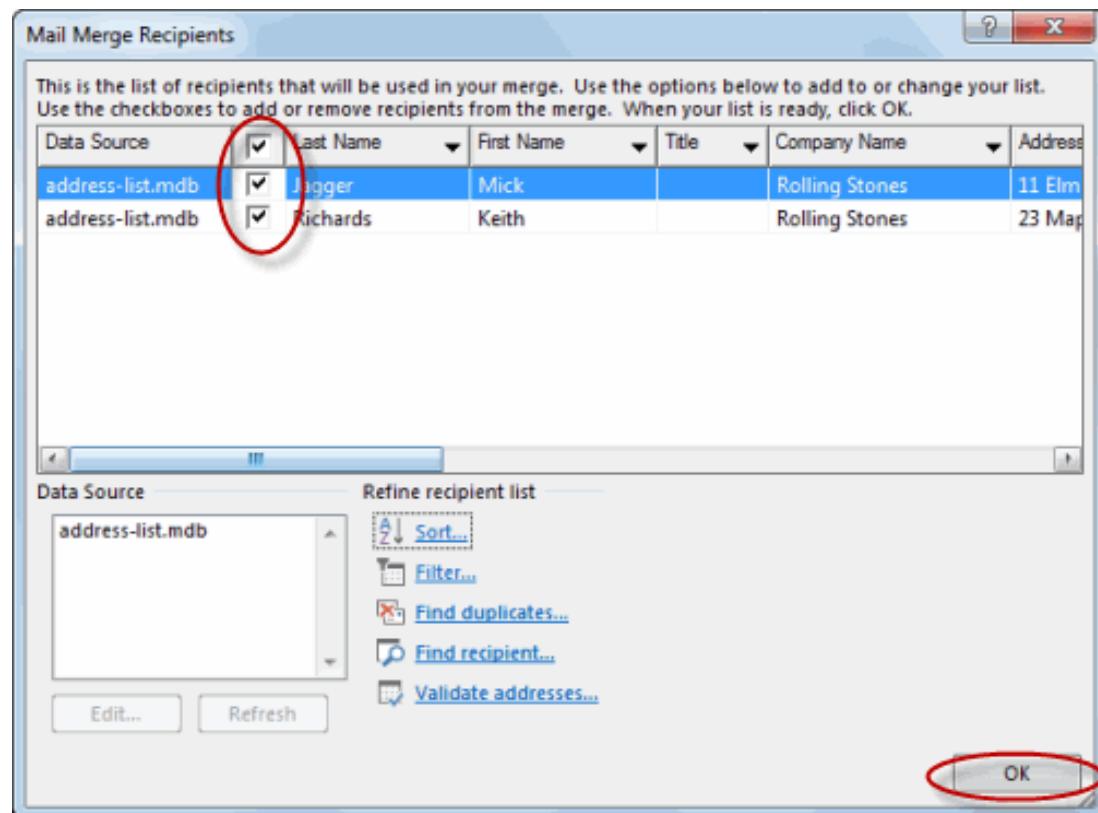
○ Save the list.

○ Note that now that a list has been created, the Mail Merge Wizard reverts to **Use an existing list** and you have the option to edit the

recipient list.

- o Selecting **Edit   recipient   list** opens   up   the **Mail   Merge Recipients** dialog box, where you can edit the list and select or unselect records. Click **OK** to accept the list as is.
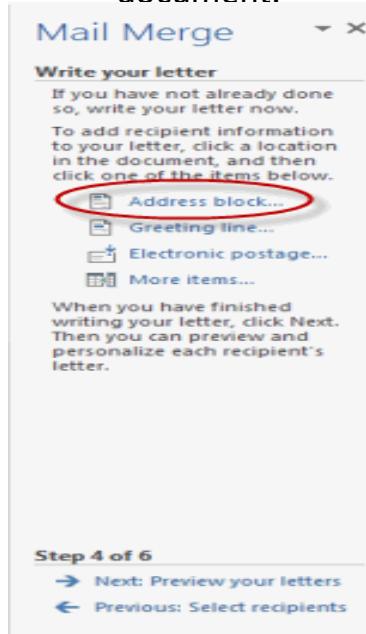
o Click **Next: Write your letter**.
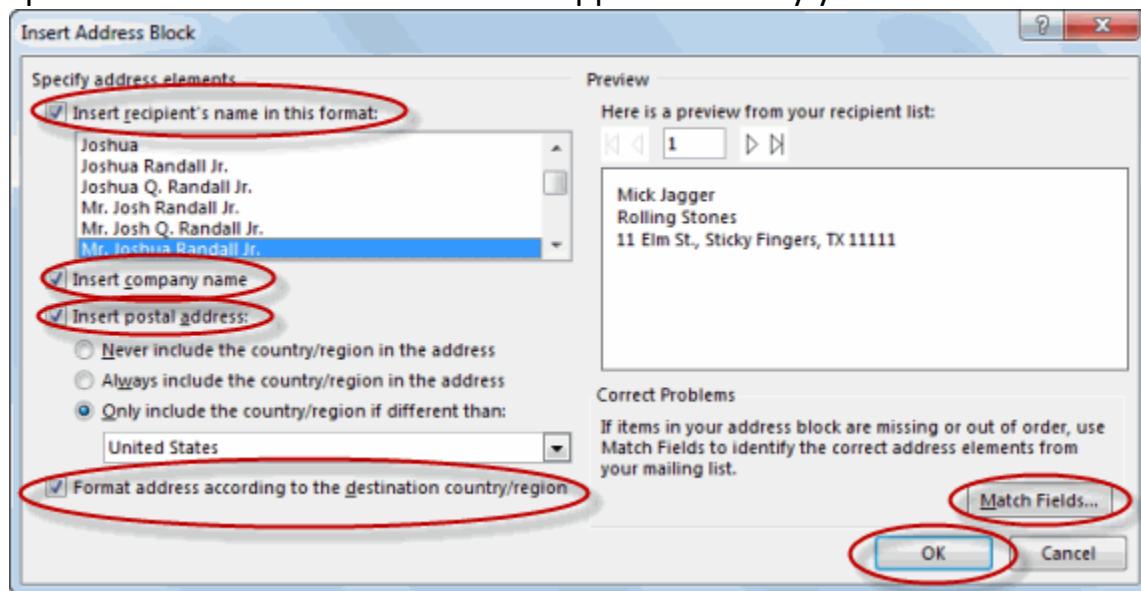
5. Write the letter and add custom fields.
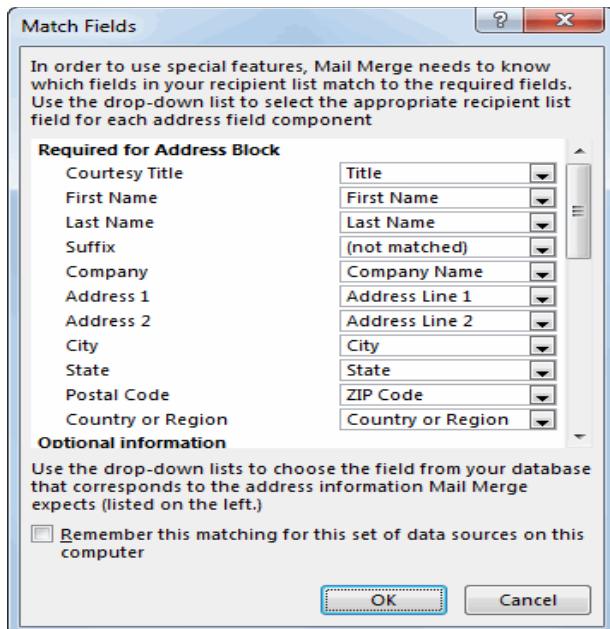
o   Click **Address block** to add the recipients' addresses at the top of the document.
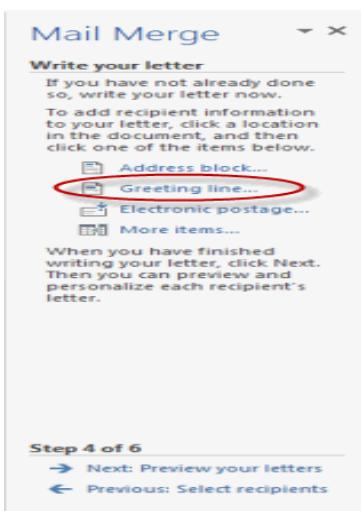
o   In the **Insert Address Block** dialog box, check or uncheck boxes and select options on the left until the address appears the way you want it to.
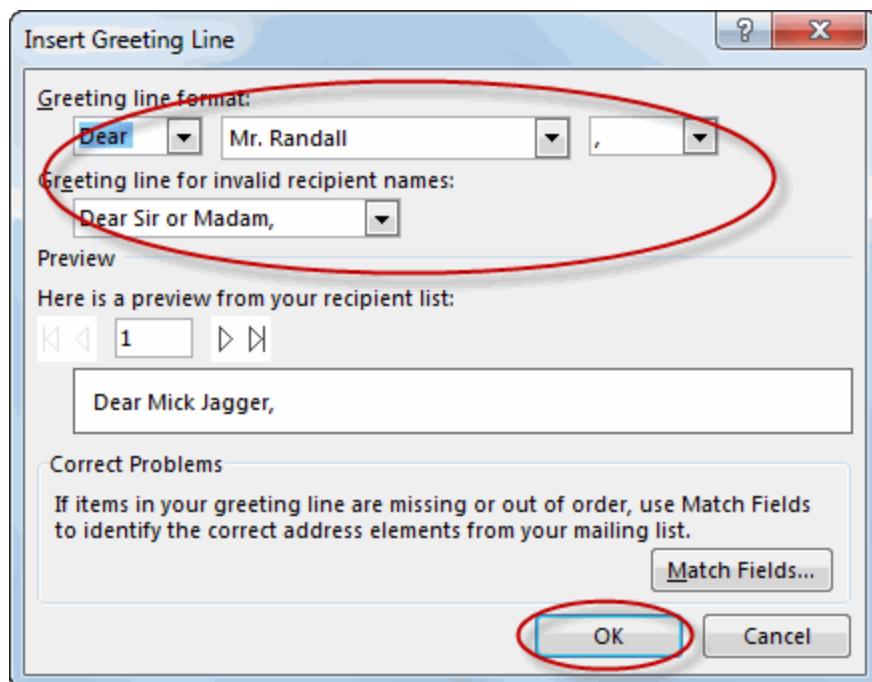
o   Note that you can use **Match   Fields** to   correct   any   problems.
Clicking **Match Fields** opens up the **Match Fields** dialog box, in which you can
associate the fields from your list with the fields required by the wizard.
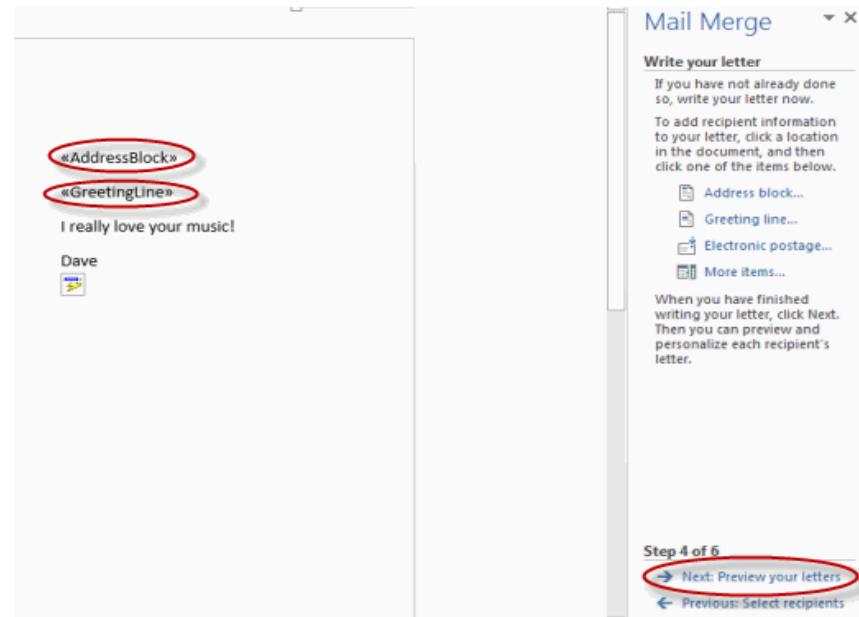
6. Press Enter on your keyboard and click **Greeting line...** to enter a greeting.
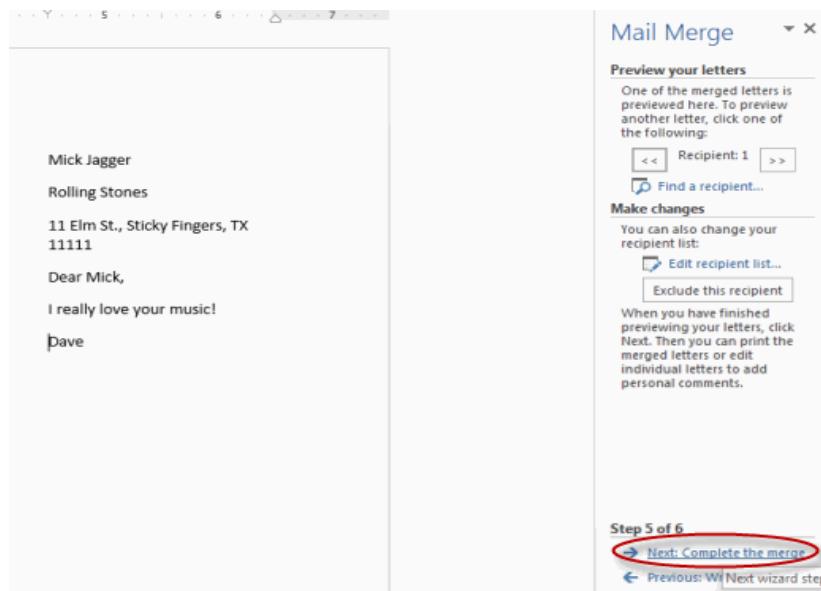
7. In the **Insert Greeting Line** dialog box, choose the greeting line format by clicking the drop-down arrows and selecting the options of your choice, and then click **OK**.
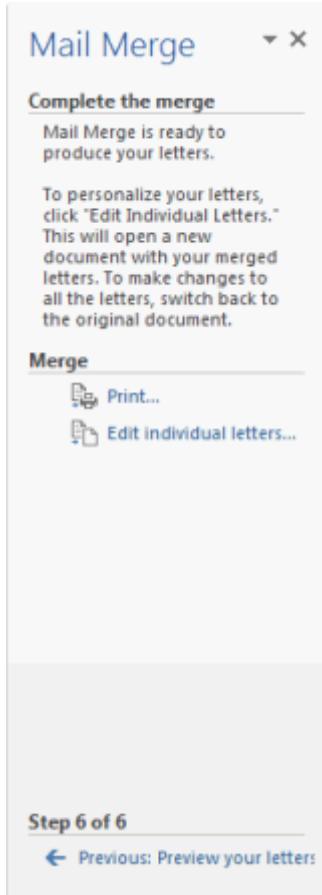
8. Note that the address block and greeting line are surrounded by chevrons (« »). Write a short letter and click **Next: Preview your letters**

.

🗆 Preview your letter and click **Next: Complete the merge**.

⏹ Click **Print** to print your letters or **Edit individual letters** to further personalize some or all of the letters.
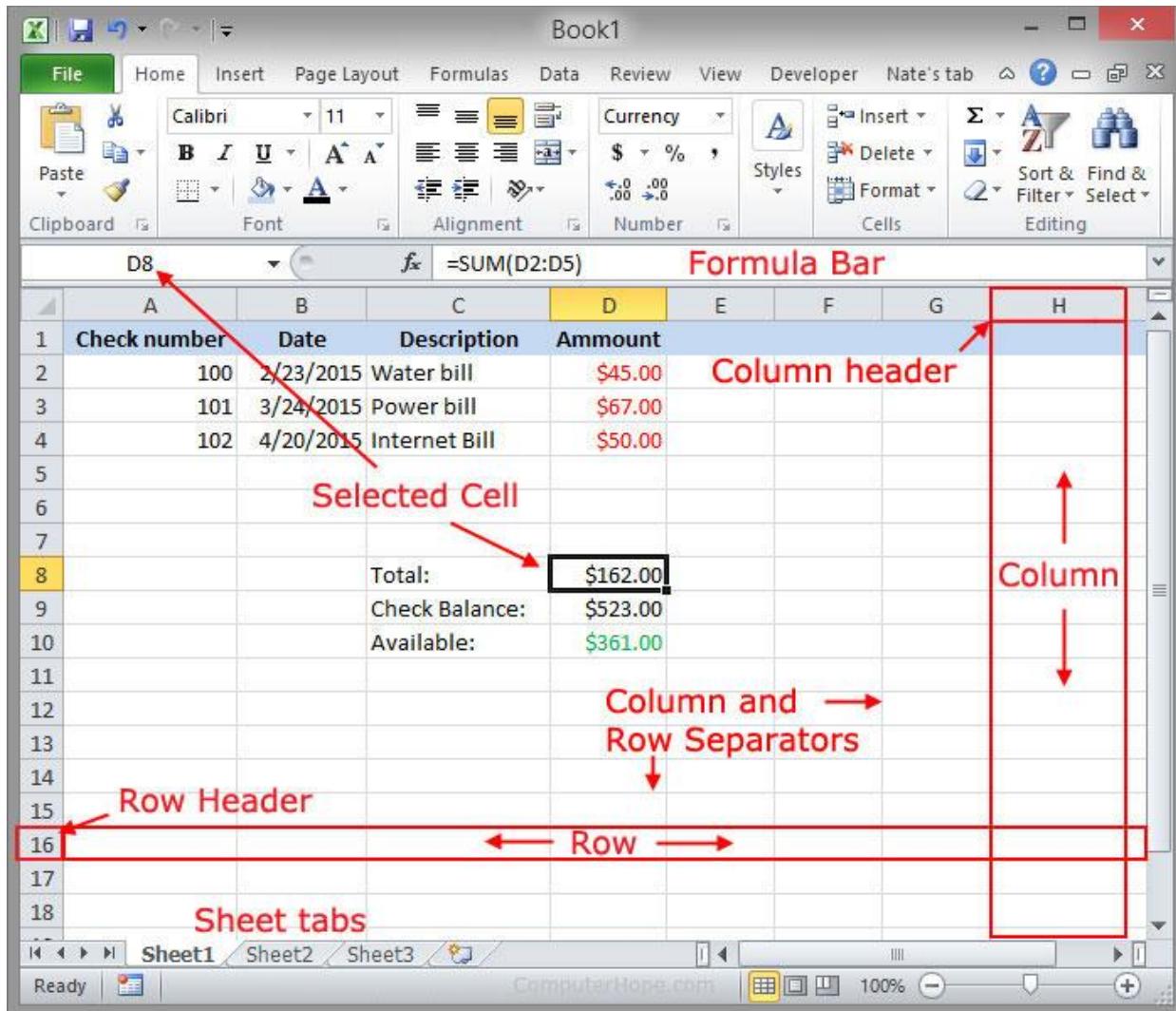
UNIT-III

SPREADSHEET

A **spreadsheet** or **worksheet** is a file made of rows and columns that help sort data, arrange data easily, 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.

Spreadsheet overview

Below is a basic example of what a Microsoft Excel spreadsheet looks like, as well as all the important features of a spreadsheet highlighted.

In the above example, this spreadsheet is listing three different checks, the date, their description, and the value of each check. These values are then added together to get the total of $162.00 in cell D6. That value is subtracted from the check balance to give an available $361.00 in cell D8.

Examples and uses of a spreadsheet

Although spreadsheets are most often used with anything containing numbers, the uses of a spreadsheet are almost endless. Below are some other popular uses of spreadsheets.

Finance

Spreadsheets are ideal for financial data, such as your checking account information, budgets, taxes, transactions, billing, invoices, receipts, forecasts, and any payment system.

Forms

Form templates can be created to handle inventory, evaluations, performance reviews, quizzes, time sheets, patient information, and surveys.

School and grades

Teachers can use spreadsheets to track students, calculate grades, and identify relevant data, such as high and low scores, missing tests, and students who are struggling.

Lists

Managing a list in a spreadsheet is a great example of data that does not contain numbers, but still can be used in a spreadsheet. Great examples of spreadsheet lists include telephone, to-do, and grocery lists.

Sports

Spreadsheets can keep track of your favorite player stats or stats on the whole team. With the collected data, you can also find averages, high scores, and statistical data. Spreadsheets can even be used to create tournament brackets.

WORKBOOK

In Microsoft Excel a **workbook** is a collection of one or more spreadsheets, also called worksheets, in a single file. Below is an example of a spreadsheet called "Sheet1" in an Excel workbook file called "Book1." Our example also has the "Sheet2" and "Sheet3" sheet tabs that are also part of the same workbook.

How to create a new workbook

To create a new workbook in Microsoft Excel, follow the steps below for your version of Excel.

Microsoft Excel 2013 and later

1. Open Excel.
2. Click the **File**
3. Click **New**
4. Under *Featured*, click **Blank workbook**.

Microsoft Excel 2010

1. Open Excel.
2. Click the **File** tab at the top of the window.
3. Click **New**
4. Click **Blank workbook**.

Microsoft Excel 2007

1. Open Excel.
2. Click the Office Button

3. Select **Blank and recent**.
4. In the right pane double-click **Blank workbook**.

The Most Common Formatting Commands

There are many types of formatting that can be applied to Microsoft Excel worksheets. The most commonly used formatting commands show up on the **Home** tab in three groups:
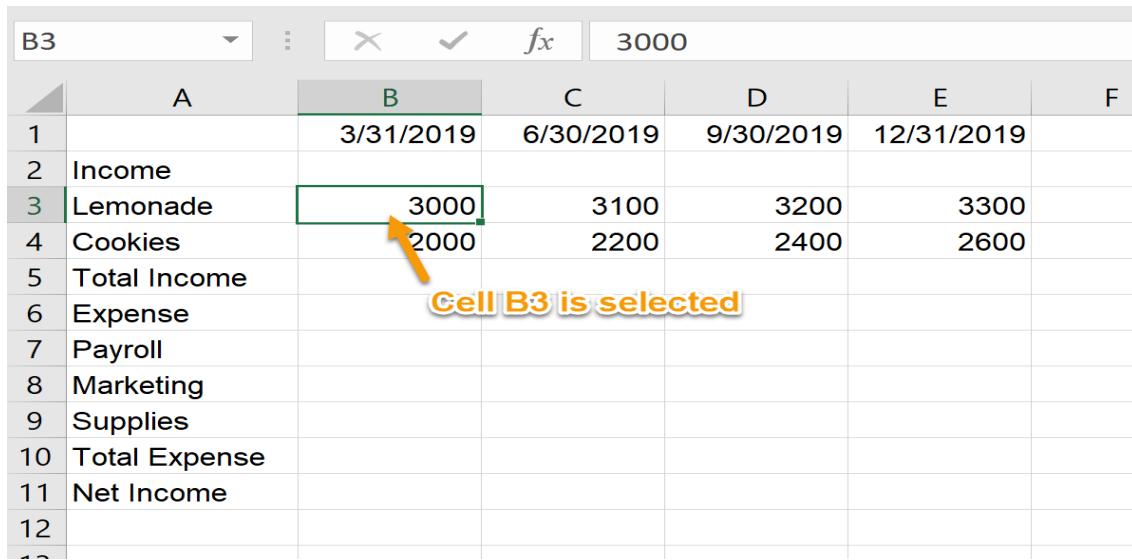
1. **The Font Group**. The font group commands change the appearance of text within a cell or of the cell itself.
2. **The Alignment Group**. The alignment group commands change the position of text within a cell or cells.
3. **The Number Group**. The number group commands change the format of numbers and dates within a cell.

Formatting changes can be applied to a whole worksheet, a range of cells within a worksheet, individual cells, and sometimes even text within a cell.

Selecting Ranges of Cells
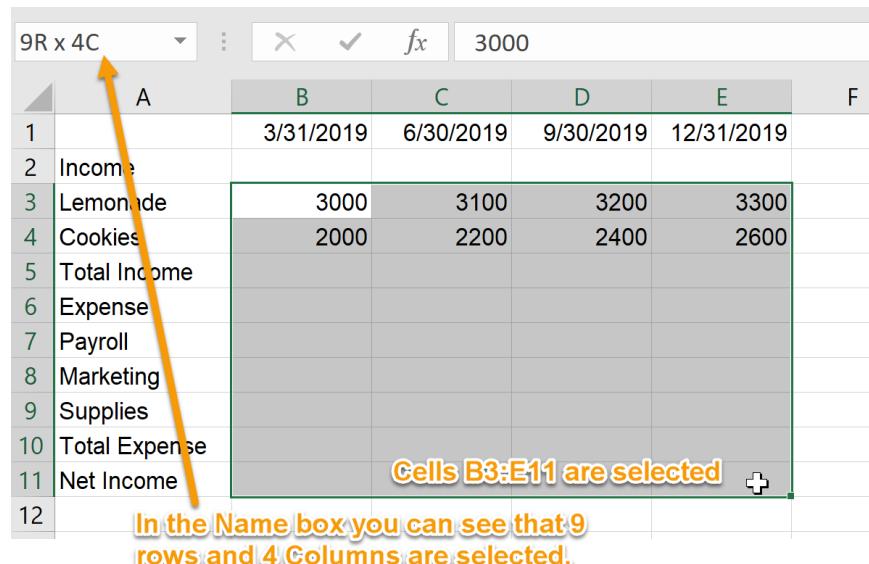
To select a range of cells in Microsoft Excel:

1. Click on a cell in one of the corners of the range of cells you wish to select

2.Hold the left mouse button down and drag horizontally and vertically until the range you wish to select is highlighted:
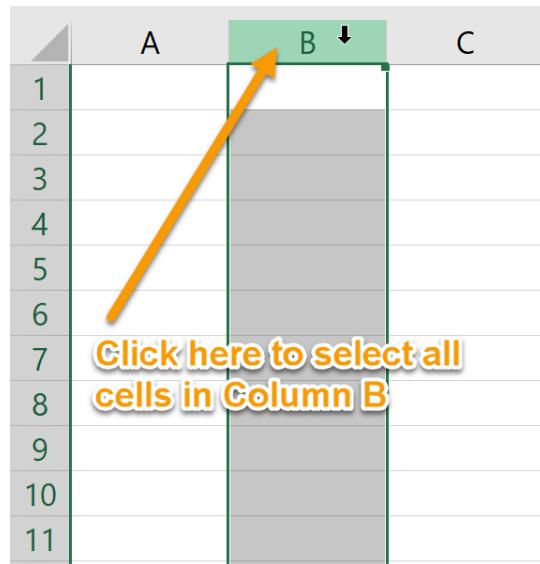
1. Release the click.

You can select all the cells in a row by clicking on the number to the left of the row:

Click here to select all cells in Row 3

You can select all the cells in a column by clicking on the letter at the top of the column:

Click here to select all cells in Column B
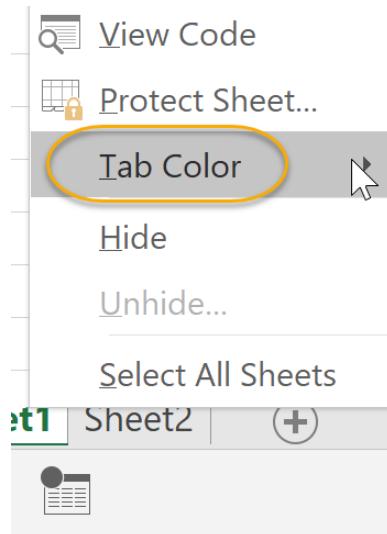
Adding Color to Worksheet Tabs

You can customize your workbook by applying colors to the sheet tabs. This can help differentiate the tabs and make them stand out.
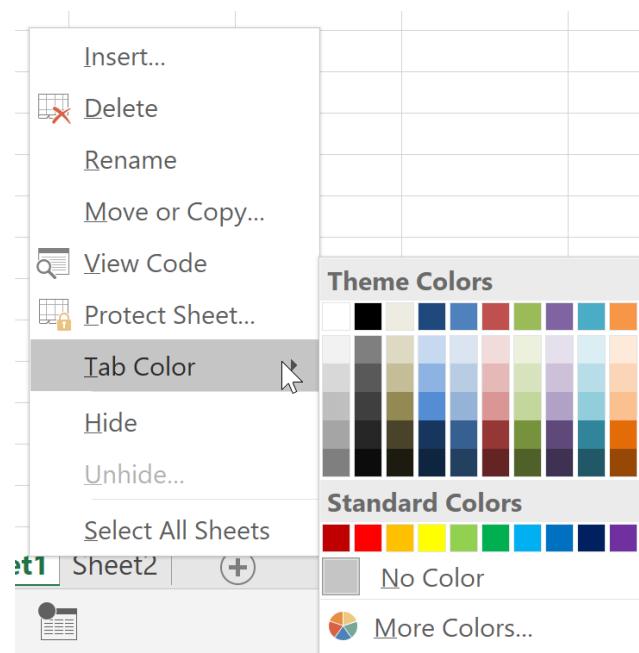
To add color to worksheet tabs:

1. Right-click the tab to which you want to add color.

2. Select **Tab Color**

3. Select a color from the displayed options
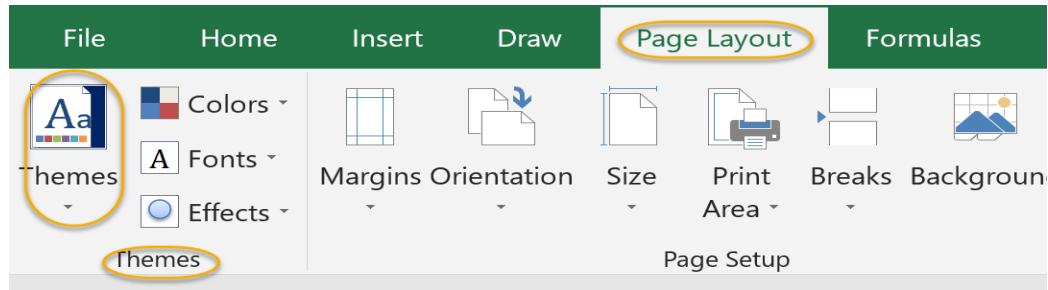
Adding Themes to Workbooks
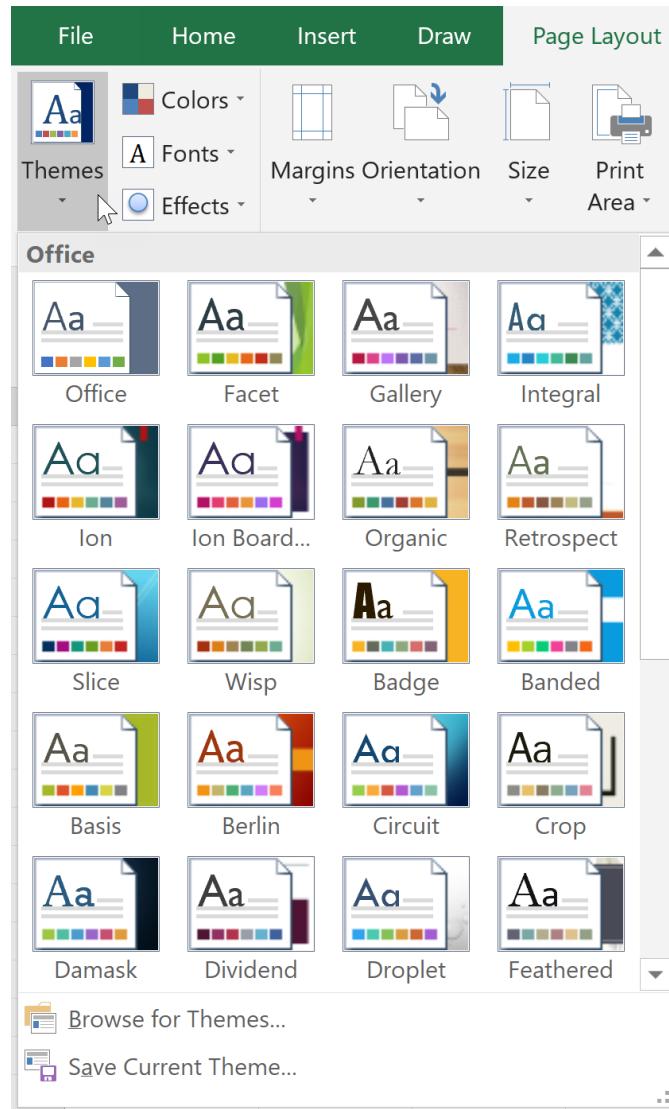
You can further customize workbooks and worksheets by using a Microsoft Office theme. Themes apply a set of fonts, colors, and other effects.

To apply a theme to a worksheet:

1. On the **Page Layout** tab, in the **Themes** group, select **Themes**.
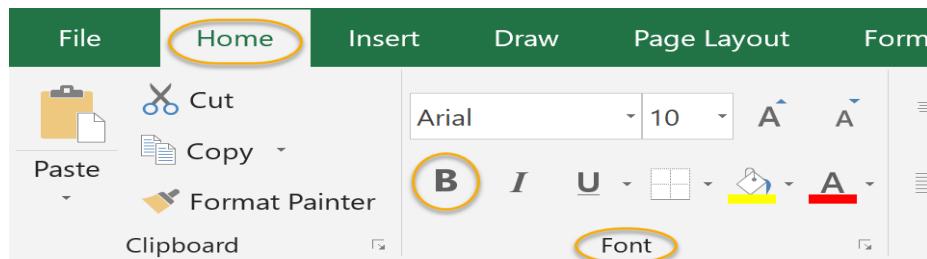
2. From the drop-down menu, select a theme to apply to the worksheet

Bold, Italicize and Underline Text
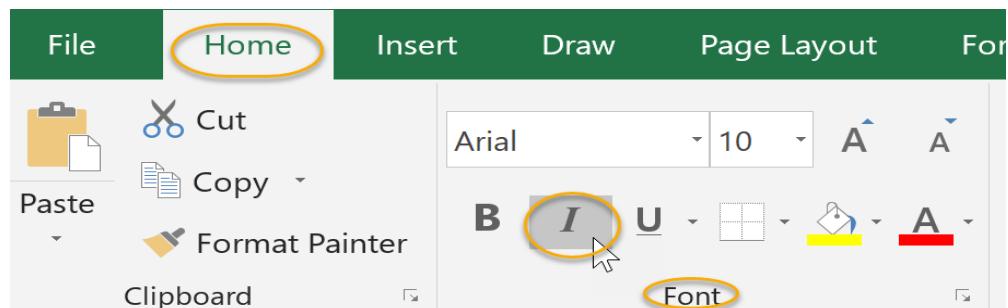
To bold text in Microsoft Excel:

1. Select the cell or cells in which you wish to bold the text.
2. On the **Home** tab, in the **Font** group, click the **Bold** command.
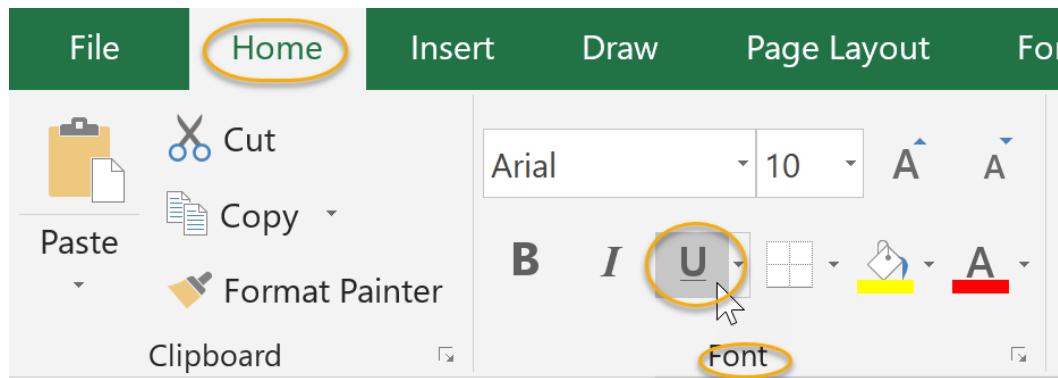
To italicize text in Microsoft Excel:

1. Select the cell or cells in which you wish to italicize the text.
2. On the **Home** tab, in the **Font** group, click the **Italic** command.
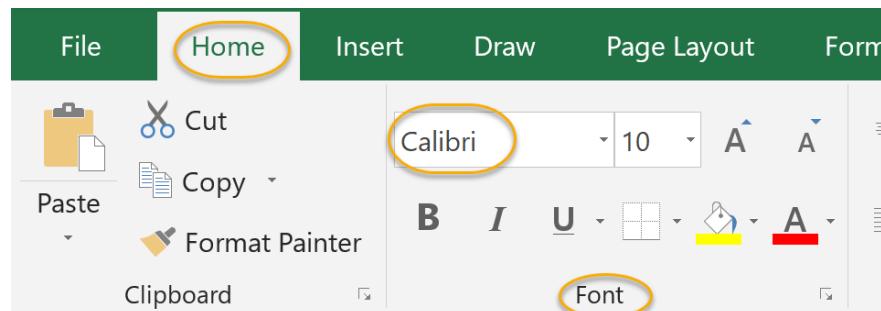

To underline text in Microsoft Excel:

1. Select the cell or cells in which you wish to underline the text.
2. On the **Home** tab, in the **Font** group, click the **Underline** command.
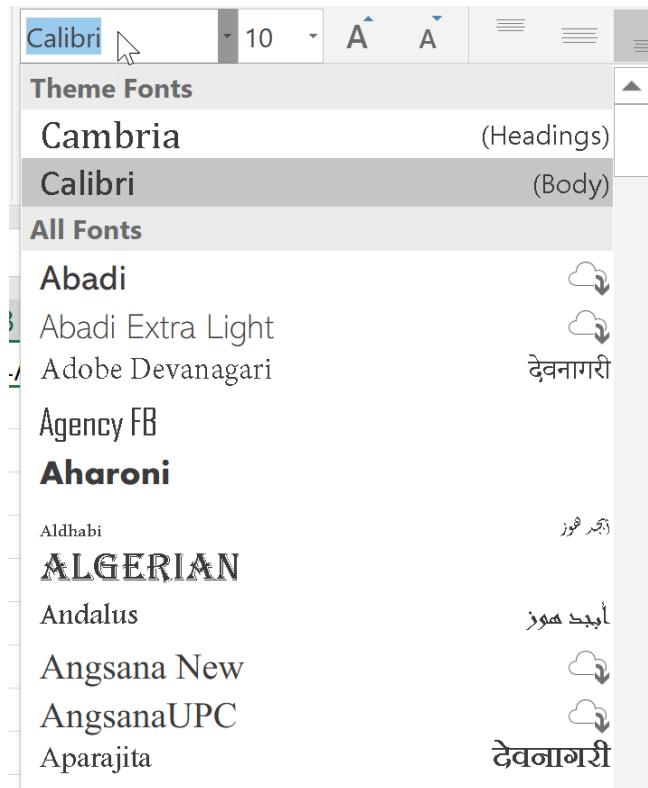
Set Font and Font Size

To change the font of text or numbers in cells in Microsoft Excel:

1. Select the cell or cells in which you wish to change the font.
2. On the **Home** tab, in the **Font** group, click the arrow to the right of the **Font** command.
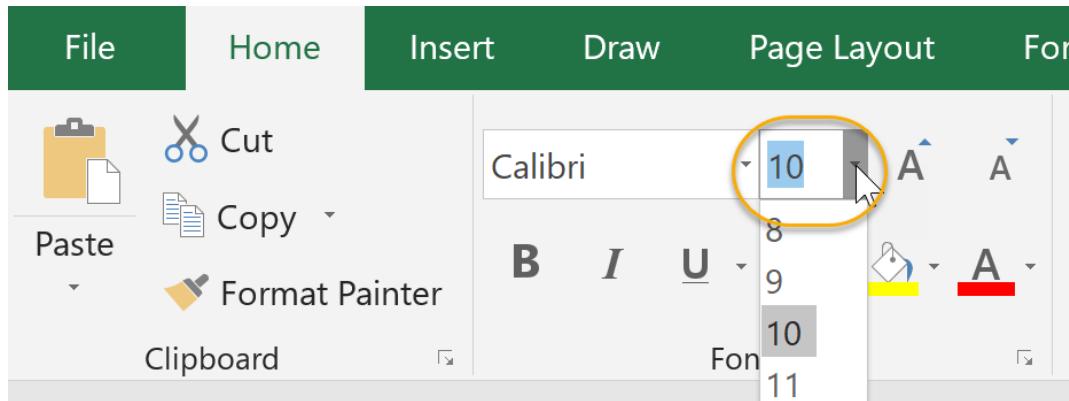

3. Select a font from the drop down menu:

To change the size of the font of text or numbers in cells in Microsoft Excel:

1. Select the cell or cells in which you wish to change the font size.
2. On the **Home** tab, in the **Font** group, click the arrow to the right of the **Font Size** command. Select a font size from the drop down menu:

CELL REFERENCING

A cell reference refers to a cell or a range of cells on a worksheet and can be used in a formula so that Microsoft Office Excel can find the values or data that you want that formula to calculate.

In one or several formulas, you can use a cell reference to refer to:

- Data from one or more contiguous cells on the worksheet.
- Data contained in different areas of a worksheet.
- Data on other worksheets in the same workbook.

For example:

This formula:	Refers to:	And Returns:
=C2	Cell C2	The value in cell C2.
=A1:F4	Cells A1 through F4	The values in all cells, but you must press Ctrl+Shift+Enter after you type in your formula.
=Asset-Liability	The cells named Asset and Liability	The value in the cell named Liability subtracted from the

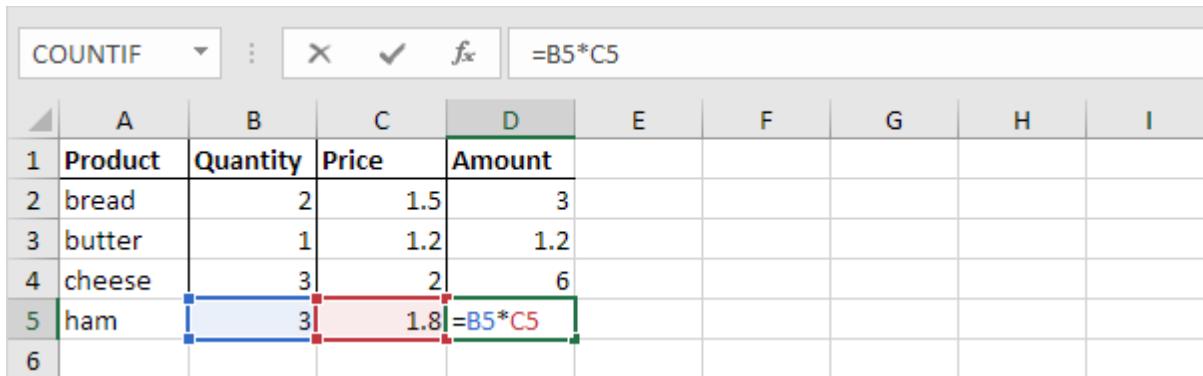| This formula:	Refers to:	And Returns:
		value in the cell named Asset.
{=Week1+Week2}	The cell ranges named Week1 and Week2	The sum of the values of the cell ranges named Week1 and Week 2 as an array formula.
=Sheet2!B2	Cell B2 on Sheet2	The value in cell B2 on Sheet2.

Cell references in Excel are very important. Understand the difference between relative, absolute and mixed reference, and you are on your way to success.
Relative Reference
By default, Excel uses relative references. See the formula in cell D2 below. Cell D2 references (points to) cell B2 and cell C2. Both references are relative.

COUNTIF	▼	⋮	✕	✓	*fx*	=B2*C2		

	A	B	C	D	E	F	G	H	I
1	Product	Quantity	Price	Amount					
2	bread	2	1.5	=B2*C2					
3	butter	1	1.2						
4	cheese	3	2						
5	ham	3	1.8						
6									

1. Select cell D2, click on the lower right corner of cell D2 and drag it down to cell D5.

COUNTIF	▼	⋮	✕	✓	fx	=B5*C5				
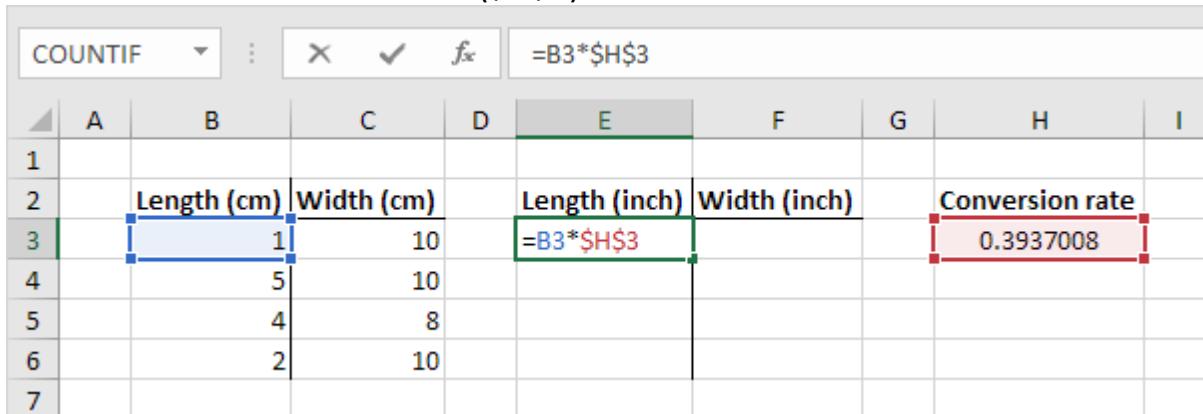
◢	A	B	C	D	E	F	G	H	I
1	Product	Quantity	Price	Amount					
2	bread	2	1.5	3					
3	butter	1	1.2	1.2					
4	cheese	3	2	6					
5	ham	3	1.8	=B5*C5					
6									

Cell D3 references cell B3 and cell C3. Cell D4 references cell B4 and cell C4. Cell D5 references cell B5 and cell C5. In other words: each cell references its two neighbors on the left.
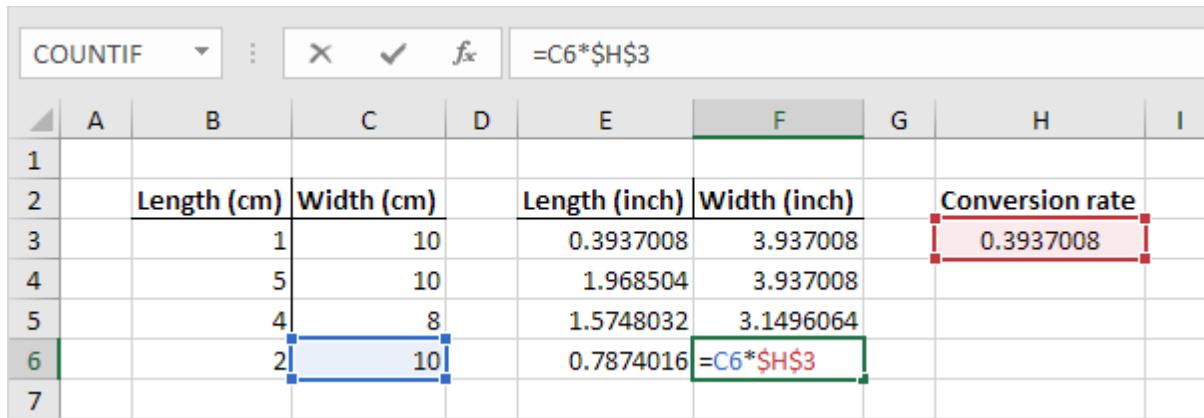
Absolute Reference
See the formula in cell E3 below.

1. To create an absolute reference to cell H3, place a $ symbol in front of the column letter and row number (H3) in the formula of cell E3.

COUNTIF	▼	⋮	✕	✓	fx	=B3*H3				

◢	A	B	C	D	E	F	G	H	I
1									
2		Length (cm)	Width (cm)		Length (inch)	Width (inch)		Conversion rate	
3		1	10		=B3*H3			0.3937008	
4		5	10						
5		4	8						
6		2	10						
7									

2. Now we can quickly drag this formula to the other cells.

| COUNTIF | ▼ | ⋮ | ✕ | ✓ | *fx* | =C6*H3 |
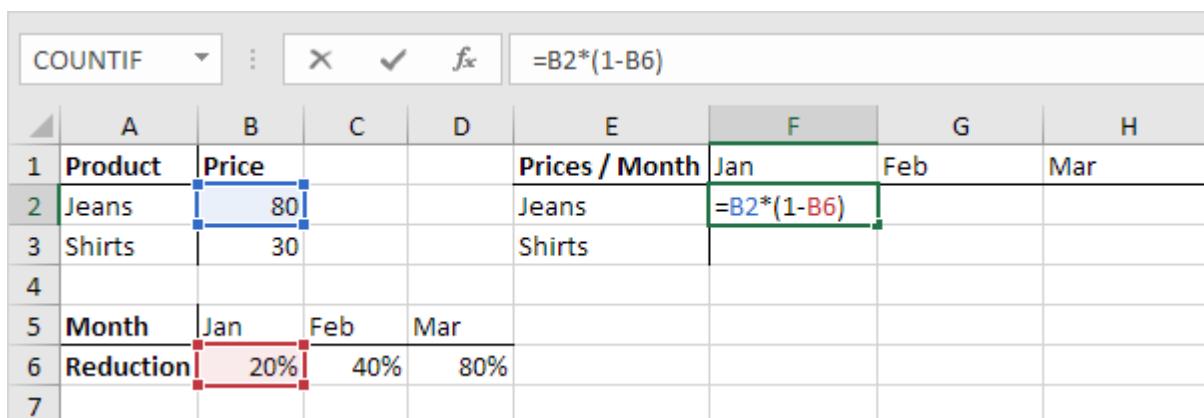
	A	B	C	D	E	F	G	H	I
1									
2		Length (cm)	Width (cm)		Length (inch)	Width (inch)		Conversion rate	
3		1	10		0.3937008	3.937008		0.3937008	
4		5	10		1.968504	3.937008			
5		4	8		1.5748032	3.1496064			
6		2	10		0.7874016	=C6*H3			
7									

The reference to cell H3 is fixed (when we drag the formula down and across). As a result, the correct lengths and widths in inches are calculated.
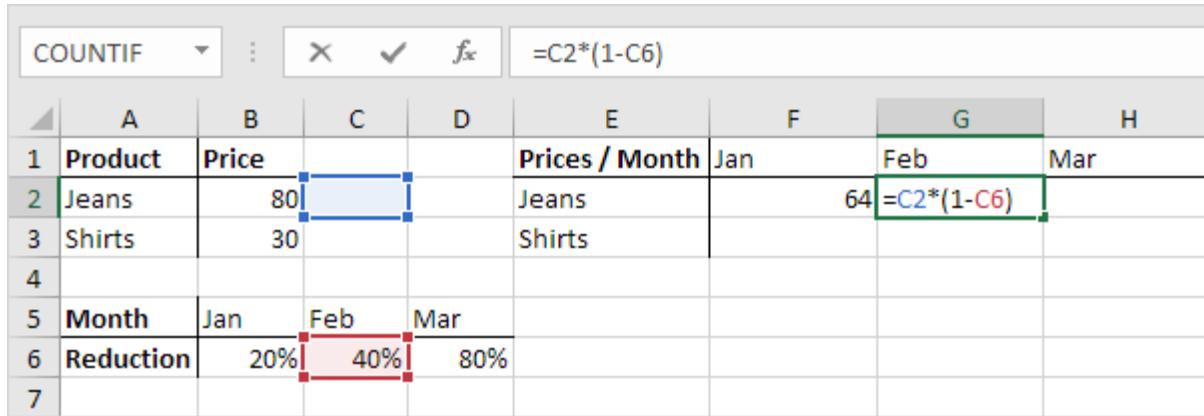
Mixed Reference

Sometimes we need a combination of relative and absolute reference (mixed reference).

1. See the formula in cell F2 below.

| COUNTIF | ▼ | ⋮ | ✕ | ✓ | *fx* | =B2*(1-B6) |

	A	B	C	D	E	F	G	H
1	Product	Price			Prices / Month	Jan	Feb	Mar
2	Jeans	80			Jeans	=B2*(1-B6)		
3	Shirts	30			Shirts			
4								
5	Month	Jan	Feb	Mar				
6	Reduction	20%	40%	80%				
7								

2. We want to copy this formula to the other cells quickly. Drag cell F2 across one cell, and look at the formula in cell G2.

COUNTIF	▼	⋮	✕	✓	*fx*	=C2*(1-C6)		
	A	B	C	D	E	F	G	H
1	Product	Price			Prices / Month Jan		Feb	Mar
2	Jeans	80			Jeans		64 =C2*(1-C6)	
3	Shirts	30			Shirts			
4								
5	Month	Jan	Feb	Mar				
6	Reduction	20%	40%	80%				
7								

Do you see what happens? The reference to the price should be a fixed reference to column B. Solution: place a $ symbol in front of the column letter ($B2) in the formula of cell F2. In a similar way, when we drag cell F2 down, the reference to the reduction should be a fixed reference to row 6. Solution: place a $ symbol in front of the row number (B$6) in the formula of cell F2.
Result:

COUNTIF	▼	⋮	×	✓	*fx*	=$B2*(1-B$6)		

◢	A	B	C	D	E	F	G	H
1	Product	Price			Prices / Month	Jan	Feb	Mar
2	Jeans	80			Jeans	=$B2*(1-B$6)		
3	Shirts	30			Shirts			
4								
5	Month	Jan	Feb	Mar				
6	Reduction	20%	40%	80%				
7								

Note: we don't place a $ symbol in front of the row number of $B2 (this way we allow the reference to change from $B2 (Jeans) to $B3 (Shirts) when we drag the formula down). In a similar way, we don't place a $ symbol in front of the column letter of B$6 (this way we allow the reference to change from B$6 (Jan) to C$6 (Feb) and D$6 (Mar) when we drag the formula across).

3. Now we can quickly drag this formula to the other cells.

COUNTIF	▼	⋮	×	✓	*fx*	=$B3*(1-D$6)		

◢	A	B	C	D	E	F	G	H
1	Product	Price			Prices / Month	Jan	Feb	Mar
2	Jeans	80			Jeans	64	48	16
3	Shirts	30			Shirts	24	18	=$B3*(1-D$6)
4								
5	Month	Jan	Feb	Mar				
6	Reduction	20%	40%	80%				
7								

The references to column B and row 6 are fixed.

CREATING FORMULAS IN EXCEL

Formulas and functions are the building blocks of working with numeric data in Excel.

What is a formula?

It is the simplest form, a formula is an expression made up of cell addresses and arithmetic operators. Formulas can also be made up of discrete values i.e. =6*3. Excel evaluates the formula to a value. An example of a formula looks as follows.

=A2 * D2 / 2

HERE,

- **"="** tells Excel that this is a formula, and it should evaluate it.
- **"A2" * D2"** makes reference to cell addresses A2 and D2 then multiplies the values found in these cell addresses.
- **"/"** is the division arithmetic operator
- **"2"** is a discrete value

Formulas practical exercise

We will work with the sample data for the home budget to calculate the subtotal.

- Create a new workbook in Excel
- Enter the data shown in the home supplies budget above.
- Your worksheet should look as follows.

	A	B	C	D	E
1	Home supplies budget				
2					
3	S/N	Item	Qty	Price	Subtotal
4	1	Mangoes	9	600	
5	2	Oranges	3	1200	
6	3	Tomatoes	1	2500	
7	4	Cooking Oil	5	6500	
8	5	Tonic water	13	3900	

FORMULA GOES HERE C4*D4

We will now write the formula that calculates the subtotal

Set the focus to cell E4

Enter the following formula.

=C4*D4

HERE,
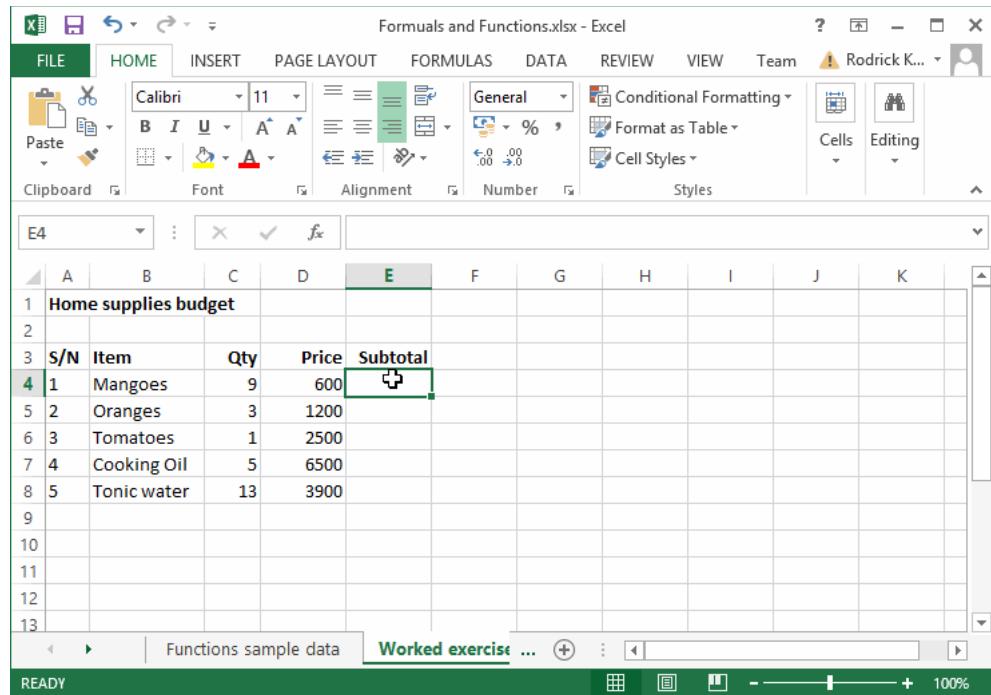
- **"C4*D4"** uses the arithmetic operator multiplication (*) to multiply the value of the cell address C4 and D4.

Press enter key

You will get the following result

The following animated image shows you how to auto select cell address and apply the same formula to other rows.

What is a function? (Function Wizard)

A function is a predefined formula. Functions allow you to use descriptive names to automatically apply formulas for you. Examples of functions include;

- **SUM** for summation of a range of numbers
- **AVERAGE** for calculating the average of a given range of numbers
- **COUNT** for counting the number of items in a given range

The importance of functions

Functions increase user productivity when working with excel. Let's say you would like to get the grand total for the above home supplies budget. To make it simpler, you can use a formula to get the grand total. Using a formula, you would have to reference the cells E4 through to E8 one by one. You would have to use the following formula.

= E4 + E5 + E6 + E7 + E8

With a function, you would write the above formula as

=SUM (E4:E8)

As you can see from the above function used to get the sum of a range of cells, it is much more efficient to use a function to get the sum than using the formula which will have to reference a lot of cells.

Common functions

Let's look at some of the most commonly used functions in Excel. We will start with statistical functions.

S/N	FUNCTION	CATEGORY	DESCRIPTION	USAGE
01	SUM	Math & Trig	Adds all the values in a range of cells	=SUM(E4:E8)
02	MIN	Statistical	Finds the minimum value in a range of cells	=MIN(E4:E8)
03	MAX	Statistical	Finds the maximum value in a range of cells	=MAX(E4:E8)

04	AVERAGE	Statistical	Calculates the average value in a range of cells	=AVERAGE(E4:E8)
05	COUNT	Statistical	Counts the number of cells in a range of cells	=COUNT(E4:E8)
06	LEN	Text	Returns the number of characters in a string text	=LEN(B7)
07	SUMIF	Math & Trig	Adds all the values in a range of cells that meet a specified criteria. =SUMIF(range,criteria,[sum_range])	=SUMIF(D4:D8,">=1000",C4:C8)
08	AVERAGEIF	Statistical	Calculates the average value in a range of cells that meet the specified criteria. =AVERAGEIF(range,criteria,[average_range])	=AVERAGEIF(F4:F8,"Yes",E4:E8)
09	DAYS	Date & Time	Returns the number of days between two dates	=DAYS(D4,C4)
10	NOW	Date & Time	Returns the current system date and time	=NOW()

Numeric Functions

As the name suggests, these functions operate on numeric data. The following table shows some of the common numeric functions.

S/N	FUNCTION	CATEGORY	DESCRIPTION	USAGE
1	ISNUMBER	Information	Returns True if the supplied value is numeric and False if it is not numeric	=ISNUMBER(A3)
2	RAND	Math & Trig	Generates a random number between 0 and 1	=RAND()
3	ROUND	Math & Trig	Rounds off a decimal value to the specified number of decimal points	=ROUND(3.14455,2)
4	MEDIAN	Statistical	Returns the number in the middle of the set of given numbers	=MEDIAN(3,4,5,2,5)
5	PI	Math & Trig	Returns the value of Math Function PI(π)	=PI()
6	POWER	Math & Trig	Returns the result of a number raised to a power. **POWER(number, power)**	=POWER(2,4)
7	MOD	Math & Trig	Returns the Remainder when you divide two numbers	=MOD(10,3)

| 8 | ROMAN | Math & Trig | Converts a number to roman numerals | =ROMAN(1984) | |

String functions

These functions are used to manipulate text data. The following table shows some of the common string functions.

S/N	FUNCTION	CATEGORY	DESCRIPTION	USAGE	COMMENT
1	LEFT	Text	Returns a number of specified characters from the start (left-hand side) of a string	=LEFT("GURU99", 4)	Left 4 Characters of "GURU99"
2	RIGHT	Text	Returns a number of specified characters from the end (right-hand side) of a string	=RIGHT("GURU99",2)	Right 2 Characters of "GURU99"
3	MID	Text	Retrieves a number of characters from the middle of a string from a specified start position and length. **=MID (text, start_num, num_chars)**	=MID("GURU99", 2,3)	Retrieving Characters 2 to 5

4	ISTEXT	Information	Returns True if the supplied parameter is Text	=ISTEXT(value)	value - The value to check.
5	FIND	Text	Returns the starting position of a text string within another text string. This function is case-sensitive. **=FIND(find_text, within_text, [start_num])**	=FIND("oo","Roofing",1)	Find oo in "Roofing", Result is 2
6	REPLACE	Text	Replaces part of a string with another specified string. **=REPLACE (old_text, start_num, num_chars, new_text)**	=REPLACE("Roofing",2,2,"xx")	Replace "oo" with "xx"

Date Time Functions

These functions are used to manipulate date values. The following table shows some of the common date functions

S/N	FUNCTION	CATEGORY	DESCRIPTION	USAGE

1	DATE	Date & Time	Returns the number that represents the date in excel code	=DATE(2015, 2,4)
2	DAYS	Date & Time	Find the number of days between two dates	=DAYS(D6,C6)
3	MONTH	Date & Time	Returns the month from a date value	=MONTH("4/ 2/2015")
4	MINUTE	Date & Time	Returns the minutes from a time value	=MINUTE("12 :31")
5	YEAR	Date & Time	Returns the year from a date value	=YEAR("04/0 2/2015")

GRAPHS AND CHARTS IN EXCEL

Charts and graphs elevate your data by providing an easy-to-understand visualization of numeric values. While the terms are often used interchangeably, they are slightly different. Graphs are the most basic way to represent data visually, and typically display data point values over a duration of time. Charts are a bit more complex, as they allow you to compare pieces of a data set relative to the other data in that set. Charts are also considered more visual than graphs, since they often take a different shape than a generic x- and y-axis.

People often use charts and graphs in presentations to give management, client, or team members a quick snapshot into progress or results. You can create a chart or graph to represent nearly any kind of quantitative data — doing so will save you the time and frustration of poring through spreadsheets to find relationships and trends.
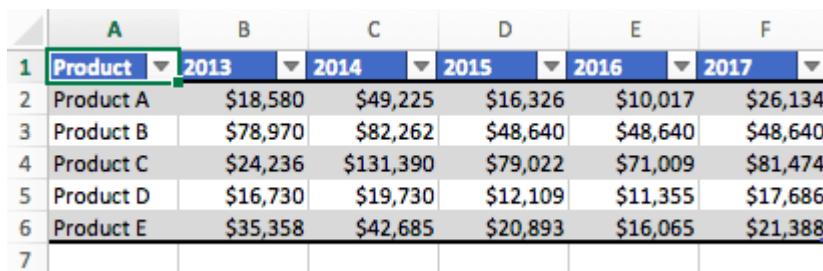
It's easy to create charts and graphs in Excel, especially since you can also store your data directly in an Excel Workbook, rather than importing data from another program. Excel also has a variety of preset chart and graph types so you can select one that best represents the data relationship(s) you want to highlight.

How to Chart Data in Excel

To generate a chart or graph in Excel, you must first provide Excel with data to pull from. In this section, we'll show you how to chart data in Excel 2016.

Step 1: Enter Data into a Worksheet

1. Open Excel and select *New Workbook*.
2. Enter the data you want to use to create a graph or chart. In this example, we're comparing the profit of five different products from 2013 to 2017. Be sure to include labels for your columns and rows. Doing so enables you to translate the data into a chart or graph with clear axis labels. You can download this sample data below.

	A	B	C	D	E	F
1	Product	2013	2014	2015	2016	2017
2	Product A	$18,580	$49,225	$16,326	$10,017	$26,134
3	Product B	$78,970	$82,262	$48,640	$48,640	$48,640
4	Product C	$24,236	$131,390	$79,022	$71,009	$81,474
5	Product D	$16,730	$19,730	$12,109	$11,355	$17,686
6	Product E	$35,358	$42,685	$20,893	$16,065	$21,388
7						

Step 2: Select Range to Create Chart or Graph from Workbook Data

1. Highlight the cells that contain the data you want to use in your graph by clicking and dragging your mouse across the cells.
2. Your cell range will now be highlighted in gray and you can select a chart type.
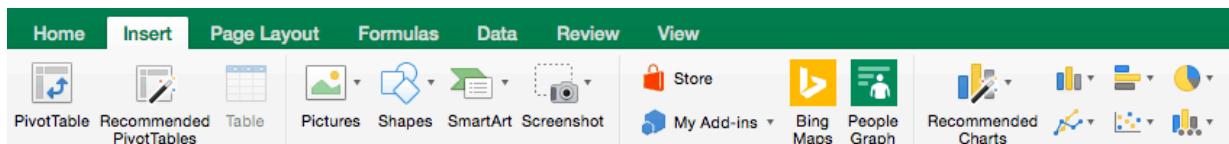
How to Make a Chart in Excel

Once you input your data and select the cell range, you're ready to choose your chart type to display your data. In this example, we'll create a clustered column chart from the data we used in the previous section.
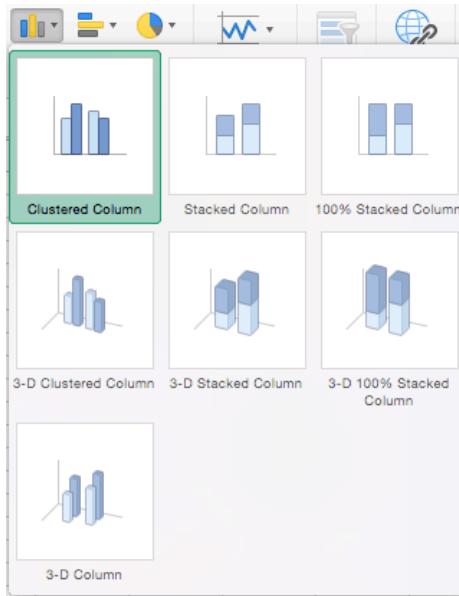
Step 1: Select Chart Type

Once your data is highlighted in the Workbook, click the Insert tab on the top banner. About halfway across the toolbar is a section with several chart options. Excel provides Recommended Charts based on popularity, but you can click any of the dropdown menus to select a different template.
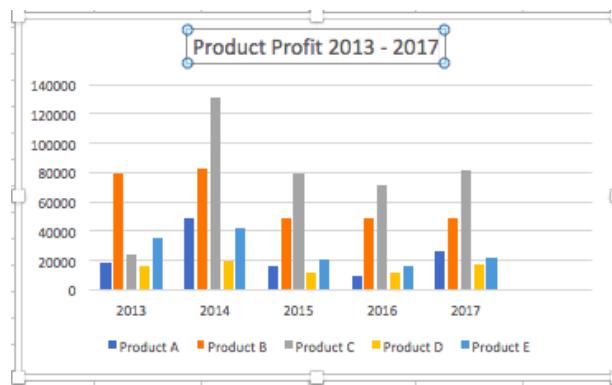
Step 2: Create Your Chart

1. From the *Insert* tab, click the column chart icon and select *Clustered Column*.
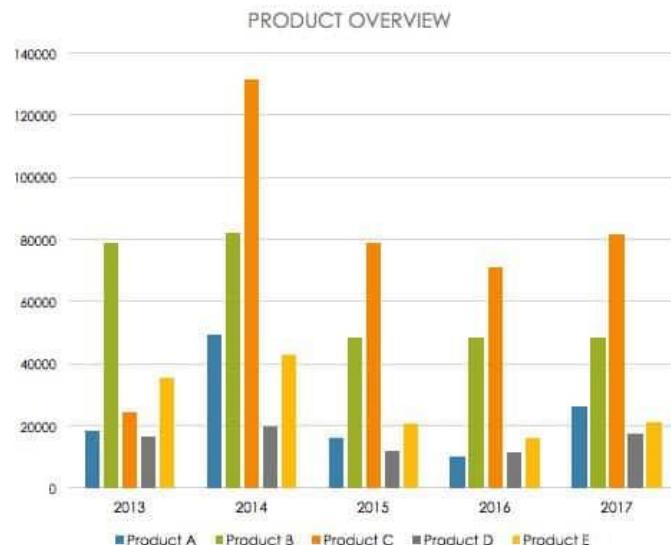
1. Excel will automatically create a clustered chart column from your selected data. The chart will appear in the center of your workbook.
2. To **name your chart**, double click the *Chart Title* text in the chart and type a title. We'll call this chart "Product Profit 2013 - 2017."

We'll use this chart for the rest of the walkthrough. You can download this same chart to follow along.

COLUMN CHART TEMPLATE

PRODUCT	2013	2014	2015	2016	2017
Product A	$18,580	$49,225	$16,326	$10,017	$26,134
Product B	$78,970	$82,262	$48,640	$48,640	$48,640
Product C	$24,236	$131,390	$79,022	$71,009	$81,474
Product D	$16,730	$19,730	$12,109	$11,355	$17,686
Product E	$35,358	$42,685	$20,893	$16,065	$21,388

PRODUCT OVERVIEW
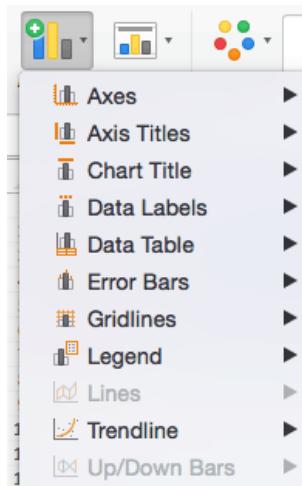
There are two tabs on the toolbar that you will use to make adjustments to your chart: *Chart Design* and *Format*. Excel automatically applies design, layout, and format presets to charts and graphs, but you can add customization by exploring the tabs. Next, we'll walk you through all the available adjustments in *Chart Design*.

Home   Insert   Page Layout   Formulas   Data   Review   View   Chart Design   Format

Step 3: Add Chart Elements

Adding chart elements to your chart or graph will enhance it by clarifying data or providing additional context. You can select a chart element by clicking on the *Add Chart Element* dropdown menu in the top left-hand corner (beneath the *Home* tab).
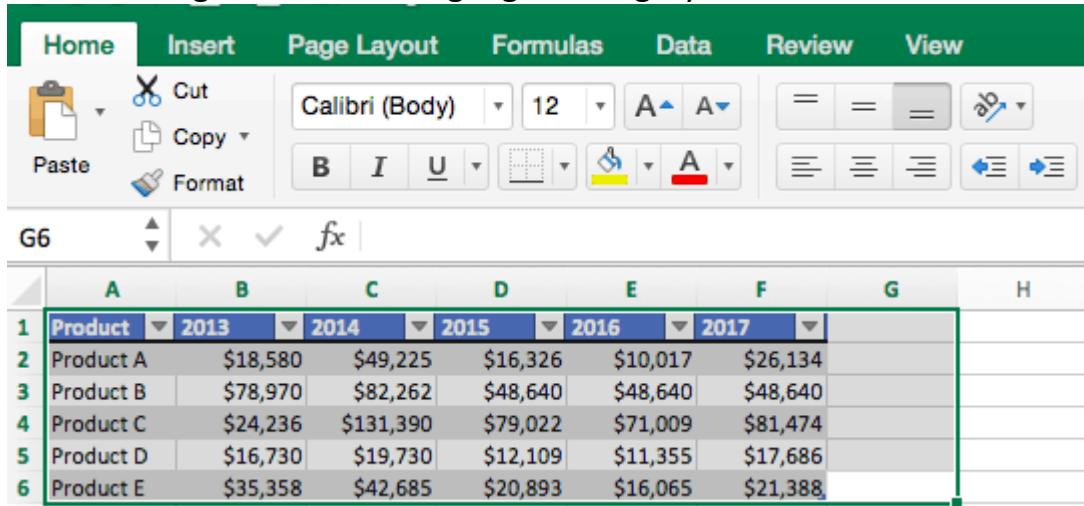
How to Make a Graph in Excel

Although graphs and charts are distinct, Excel groups all graphs under the charts categories listed in the previous sections. To create a graph or another chart type, follow the steps below and select the appropriate graph type.

Select Range to Create a Graph from Workbook Data

1. Highlight the cells that contain the data you want to use in your graph by clicking and dragging your mouse across the cells.

2. Your cell range will now be highlighted in gray.

	A	B	C	D	E	F	G	H
1	Product	2013	2014	2015	2016	2017		
2	Product A	$18,580	$49,225	$16,326	$10,017	$26,134		
3	Product B	$78,970	$82,262	$48,640	$48,640	$48,640		
4	Product C	$24,236	$131,390	$79,022	$71,009	$81,474		
5	Product D	$16,730	$19,730	$12,109	$11,355	$17,686		
6	Product E	$35,358	$42,685	$20,893	$16,065	$21,388		

3. Once the text is highlighted you can select a graph (which Excel refers to as chart). Click the *Insert* tab and click *Recommended Charts* on the toolbar. Then click the type of graph you wish to use.
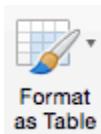
Now you have a graph. To customize your graph, you can follow the same steps explained in the previous section. All functionality for creating a chart remains the same when creating a graph.

How to Create a Table in Excel
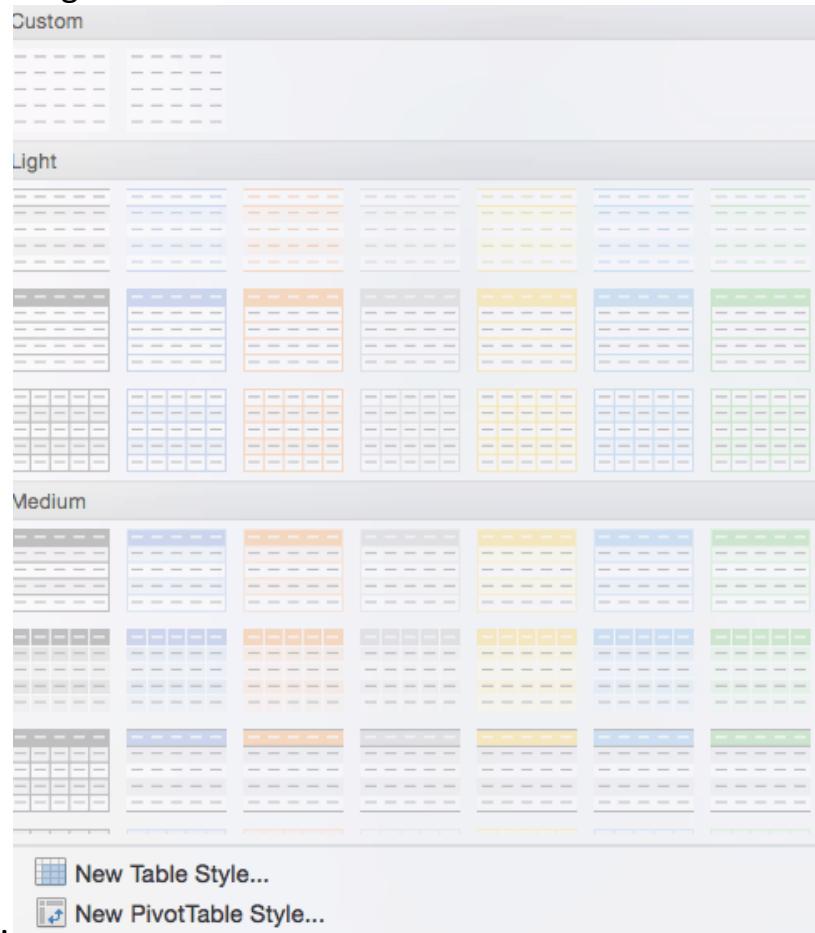
If you don't need to make a data visualization, you can also create a table in Excel using preexisting data. There are two ways to format a data set as a table:

- **Manually:** In this example, we manually added data and formatted as a table by including column and row names (products and years).
- **Use Excel's *Format as Table* Preset:** You can also input raw data (numbers without any column and row names).

1. To format data as a table, click and drag your mouse across the cells with the data range, click the *Home* tab, and click the *Format as Table* drop-

   down menu on the toolbar.
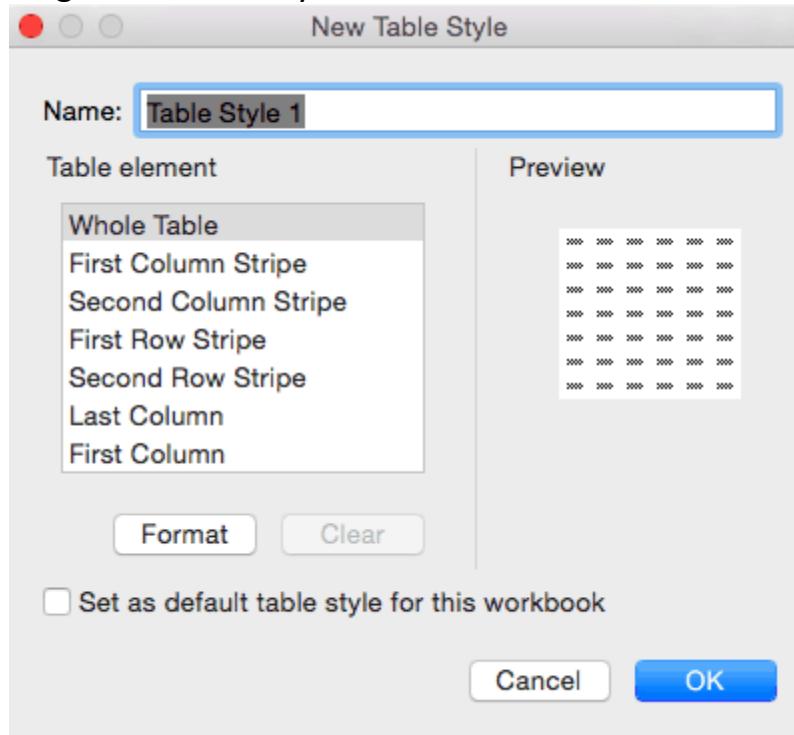
2. Click *New Table Style*... (You will also see an option to use *PivotTables*. This feature is outside the scope of this how-to, but the concept is explained in the following

3. section).

4. A dialogue box opens and you can choose which aspects of the selected range to include in your formatted table. Click the blue *OK* button.

PRESENTATION GRAPHICS SOFTWARE

Presentation graphics software are tools that let people make slideshows of charts, diagrams and graphics on the computer that can be show to a group using a projector.

An example of presentation graphics software is Microsoft PowerPoint.

Presentation software (sometimes called "presentation graphics") is a category of application program used to create sequences of words and pictures that tell a story or help support a speech or public presentation of information. Presentation software can be divided into business presentation software and more general multimedia authoring tools, with some products having characteristics of both. Business presentation software emphasizes ease- and quickness-of-learning and use. Multimedia authoring software enables you to create a more sophisticated presentation that includes audio and video sequences. Business presentation software usually enables you to include images and sometimes audio and video developed with other tools.

Microsoft PowerPoint

Microsoft PowerPoint is a powerful presentation software developed by Microsoft. It is a standard component of the company's Microsoft Office suite software, and is bundled together with Word, Excel and other Office productivity tools. The program uses slides to convey information rich in multimedia. The term "slide" refers to the slide projector, which this software effectively replaces.
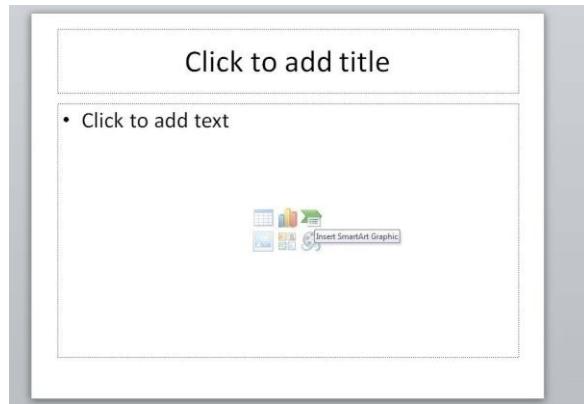
Features of MS PowerPoint

PowerPoint is a complete presentation Graphics package. It gives everything that we need to produce a professional-looking presentation. **PowerPoint** offers word

processing software, outlining, drawing, graphing, and presentation management tools- all designed to be easy to use and learn.

Below are the various Features avalaible for MS Powerpoint

1) Adding Smart Art

Don't confuse SmartArt with the similarly named WordArt. Where WordArt just allows you to display text using a wide variety of different formats and effects, SmartArt is a comprehensive and flexible business diagram tool that greatly improves upon the 'Diagram Gallery' feature found in previous versions of Office.

Click the insert SmartChart Graphic to choose from a selection of options.

2) Inserting Shapes
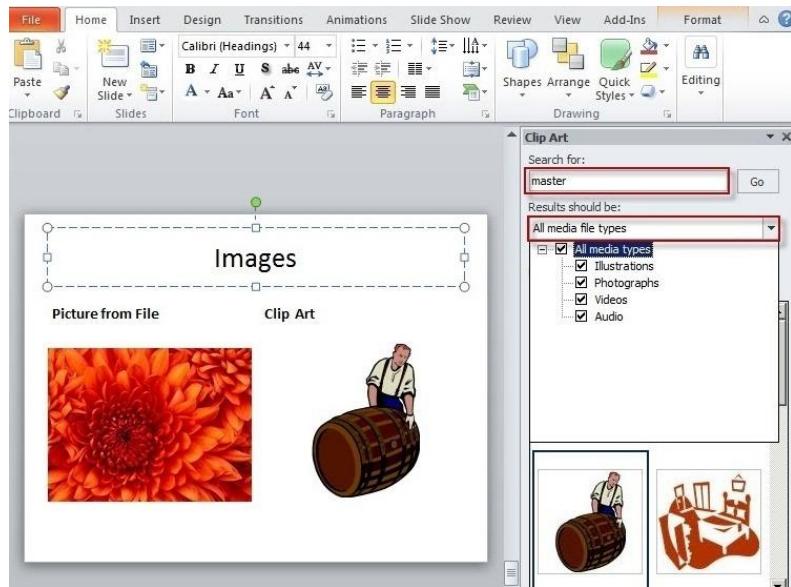
If you need to include some sort of diagram in your presentation, then the quickest and easiest way is probably to use SmartArt. However, it is important to be able to include shapes independently of SmartArt and worth being familiar with the various Drawing Tool format options.

Not only will they be useful if you do need to manually draw a diagram (and SmartArt doesn't suit all diagrams), but they can also be applied to objects on a slide that you might not immediately think of as shapes. For example the box that contains your slide title or your content. This can be anything from text to a video, or even the individual shapes in a SmartArt diagram.

As you can see, the gallery of available shapes is very extensive. Once you have selected your chosen shape, you can just click in your slide to insert a default version of the shape or, to set a particular size and position, click and drag with the mouse to create the shape and size you want.
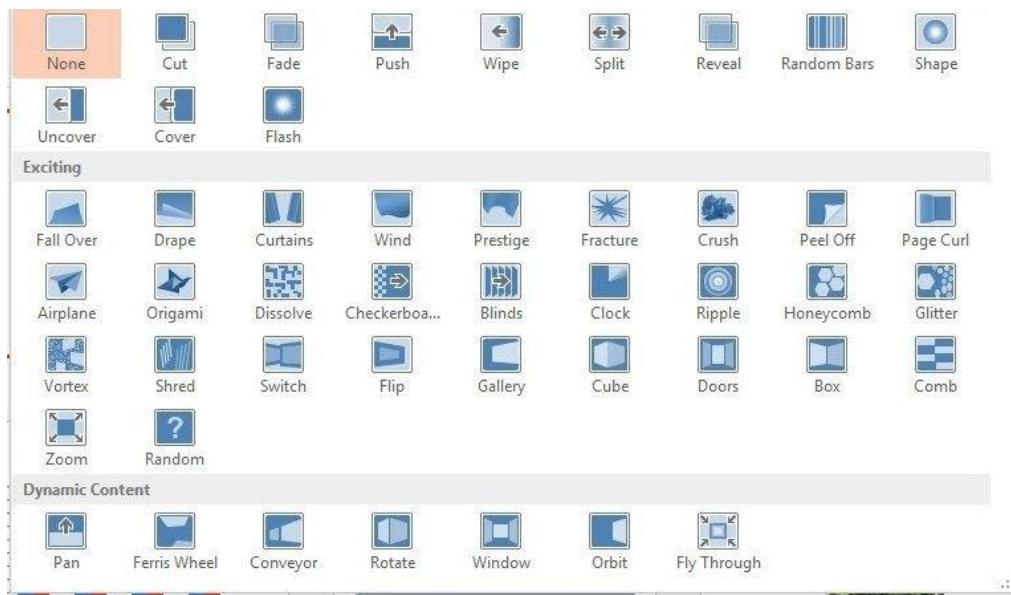
3) Inserting an Image

Here are two content type icons which appear in new content Placeholders for inserting pictures. You can Insert Picture from File or Insert Clip Art. Alternatively, the Illustrations group of the Insert ribbon tab includes the same two tools. In addition, PowerPoint 2010 has a new 'Screenshot' option that allows you to capture an entire window or part of a window for inclusion on a slide. You can also copy any image and just paste it directly to a slide.

Insert Picture from File allows you to browse to an image file saved somewhere on your system whereas Clip Art is held in an indexed gallery of different media types. Clip Art is not limited to pictures: 'The Results should be:' box lets you choose between: 'All media file types' and one or more of the following different types:

- Illustrations
- Photographs
- Video
- Audio

Once you have found the image you want to use, click on it to insert it into the current slide. You can now re-size and move the image accordingly with further editting options available when you right click the desired image.
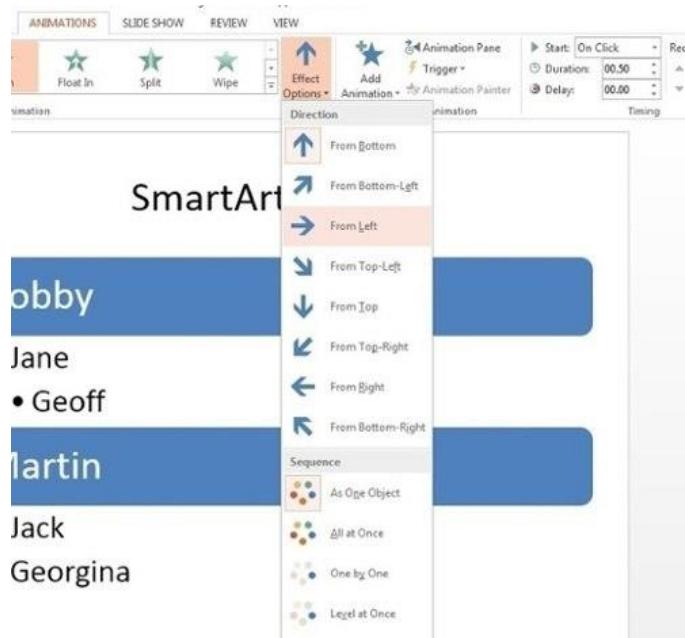
4) Slide Transitions

Properly used, slide transitions can be make your presentations clearer and more interesting and, where appropriate, more fun. Badly used, the effect of slide transitions can be closer to irritating or even nauseating. Simple animation effects are often used to add interest to bullet point text. Much more extreme animation effects are available but, in most cases, should be used sparingly if at all.

Two main kinds of animation are available in a PowerPoint presentation: the transition from one slide to the next and the animation of images/text on a specific slide.

In PowerPoint 2010 & 2013 there is also a separate Transitions ribbon tab that includes a gallery of different transition effects. These can be applied to selected slides or all slides. If you want to apply different transition effects to different groups of slides, then you might want to choose 'Slide Sorter' view from the Presentation Views group of the View ribbon.

5) Adding Animations

Whereas the transition effects are limited to a single event per slide, animations can be applied to every object on a slide – including titles and other text boxes. Many objects can even have animation applied to different components, for example each shape in a SmartArt graphic, each paragraph in a text box and each column in a chart. Animations can be applied to three separate 'events' for each object:

Entrance – how the object arrives on the slide

Emphasis – an effect to focus attention on an object while it is visible

Exit – how the object disappears from the slide

To apply an animation effect, choose the object or objects to be animated, then choose Animation Styles or Add Animation from the Animations toolbar.
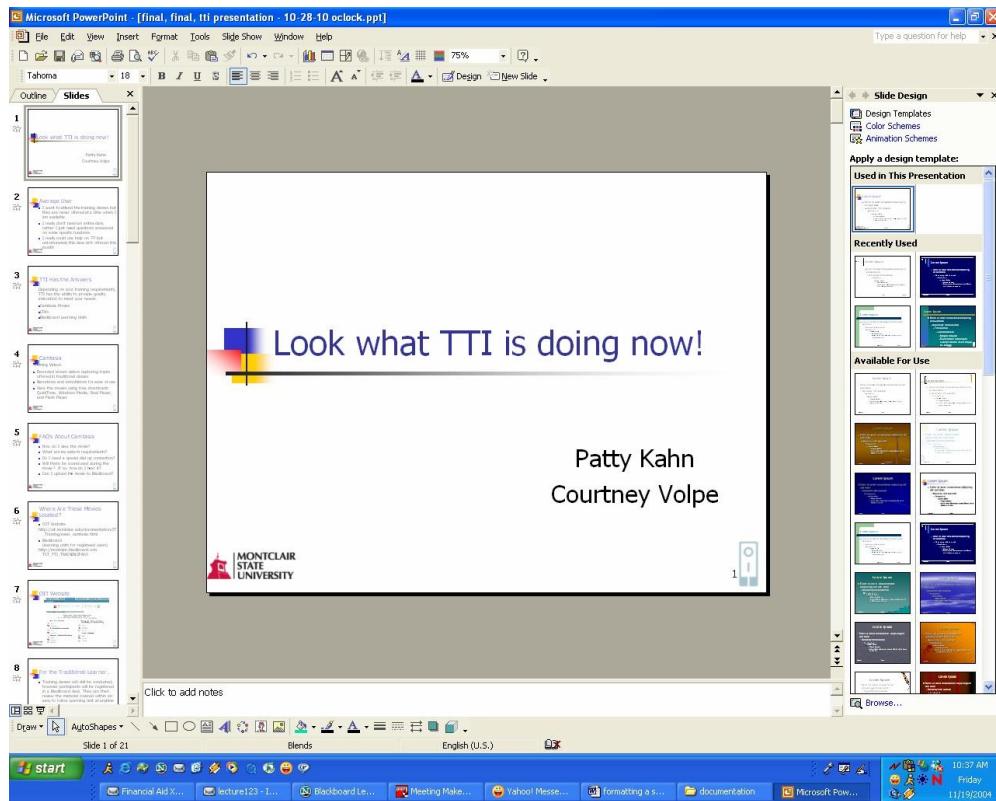
Where an animation is applied to an object with different components (for instance a SmartArt graphic made up of several boxes), the Effect Options tool becomes available to control how each component will be animated. So for

example, your animation can be used to introduce elements of an organisation chart to your slide one by one.

Templates

A PowerPoint design template is a pre-made design you can use to lend cohesiveness, visual organization and appeal to your presentation. All you have to do is add your own content; the rest is already designed into the template. Even though individual slides can have different layouts and graphics, templates help the whole presentation go together as an attractive package.

Powerpoint: Formatting a Slide

To Select Text in a Text Box:
>   1) Position your cursor inside the text box by clicking once
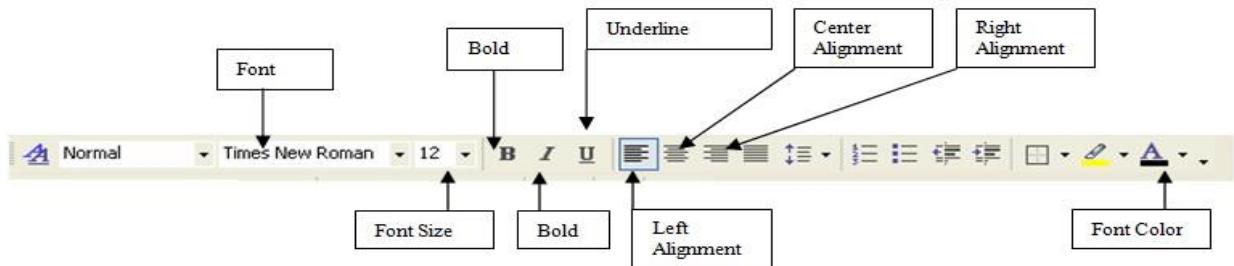>   2) Click and drag your mouse to select the desired text

To Select a Word:
 Double click your mouse on the word

To Select an Entire Text Box:
 Click once on the text box

Formatting Text

To Bold Text on a Slide:
   1) Select the text
   2) Click the **Bold Icon** on the Formatting Toolbar

To Italicize Text on a Slide:
   1) Select the text
   2) Click the **Italic Icon** on the Formatting Toolbar

To Underline Text on a Slide
   1) Select the text
   2) Click the **Underline Icon** on the Formatting Toolbar

To Select a Different Font
   1) Select the text
   2) Click the drop down arrow for **Font** on the Formatting Toolbar and
      select a font

To Select a Different Font Size
   1) Select the text
   2) Click the **Font Size Icon** on the Formatting Toolbar and pick a
      different font size (The larger the number the larger the
      lettering)

To Change the Font Color
   1) Select the text
   2) Click the **Font Color** drop down arrow on the Formatting
      Toolbar and select a different font color

Selecting a Slide Design

Microsoft PowerPoint provides design templates that you can
apply to a presentation to give it a fully designed, professional
look.

To Select a Design for your Presentation:
   1) Click the **Design Button** on your Formatting Toolbar
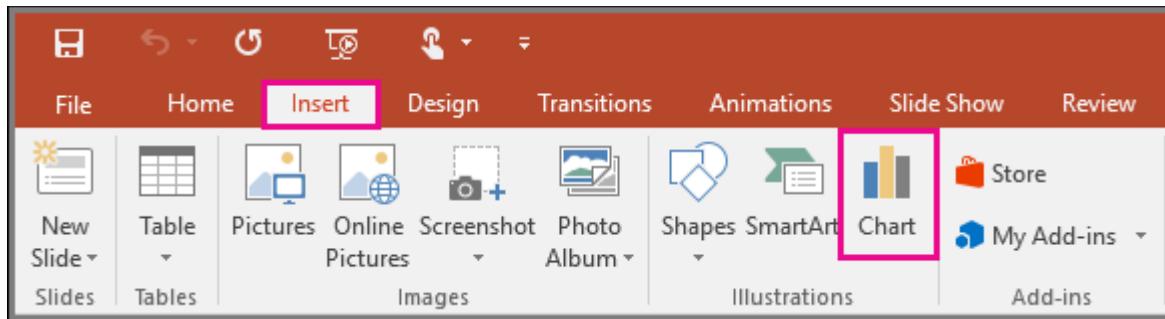   2) From the Task Pane on the right, click on the desired design

Note: The design, by default, is applied to all pages of the presentation.

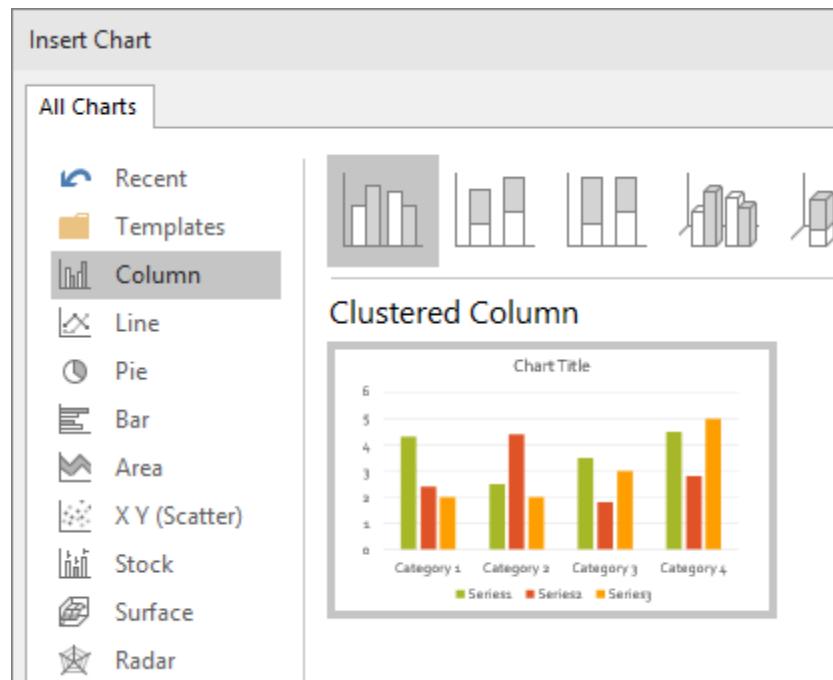**Use charts and graphs in your presentation**

You can make a chart in PowerPoint or Excel. If you have lots of data to
chart, create your chart in Excel, and then copy it into your presentation. This is
also the best way if your data changes regularly and you want your chart to
always reflect the latest numbers. In that case, when you copy and paste the
chart, keep it linked to the original Excel file.

To create a simple chart from scratch in PowerPoint, click **Insert** > **Chart** and pick
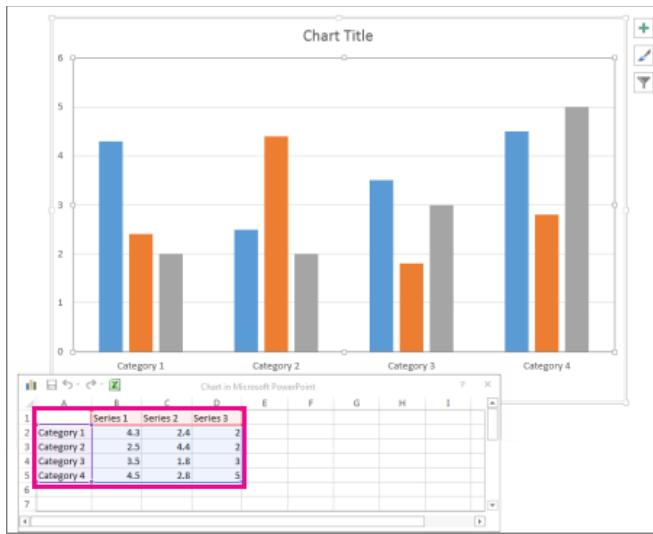the chart you want.

1. Click **Insert** > **Chart**.

2. Click the chart type and then double-click the chart you want.

3. In the worksheet that appears, replace the placeholder data with your own information.
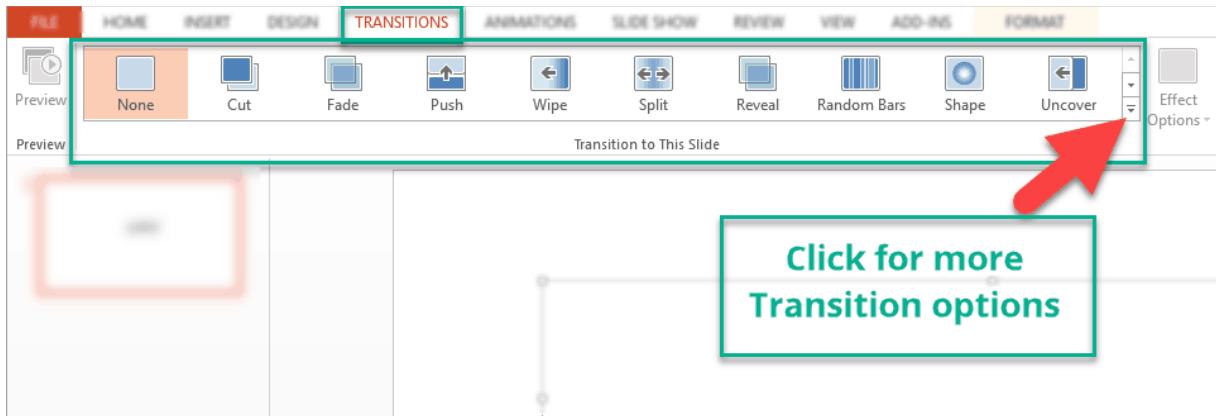
4. When you've finished, close the worksheet.

The Different Types of Animations In PowerPoint

Animations are visual effects which make your texts, images, shapes, or charts come 'alive.' They catch your audience's attention and helps them engage with you and your presentation.
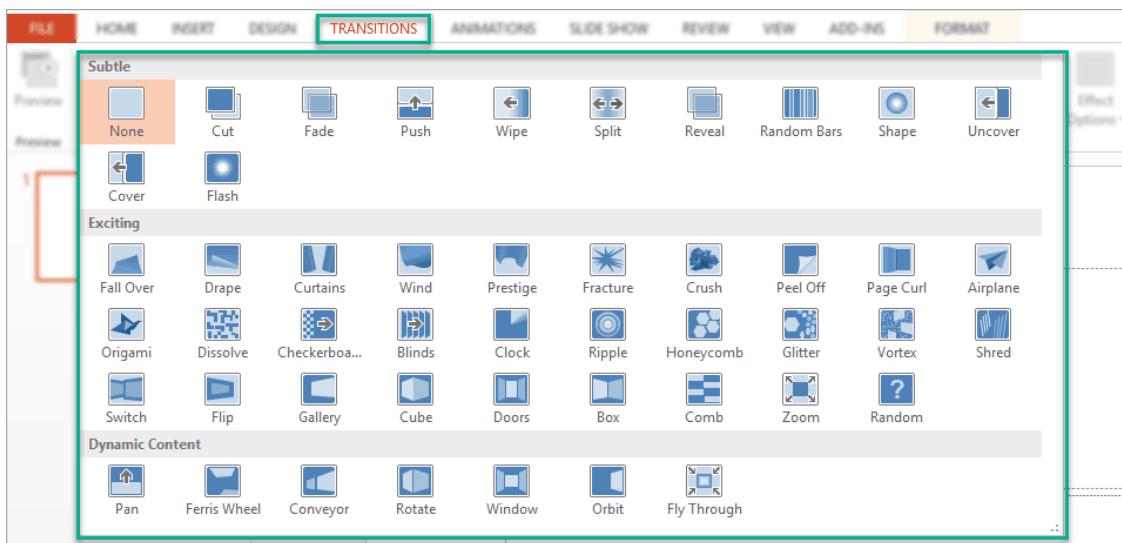
Moreover, there are generally two types of animations you can use to make your presentation come alive. These are:

- **Transitions**

The first type of animation is called *transition animation*; these are animations added in between slides. When you transition from slide 1 to slide 2, you can add an animation in between the slides. You can view the different transition options by going to the **Transitions pane** on the PowerPoint ribbon.

The default view shows 10 transitions, but if you click on the little arrow like you see in the screenshot above, then you'll see many more options like you see here:
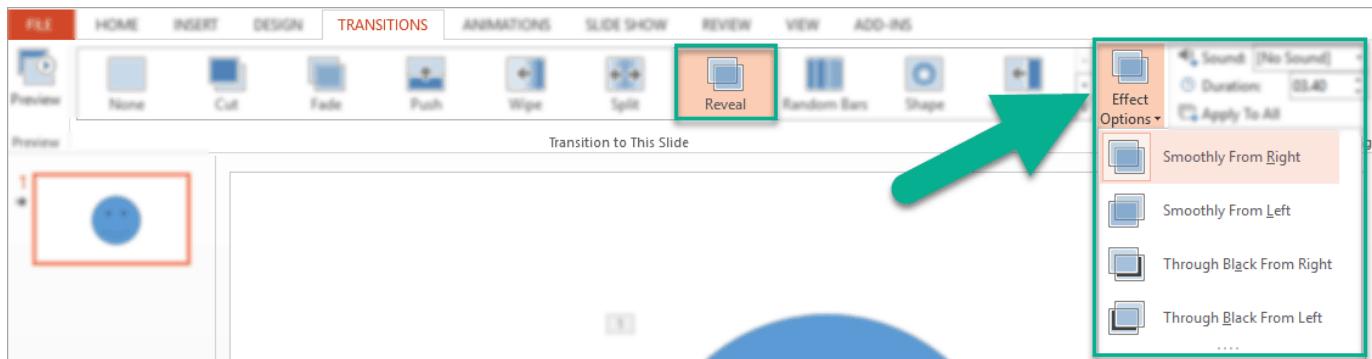

Transition animations have additional effect options. You will notice this when you click on the transition you want to use. The **Effect Options** button won't be grayed out, and you can select additional settings.

For example, I selected **'Reveal'** as my transition animation. Available effect options would be:
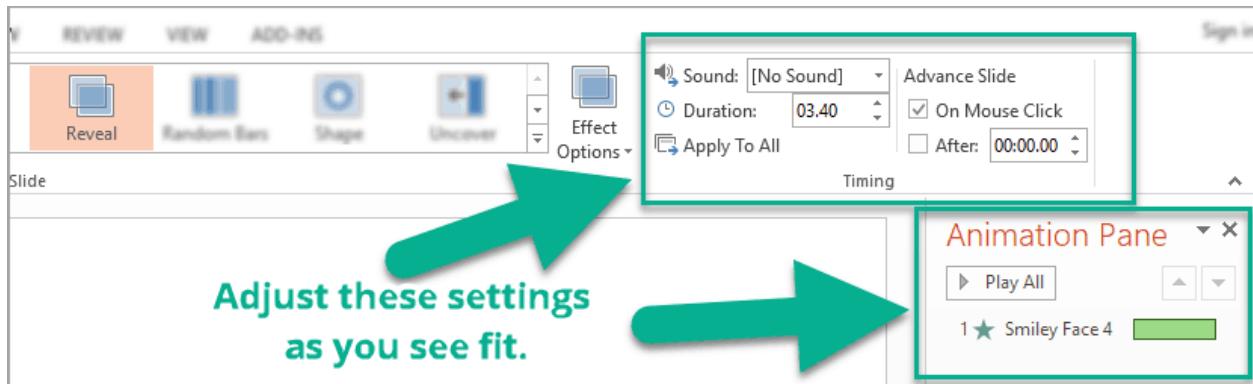
- *Smoothly from right*

- *Smoothly from left*

- *Through black from right*

- *Through black from left*

Here's a screenshot of what it looks like:

You can also adjust the timing and duration of each transition as well as set how you want the slides to advance so that the transition can take place.
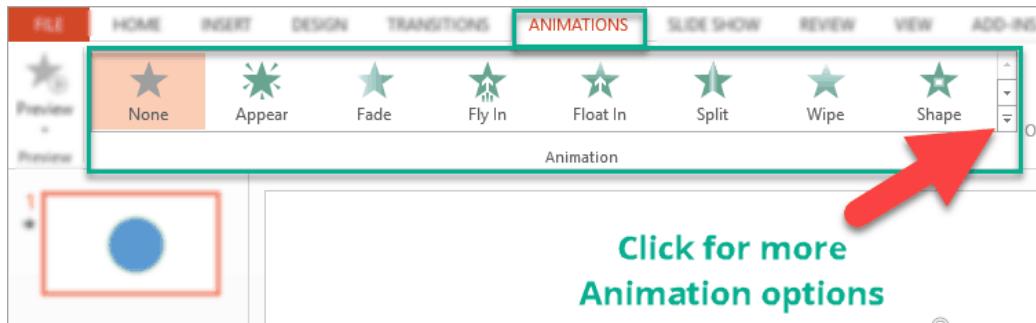
Feel free to play around with the transition animations and effect options that work best with your presentation.
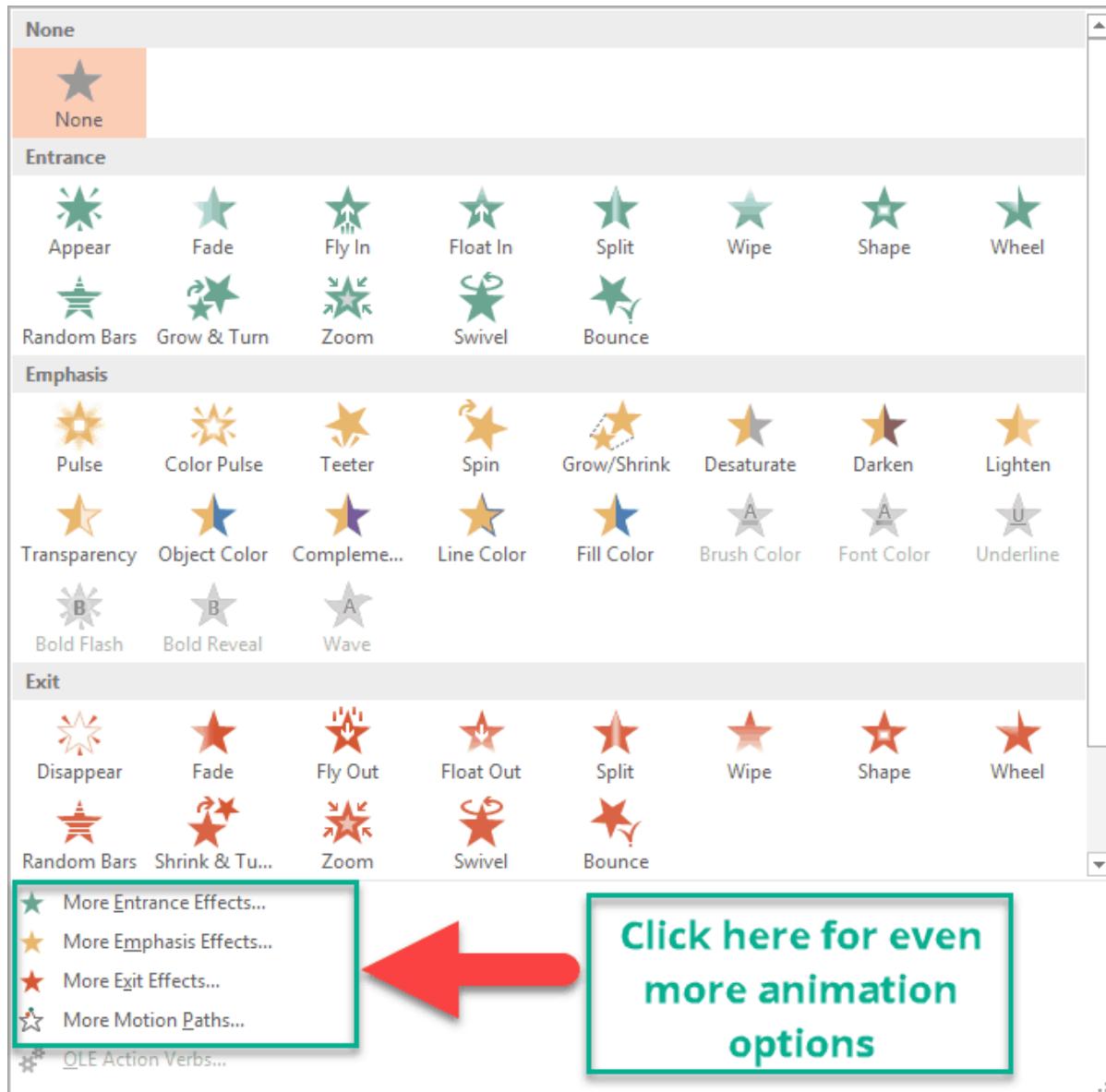
- **Animations**

The second type of animations brings the objects or elements within your slide to life. If you want to animate text, an image, shape, graph or chart, this is the type of animation you select.

You first to have to **click on the object you want to animate**, then **click on the Animations tab**.

The default view shows 8 animations, but if you click on the little arrow like you see on the screenshot above, then you'll see many more options like you see here:

You can choose from the following types of animations:
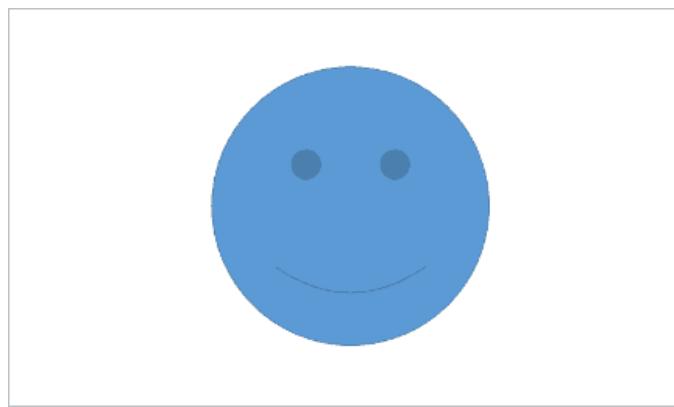
- **Entrance animations.** The icons for this type of animation are **colored green**. If you use this type of animation for an object, that object will **enter the slide** according to your timing preferences.

- **Exit animations.** The icons for this type of animation are **colored red**. The object you've added this animation to will **exit the slide**.

- **Emphasis animations.** The icons for this kind of animation are **colored yellow**. The object won't enter or exit the slide (unless you've added that particular animation to the same object) but will emphasize and draw attention to that object.

- **Motion path animations.** This type of animation will allow you to **move an object from one spot to another.** You can specify or draw the path you want the object to take.

In the next sections, we'll go over how to add the *4 different types of animations* to your slides.
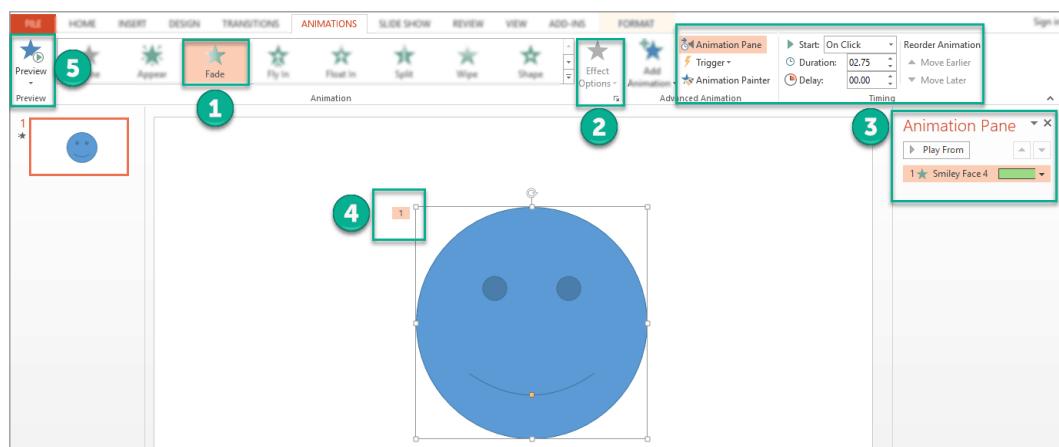
How To Add Animations to PowerPoint In 2 Simple Steps

To add entrance animations to any object in PowerPoint, here's what you need to do:

1. Click on the object you want to animate. In this example, we will use a blue smiley face.

      2. Select the animation you want to use. For this example, we used the **entrance animation – fade** animation. We set the duration to 2.75 seconds. You will notice in the screenshot below that the fade animation has no effect options (the button is greyed out).

Here's what those numbers in the screenshot mean:

1 – We chose the Fade animation.

2 – There are no Effect Options for Fade Animation (the button is grayed out and not clickable)

3 – You can adjust settings via the Advanced Animation, Timing, and Animation Pane sections

4 – The number (1) refers to the fact that we've added 1 animation to our object (this is the Fade animation).

5 – You can click on the Preview button to preview the animation.

As you can see, adding animations to an object is no rocket science. You can even add entrance, exit, emphasis and motion path animations to a single object!

Important Points To Remember When Adding Animations

It's so easy adding animations to presentation slides that you can easily lose control. Therefore, you'll find yourself animating all objects on your slides and adding slide transitions as well. Nevertheless, it might look fun to you, but in reality, it can distract your audience's attention from the message you're trying to convey in your presentation.

So here are **some guidelines** you should following when adding animations to PowerPoint:

1. **Simplicity** is key. Simple animations like fade and appear may not be as impressive as other animations available, but these add a touch of elegance to well-timed slides. It makes your slides look clean and simple.
2. Limit the number of animations on a slide. One or two animations per slide should suffice. There's really no need to animate every single object on each slide.
3. Time your presentation well. Make sure your objects appear right after you introduce it. This keeps your audience's interest piqued.
4. Don't forget to practice. Practicing your timings and your animations are key to a successful presentation.

POWERPOINT SLIDESHOW

A PowerPoint slideshow (PPT) is a presentation created on software from Microsoft that allows users to add audio, visual and audio/visual features to a presentation. It is considered to be a multimedia technology and also acts as a tool for collaboration and content sharing. PowerPoint is included in Microsoft Office, making it one of the most well-known and widely used brands of presentation software.

A PowerPoint slideshow is also known as a PowerPoint presentation

Slide Show view is the view that you use when showing the presentation to others. One slide appears onscreen at a time, completely filling the screen. You may have used this view already — to check your work — while you were creating the presentation.

You can start Slide Show view from the first slide or from the current slide. The following table summarizes the methods of doing each.
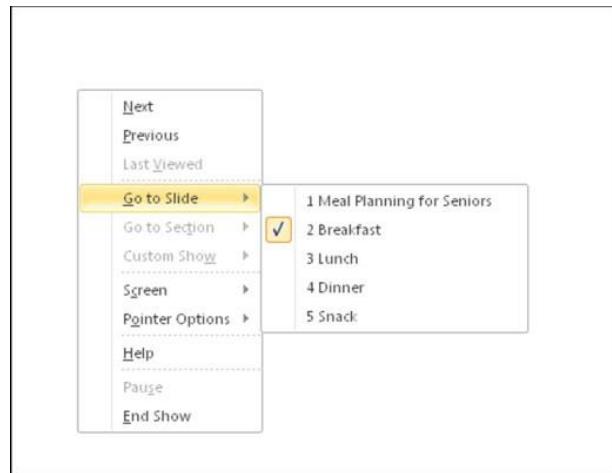
**Methods of Entering Slide
Show View**

From First Slide	From Current Slide	
Shortcut key(s)	Press F5	Press Shift+F5
View tab	Slide Show→From Beginning	Slide Show→From Current Slide
View buttons (bottom right of screen)	N/A	Slide Show View button

Then, after you're in Slide Show view, you can show your presentation. Here's how:

- **Move to the next slide** (in any of these ways):
    - Click the mouse.
    - Press any key on the keyboard (except Backspace or the left arrow).
    - Right-click to display a shortcut menu and then choose Next.
- **Move to the previous slide** (in any of these ways):
    - Press Backspace or the left arrow on the keyboard.
    - Right-click to display a shortcut menu and choose Previous.
- **Jump to a specific slide:**
    - a.Right-click to display a shortcut menu.
    - b.Point to Go to Slide.
    - c.Click the slide you want to display.

- **End the show** (in any of these ways):

  o Click through to the end of the slide show (black screen) and then click one more time.

  o Press the Esc key.

  o Right-click to display a shortcut menu and then choose End Show.

UNIT – D

- Secure Electronic Transaction,
- Types ofPayment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit
- Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer
- (EFT), Unified Payment Interface (UPI), Immediate Payment System (IMPS),
- Digital Signature and Certification Authority.
- Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile
- Computing and Embedded Systems and Internet of Things (IoT)

Electronic Payment System

Electronic Payment is a financial exchange that takes place online between buyers and sellers. The content of this exchange is usually some form of digital financial instrument (such as encrypted credit card numbers, electronic cheques or digital

cash) that is backed by a bank or an intermediary, or by a legal tender. The various factors that have lead the financial institutions to make use of electronic payments are:

1. **Decreasing technology cost:**

   The technology used in the networks is decreasing day by day, which is evident from the fact that computers are now dirt-cheap and Internet is becoming free almost everywhere in the world.

2. **Reduced operational and processing cost:**

   Due to reduced technology cost the processing cost of various commerce activities becomes very less. A very simple reason to prove this is the fact that in electronic transactions we save both paper and time.
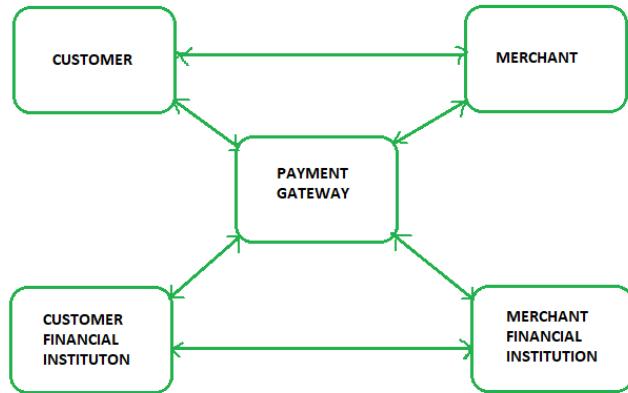
3. **Increasing online commerce:**

Secure Electronic Transactions

Secure Electronic Transaction or SET is a system which ensures security and integrity of electronic transactions done using credit cards in a scenario. SET is not some system that enables payment but it is a security protocol applied on those payments. It uses different encryption and hashing techniques to secure payments over internet done through credit cards. SET protocol was supported in development by major organizations like Visa, Mastercard, Microsoft which provided its Secure Transaction Technology (STT) and NetScape which provided technology of Secure Socket Layer (SSL).
SET protocol restricts revealing of credit card details to merchants thus keeping hackers and thieves at bay. SET protocol includes Certification Authorities for making use of standard Digital Certificates like X.509 Certificate.

Before discussing SET further, let's see a general scenario of electronic transaction, which includes client, payment gateway, client financial institution, merchant and merchant financial institution.

Requirements in SET :

SET protocol has some requirements to meet, some of the important requirements are :

- It has to provide mutual authentication i.e., customer (or cardholder) authentication by confirming if the customer is intended user or not and merchant authentication.
- It has to keep the PI (Payment Information) and OI (Order Information) confidential by appropriate encryptions.

- It has to be resistive against message modifications i.e., no changes should be allowed in the content being transmitted.
- SET also needs to provide interoperability and make use of best security mechanisms.

Participants in SET :

In the general scenario of online transaction, SET includes similar participants:

1. **Cardholder –** customer
2. **Issuer –** customer financial institution(bank)
3. **Merchant**
4. **Acquirer –** Merchant financial
5. **Certificate authority –** Authority which follows certain standards and issues certificates(like X.509V3) to all other participants.

Types of Electronic Payment System

When you purchase goods and services online, you pay for them using an electronic medium. This mode of payment, without using cash or cheque, is called an e-commerce payment system and is also known as online or electronic payment systems.
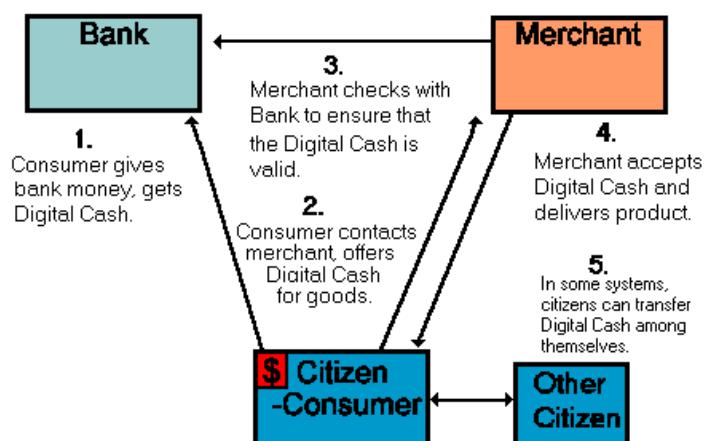
The growing use of internet-based banking and shopping has seen the growth of various e-commerce payment systems and technology has been developed to increase, improve and provide secure e-payment transactions.

Paperless e-commerce payments have revolutionised the payment processing by reducing paper work, transaction costs, and personnel cost. The systems are user-friendly and consume less time than manual processing and help businesses extend their market reach.

The different types of e-commerce payments in use today are:

1. Digital Cash

Digital Cash acts much like real cash, except that it's not on paper. Money in your bank account is converted to a digital code. This digital code may then be stored on a microchip, a pocket card (like a smart card), or on the hard drive of your computer.

The concept of privacy is the driving force behind digital cash. The user of digital cash is assured an anonymous transaction by any vendor who accepts it. Your special bank account code can be used over the internet or at any participating merchant to purchase an item. Eve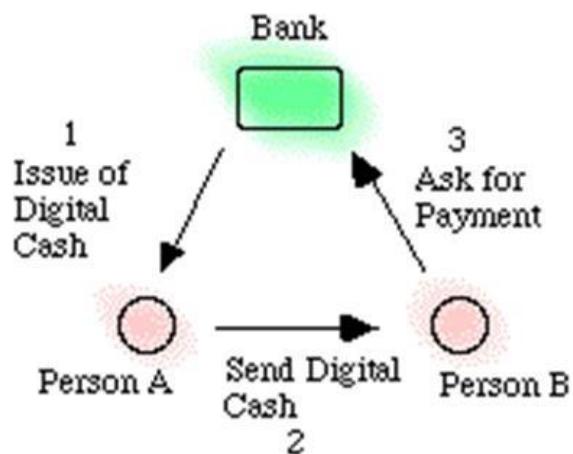rybody involved in the transaction, from the bank to the user to the vendor, agree to recognize the worth of the transaction, and thus create this new form or exchange.

This example shows how digital cash might work through a banking institution. The bank creates a digital bank note by signing a message which specifies the serial number (with a primary or public key) and value of the note, and sends it to Person A. Person A, as he withdraws it, uses Chaum's technique (A Cryptography technique) to alter the serial number so that the bank will not recognize the note as being from this withdrawal. This note is now returned to the bank with the new serial number. The bank now has a note with a new serial number. Person A then pays Person B electronically by sending the bank note to him. Person B checks the note's validity by decrypting using the bank's public key to check its signature (new serial number validity). Person B then sends the note to the bank, which checks the serial number to confirm that this bank note hasn't been spent before. The serial number is now different from that in Person A's withdrawal, thereby pre- venting the bank from linking the two transactions. The enabling bank merely checks the new serialized key account for the amount of the transaction and transfers the money by sending out a depository notice. Person B

using the same encrypting technique returns the depository notice with the new serialize account.

2. Electronic Cheque:

An electronic check or e check is a form of payment made via the Internet, or another data network, designed to perform the same function as a conventional paper check. Since the check is in an electronic format, it can be processed in fewer steps.
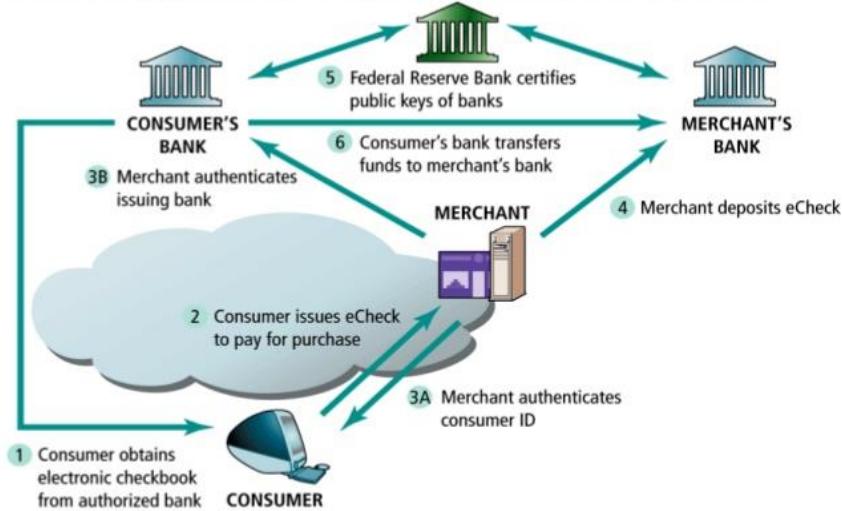
Additionally, it has more security features than standard paper checks including authentication, public key cryptography, digital signatures, and encryption, among others.

- An electronic check is a form of payment made via the internet that is designed to perform the same function as a conventional paper check.
- One of the more frequently used versions of the electronic check is the direct deposit system offered by many employers.
- Generally, the costs associated with issuing an electronic check are notably lower than those associated with paper checks.
- An electronic check has more security features than standard paper checks.

How an Electronic Check Works
An electronic check is part of the larger electronic banking field and part of a subset of transactions referred to as electronic fund transfers (EFTs). This includes not only electronic checks but also other computerized banking functions such as ATM withdrawals and deposits, debit card transactions and remote check depositing features. The transactions require the use of various computer and networking technologies to gain access to the relevant account data to perform the requested actions.

How Digital Checking Works: eCheck

3. Smart Card

Smart Card It is a plastic card embedded with a microprocessor that has the customer's personal information stored in it and can be loaded with funds to make online transactions and instant payment of bills. The money that is loaded in the smart card reduces as per the usage by the customer and has to be reloaded from his/her bank account.

A smart card is a physical card that has an embedded integrated chip that acts as a security token. Smart cards are typically the same size as a driver's license or credit card and can be made out of metal or plastic. They connect to a reader either by direct physical contact (also known as chip and dip) or through a short-range wireless connectivity standard such as radio-frequency identification **(RFID).**The chip on a smart card can be either a microcontroller or an embedded memory chip. Smart cards are designed to be tamper-resistant and use encryption to provide protection for in-memory information. Those cards with microcontroller chips can perform on-card processing functions and can manipulate information in the chip's memory.

Smart cards are used for a variety of applications, though most commonly are used for credit cards and other payment cards

How smart cards work

Smart card microprocessors or memory chips exchange data with card readers and other systems over a serial interface. The smart card itself is powered by an external source, usually the smart card reader. A smart card communicates with readers either via direct physical contact or using a short-range wireless connectivity standard such as RFID . The card reader then passes data from the smart card to its intended destination, usually a payment or authentication system connected to the smart card reader over a network connection.

3. Credit Card

Credit Card The most popular form of payment for e-commerce transactions is through credit cards. It is simple to use; the customer has to just enter their credit card number and date of expiry in the appropriate area on the seller's web page. To improve the security system, increased security measures, such as the use of a card verification number (CVN), have been introduced to on-line credit card payments. The CVN system helps detect fraud by comparing the CVN number with the cardholder's information.

Users can swipe the credit card to make a payment or use it for online transactions. After you apply for a credit card, simply make sure that the

borrowed amount is repaid within the stipulated time frame to avoid penalty charges. Your credit card details are always secured with the card issuer and you should not share your credit card information with anyone to avoid fraud.

The credit company provider may also grant a line of credit (LOC) to cardholders, enabling them to borrow money in the form of cash advances. Issuers customarily pre-set borrowing limits, based on an individual's credit rating. A vast majority of businesses let the customer make purchases with credit cards, which remain one of today's most popular payment methodologies for buying consumer goods and services.

4. Debit Card

Debit Card Debit cards are the second largest e-commerce payment medium in India. Customers who want to spend online within their financial limits prefer to pay with their Debit cards. With the debit card, the customer can only pay for purchased goods with the money that is already there in his/her bank account as opposed to the credit card where the amounts that the buyer spends are billed to him/her and payments are made at the end of the billing period.

A debit card is a payment card that deducts money directly from a consumer's checking account to pay for a purchase. Debit cards eliminate the

need to carry cash or physical checks to make purchases. In addition, debit cards, also called check cards, offer the convenience of credit cards and many of the same consumer protections when issued by major payment processors like Visa or Mastercard.

Unlike credit cards, debit cards do not allow the user to go into debt

How a Debit Card Works

Debit cards serve a dual purpose: They allow the user to withdraw money from his or her checking account through an ATM or through the cash-back function many merchants offer at the point of sale. In addition, they also allow the user to make purchases.

ATM cards, by contrast, only allow the user to withdraw money from an ATM, while credit cards only allow purchases unless the credit card holder has a PIN-enabled cash advance feature (and the cash advance will incur interest, unlike withdrawing cash from a checking account).

Debit card purchases can usually be made with or without a personal identification number (PIN). If the card has a major payment processor's logo, it can be run as a credit card, and the cardholder won't need to take the risk of exposing their PIN number. The money will still come directly out of the cardholder's checking account, and there won't be any finance charges when the debit card is run as a credit card. Some debit cards also offer reward programs, similar to credit card reward programs, such as 1% back on all purchases.

What are cryptocurrencies?

Cryptocurrencies, also known as virtual currencies or digital currencies, are a form of electronic money. They do not physically exist as coins or notes. A cryptocurrency unit, such as a bitcoin or ether, is a digital token created from code using an encrypted string of data blocks, known as a blockchain. There are usually only a fixed number of digital currency tokens available.

Cryptocurrencies are not only used as payment systems but can also be used to execute contracts and run programs. Anyone can create a digital currency, so at any given time there can be hundreds, or even thousands, of cryptocurrencies in circulation.

Virtual currencies can be bought or sold on an exchange platform using conventional money. Some popular digital currencies, like Bitcoin can be bought or sold for cash through special ATMs.

Electronic Funds Transfer (EFT)

Electronic Funds Transfer (EFT) is a system of transferring money from one bank account directly to another without any paper money changing hands. One of the most widely-used EFT programs is direct deposit, through which payroll is deposited straight into an employee's bank account. However, EFT refers to any transfer of funds initiated through an electronic terminal, including credit card, ATM and point-of-sale (POS) transactions. It is used for both credit transfers, such as payroll payments, and for debit transfers, such as mortgage payments.

How EFT works

Transactions are processed by the bank through the **Automated Clearing House (ACH)** network, the secure transfer system that connects all financial institutions. For payments, funds are transferred electronically from one bank account to the billing company's bank, usually less than a day after the scheduled payment date.

The ACH Network operates as a batch processing system. Financial institutions accumulate ACH transactions throughout the day, which are handled via batch processing later on

Types of EFTs

The most common types of EFTs include:

- **Direct deposit**: Enables businesses to pay employees. During the employee on boarding process, new employees typically specify the financial institution to receive the direct deposit payments.

- **Wire transfers**: Used for non-regular payments, such as the down payment on a house.

- **Automated Teller Machines (ATMs)**: Allows cash withdrawals and deposits, fund transfers and checking of account balances at multiple locations, such as branch locations, retail stores, shopping malls and airports.

- **Debit cards:** Allows users to pay for transactions and have those funds deducted from the account linked to the card.

- **Pay-by-phone systems**: Allows users to pay bills or transfer money over the phone.

- **Online banking**: Available via personal computer, tablet or Smartphone. Using online banking, users can access accounts to make payments, transfer funds and check balances.

Advantages of EFT:

The main advantage of an electronic funds transfer is time. Since all the transaction is done automatically and electronically, the bank doesn't need to pay a person to do it, a person to drive the loans to the other bank, the cost of the transport, the cost of the maintenance of the transport, insurance and the gas of the transport. EFT's have revolutionized modern banking.

Other benefit is immediate payment, which brings an up to date cash flow. You won't hear either about lost checks causes by the inefficiency of normal mail

(nowadays known as snail mail for its velocity compared to emails) and up to date bookkeeping.

There are numerous ways of transferring money from one bank account to account. With the increasing technology, online money transfer has become the easiest way of transferring money from one bank to another without any difficulty. Here are three major means of transferring money.

1. NEFT

2. RTGS

3.UPI

4. IMPS

National Electronic Fund Transfer (NEFT)

National Electronic Fund Transfer (NEFT) is a nation-wide payments system that allows transfer of funds from one bank's account to another. With an increased focus on online banking, NEFT has become one of the most popular ways of transferring funds. Since it can electronically transfer funds from any bank branch to any individual, it has eliminated the need to visit a bank branch for transfer of funds. Let us learn about the how NEFT operates in India and what benefits it offers. Let us find out what is NEFT.

What is NEFT Process?

Stated simply, if an individual wishes to transfer a sum of money from his bank account to another person's bank account, he can do so through the process of <u>NEFT</u>, instead of withdrawing money and then paying it in cash or by writing out a cheque. The main benefit offered by NEFT is that it can transfer funds from

any account of any branch to any other bank account located at any given place. The only condition is that both the sender and receiver branches should be NEFT-enabled

Benefits of using NEFT

In the process of NEFT, you just have to enter the details of the beneficiary for the first time after which you can just select the beneficiary from the list, enter the amount and send. Take a look at some of the benefits of NEFT transactions that could make your daily transactions simpler:

- No physical presence of either party is required to conduct a transaction. Also, no physical instrument needs to be transferred at any point of time, between the conducting parties, to conclude the transaction.
- No visit to the bank is required, as long as a person holds a valid bank account.
- Shortcomings of a physical instrument are easily overcome. This means that NEFT has completely omitted instances of physical damage of any monetary instruments, its theft or forging.
- NEFT is simple and efficient. It can be done in under a minute's time and hardly involves any major formality.
- Confirmation of a successful transaction can be easily received and viewed through email and SMS notifications.
- Internet banking can be initiated and conducted from any place. This means that a person does not need to be present at a particular location to make NEFT transactions.
- Real time transactions provide assurance to both the parties.

Real-Time Gross Settlement (RTGS)

Real-time gross settlement (RTGS) is the continuous process of settling payments on an individual order basis without netting debits with credits across the books

of a central bank (e.g., bundling transactions). Once completed, real-time gross settlement payments are final and irrevocable.

Real Time Gross Settlement (RTGS) is an electronic form of funds transfer where the transmission takes place on a real time basis.

In India, transfer of funds with RTGS is done for high value transactions, the minimum amount being Rs 2 lakh. The beneficiary account receives the funds transferred, on a real time basis. The main difference between RTGS and National Electronic Funds Transfer (NEFT) is that while transfer via NEFT takes place in batches (with settlements and transactions being netted off), in the case of RTGS, the transactions are executed individually and on gross basis.

The customer initiating the funds transfer through RTGS has to have the Indian Financial System Code (IFSC) of the beneficiary's bank, along with the name of the beneficiary, account number and name of the bank. The bank branches, both at the initiating and receiving end, have to be RTGS-enabled for the transaction to be processed. Customers with Internet banking accounts can do RTGS transactions on their own

UPI (Unified Payments Interface):

A Unified Payments Interface is a real-time payment system that allows transactions to be done through any smartphone using VPA (Virtual Payment Address).

No bank account detail is needed for the money transfer through UPI. Only mobile number or name is sufficient and the transactions can be done 24/7. UPI-enabled apps allow the transfers up to Rs 1 lakh.

UPI or Unified Payments Interface is an immediate real-time payment system that helps in instantly transferring the funds between the two bank accounts through a mobile platform.Hence, UPI is a concept that allows multiple bank accounts to get into a single mobile application. This idea was developed by the National Payments Corporation of India and is controlled by the RBI and IBA(Indian Banking Association)

Key Features of UPI

Some of the features of UPI are listed below:

* Instant transfer of fund through Immediate Payment Service (IMPS) which is faster than NEFT.
* Since it is completely digital, one can use UPI 24 hours and on all public holidays.
* Single mobile application for accessing various bank accounts.
* Uses Virtual Payment Address which is a unique ID as given by the bank
* Uses Account Number with IFS Code and Mobile Number with MMID or Mobile Money Identifier

* Bill Sharing facility.
* Best for doing merchant payment, utility bill payments, in-app payments, OTC payments, Barcode based payments.
* One can file a complaint from Mobile App directly.

IMPS (Immediate Payment Service)

Immediate Payment Service or IMPs an instant fund transfer service and it can be used anytime. IMPS can be simply defined as NEFT+RTGS.
In order to avoid fraud complaints, the cap on transaction limit is set very low. For IMPS transfer, you just need to know the destination account holder's IMPS id (MMID) and his/her mobile number.

Steps to make IMPS money transfer:

Step 1: Using your Customer ID and Password into Net Banking/Mobile Banking
Step 2: Go to Funds Transfer tab (Other Bank Account)
Step 3: Select Debit / Credit Account, mode of transfer as IMPS and beneficiary account
Step 4: Enter the amount to be transferred and click on Submit
Step 5: Click on the confirm button
Step 6: Recheck all the information and approve the transaction using OTP (one time password) received on your registered mobile number
Step 7: And at last, confirm by clicking on the submit button.
Through IMPS, you can transfer money 24/7, But RTGS & NEFT can be done only in working hours on weekdays + a few hours on Saturdays only. Other than NEFT, RTGS and IMPS, you can also transfer your money through UPI and cheque.

The major feature of IMPS is that it is available at all times for usage. It transfers funds instantly and is a great banking platform in case of emergencies. The transaction charges of this platform are also very nominal and the transfer limit is also considerable, approximately Rupees 2 lakhs per day. Moreover, IMPS is available on mobile too which makes it super-convenient.

DIGITAL SIGNATURE

Digital signatures are like electronic "fingerprints." In the form of a coded message, the digital signature securely associates a signer with a document in a recorded transaction. Digital signatures use a standard, accepted format, called Public Key Infrastructure (PKI), to provide the highest levels of security and universal acceptance. They are a specific signature technology implementation of electronic signature (eSignature).

Digital signatures, like handwritten signatures, are unique to each signer. Digital signature solution providers, such as DocuSign, follow a specific protocol, called PKI. PKI requires the provider to use a mathematical algorithm to generate two long numbers, called keys. One key is public, and one key is private.

When a signer electronically signs a document, the signature is created using the signer's private key, which is always securely kept by the signer. The mathematical algorithm acts like a cipher, creating data matching the signed document, called a hash, and encrypting that data. The resulting encrypted data is the digital signature. The signature is also marked with the time that the document was signed. If the document changes after signing, the digital signature is invalidated.

As an example, Jane signs an agreement to sell a timeshare using her private key. The buyer receives the document. The buyer who receives the document also receives a copy of Jane's public key. If the public key can't decrypt the signature (via the cipher from which the keys were created), it means the signature isn't Jane's, or has been changed since it was signed. The signature is then considered invalid.

CERTIFICATE AUTHORITY (CA)

A certificate authority (CA) is a trusted entity that manages and issues security certificates and public keys that are used for secure communication in a public network. The CA is part of the public key infrastructure (PKI) along with the registration authority (RA) who verifies the information provided by a requester of a digital certificate. If the information is verified as correct, the certificate authority can then issue a certificate.

Certificate authorities are trusted third-party entities who provide digital certificates to organizations that have the need to ensure that their users are provided with secure authentication and connection. Certificates given by CAs build trust between the users and the providers because they can ensure the validity of each other's identities and authorities.

CAs provide the most basic security and business process principles in a public key infrastructure by creating trust relationships between enterprise and entities

Introduction to Bluetooth

Bluetooth is a short-range wireless communication technology that allows devices such as mobile phones, computers, and peripherals to transmit data or voice wirelessly over a short distance. The purpose of Bluetooth is to replace the cables that normally connect devices, while still keeping the communications between them secure.

Bluetooth Technology

Developed in 1994, Bluetooth was intended as a wireless replacement for cables. It uses the same 2.4GHz frequency as some other wireless technologies in the home or office, such as cordless phones and WiFi routers. It creates a 10-meter (33-foot) radius wireless network, called a personal area network (PAN) or piconet, which can network between two and eight devices. This short-range network allows you to send a page to your printer in another room, for example, without having to run an unsightly cable.

How does Bluetooth work?

Bluetooth technology requires that a low-cost transceiver chip be included in each device. The transceiver transmits and receives in a previously unused frequency band of 2.45 GHz that is available globally -- with some variation of bandwidth in different countries. In addition to data, up to three voice channels are available. Each device has a unique 48-bit address from the IEEE 802 standard. Bluetooth connections can be point to point or multipoint.

The maximum Bluetooth range is 10 meters. Data can be exchanged at a rate of 1 megabit per second -- up to 2 Mbps
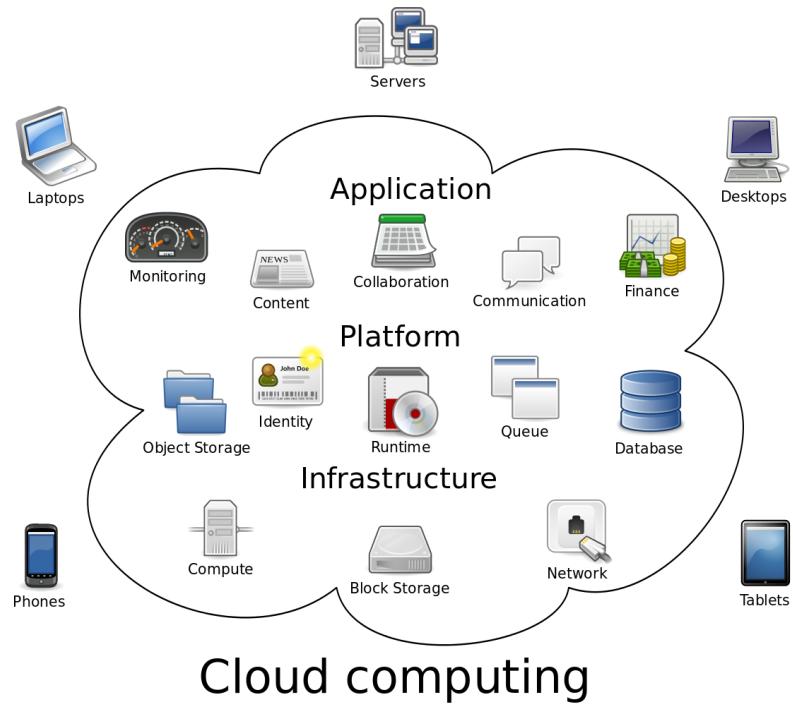
Bluetooth is used for the following:

- Wireless control and communication between mobile and hands-free headsets
- Wireless networking between multiple computers in areas with limited service
- Wireless communication with PCs and peripheral input/output (I/O) devices
- To replace conventional wired communication, like GPS receivers, medical equipment, traffic control devices and bar code scanners
- For low-bandwidth applications, when a higher USB bandwidth is not desired
- Bridge multiple industrial Ethernet networks
- Wireless controllers in many interactive games and play stations
- Access dialup Internet connection via a PDA or PC
- Manage short-range data transmission between medical and cellular/other tele-health devices
- Mobile phone communication with digital enhanced cordless telecommunication (DECT)
- Identify and track object positions with the real-time location system
- Personal mobile security applications

What Is Cloud Computing?

Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software.

Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it.

Cloud computing is a popular option for people and businesses for a number of reasons including cost savings, increased productivity, speed and efficiency, performance, and security.

Cloud computing

Understanding Cloud Computing

Cloud computing is named as such because the information being accessed is found remotely in the cloud or a virtual space. Companies that provide cloud services enable users to store files and applications on remote servers and then access all the data via the Internet. This means the user is not required to be in a specific place to gain access to it, allowing the user to work remotely.

Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). The name cloud computing was inspired by the cloud symbol that's often used to represent the Internet in flowcharts and diagrams

Types of Cloud Services

Regardless of the kind of service, cloud computing services provide users with a series of functions including:

- Email
- Storage, backup, and data retrieval
- Creating and testing apps
- Analyzing data
- Audio and video streaming
- Delivering software on demand

Big Data

Data

The quantities, characters, or symbols on which operations are performed by a computer, which may be stored and transmitted in the form of electrical signals and recorded on magnetic, optical, or mechanical recording media.

What is Big Data?

Big Data is also **data** but with a **huge size**. Big Data is a term used to describe a collection of data that is huge in size and yet growing exponentially with time. In short such data is so large and complex that none of the traditional data management tools are able to store it or process it efficiently.

Characteristics Of Big Data

(i) Volume – The name Big Data itself is related to a size which is enormous. Size of data plays a very crucial role in determining value out of data. Also, whether a particular data can actually be considered as a Big Data or not, is dependent upon the volume of data. Hence, **'Volume'** is one characteristic which needs to be considered while dealing with Big Data.

(ii) Variety – The next aspect of Big Data is its **variety**.

Variety refers to heterogeneous sources and the nature of data, both structured and unstructured. During earlier days, spreadsheets and databases were the only sources of data considered by most of the applications. Nowadays, data in the form of emails, photos, videos, monitoring devices, PDFs, audio, etc. are also being considered in the analysis applications. This variety of unstructured data poses certain issues for storage, mining and analyzing data.

(iii) Velocity – The term **'velocity'** refers to the speed of generation of data. How fast the data is generated and processed to meet the demands, determines real potential in the data.

Big Data Velocity deals with the speed at which data flows in from sources like business processes, application logs, networks, and social media sites, sensors, Mobile devices, etc. The flow of data is massive and continuous.

(iv) Variability – This refers to the inconsistency which can be shown by the data at times, thus hampering the process of being able to handle and manage the data effectively.

Benefits of Big Data Processing

Ability to process Big Data brings in multiple benefits, such as-

- o   Businesses can utilize outside intelligence while taking decisions

Access to social data from search engines and sites like face book, twitter are enabling organizations to fine tune their business strategies.
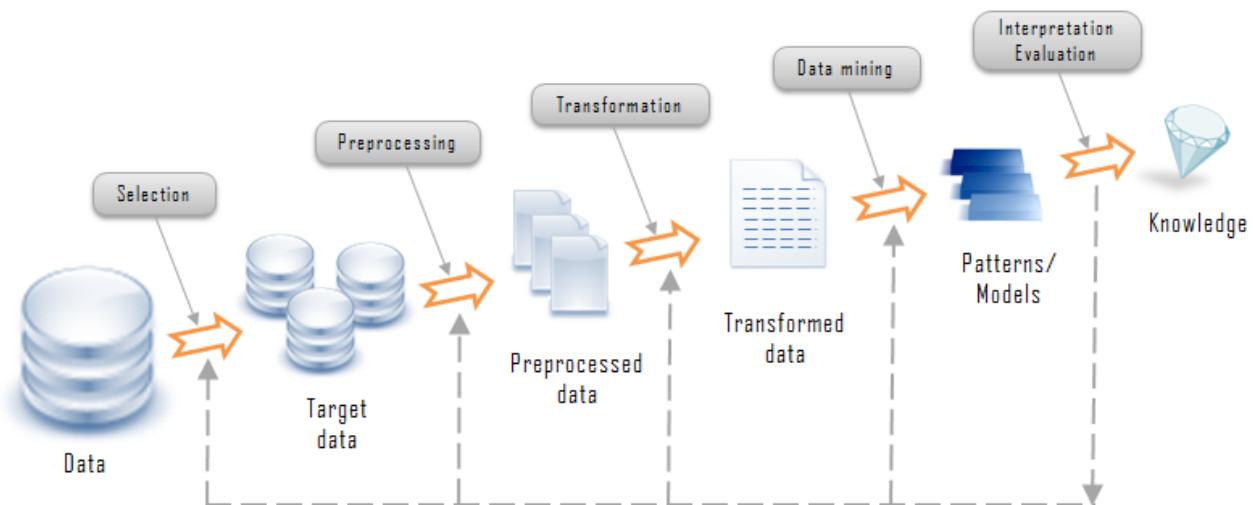
- o   Improved customer service

Traditional customer feedback systems are getting replaced by new systems designed with Big Data technologies. In these new systems, Big Data and natural language processing technologies are being used to read and evaluate consumer responses.

- o Early identification of risk to the product/services, if any
- o Better operational efficiency

DATA MINING

Data mining is the process of analyzing hidden patterns of data according to different perspectives for categorization into useful information, which is collected and assembled in common areas, such as data warehouses, for efficient analysis, data mining algorithms, facilitating business decision making and other information requirements to ultimately cut costs and increase revenue.

Data mining is also known as data discovery and knowledge discovery.

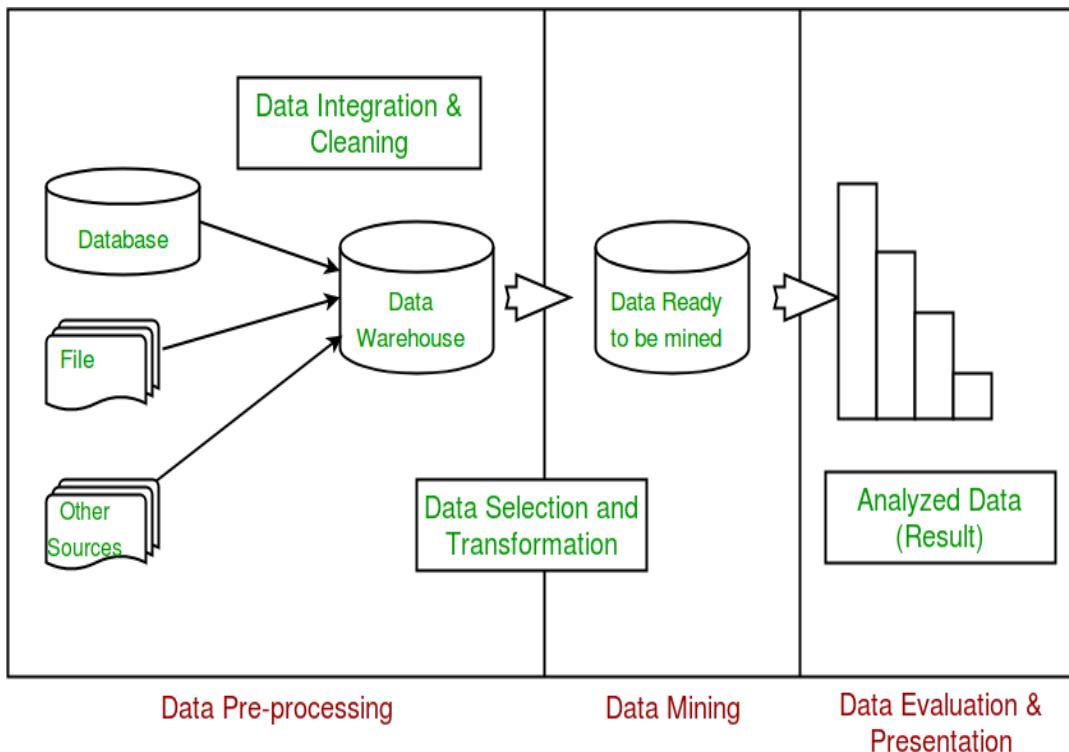The major steps involved in a data mining process are:

- Extract, transform and load data into a data warehouse
- Store and manage data in a multidimensional databases
- Provide data access to business analysts using application software
- Present analyzed data in easily understandable forms, such as graphs

The first step in data mining is gathering relevant data critical for business. Company data is either transactional, non-operational or metadata. Transactional data deals with day-to-day operations like sales, inventory and cost etc. Non-operational data is normally forecast, while metadata is concerned with logical database design. Patterns and relationships among data elements render relevant information, which may increase organizational revenue. Organizations with a strong consumer focus deal with data mining techniques providing clear pictures of products sold, price, competition and customer demographics.

Data Mining as a whole process

The whole process of Data Mining comprises of three main phases:
1. Data Pre-processing – Data cleaning, integration, selection and transformation takes place
2. Data Extraction – Occurrence of exact data mining
3. Data Evaluation and Presentation – Analyzing and presenting results

Data Pre-processing   Data Mining   Data Evaluation & Presentation

In future articles, we will cover the details of each of these phase.

Applications of Data Mining

1. Financial Analysis
2. Biological Analysis
3. Scientific Analysis
4. Intrusion Detection
5. Fraud Detection
6. Research Analysis

Real life example of Data Mining – Market Basket Analysis

Market Basket Analysis is a technique which gives the careful study of purchases done by a customer in a super market. The concept is basically applied to identify the items that are bought together by a customer. Say, if a person buys bread, what are the chances that he/she will also purchase butter. This analysis helps in

promoting offers and deals by the companies. The same is done with the help of data mining.

Mobile Computing

Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. The main concept involves –

- Mobile communication
- Mobile hardware
- Mobile software

Mobile communication

The mobile communication in this case, refers to the infrastructure put in place to ensure that seamless and reliable communication goes on. These would include devices such as protocols, services, bandwidth, and portals necessary to facilitate and support the stated services. The data format is also defined at this stage. This ensures that there is no collision with other existing systems which offer the same service.

Since the media is unguided/unbounded, the overlaying infrastructure is basically radio wave-oriented. That is, the signals are carried over the air to intended devices that are capable of receiving and sending similar kinds of signals.

Mobile Hardware

Mobile hardware includes mobile devices or device components that receive or access the service of mobility. They would range from portable laptops, smartphones, tablet Pc's, Personal Digital Assistants.

These devices will have a receptor medium that is capable of sensing and receiving signals. These devices are configured to operate in full- duplex, whereby they are capable of sending and receiving signals at the same time. They don't have to wait until one device has finished communicating for the other device to initiate communications.

Above mentioned devices use an existing and established network to operate on. In most cases, it would be a wireless network.

Mobile software

Mobile software is the actual program that runs on the mobile hardware. It deals with the characteristics and requirements of mobile applications. This is the engine of the mobile device. In other terms, it is the operating system of the appliance. It's the essential component that operates the mobile device.

Since portability is the main factor, this type of computing ensures that users are not tied or pinned to a single physical location, but are able to operate from anywhere. It incorporates all aspects of wireless communications.

The Benefits of Mobile Computing

- **Connectivity:** You can stay connected to all sources at all times.
- **Social Engagement:** You can interact with a variety of users via the Internet.
- **Personalization:** You can tailor your mobile computing to your individual needs.

System

A system is an arrangement in which all its unit assemble work together according to a set of rules. It can also be defined as a way of working, organizing or doing one or many tasks according to a fixed plan. For example, a watch is a time displaying system. Its components follow a set of rules to show time. If one of its parts fails, the watch will stop working. So we can say, in a system, all its subcomponents depend on each other.

Embedded System

As its name suggests, Embedded means something that is attached to another thing. An embedded system can be thought of as a computer hardware system having software embedded in it. An embedded system can be an independent system or it can be a part of a large system. An embedded system is a microcontroller or microprocessor based system which is designed to perform a specific task. For example, a fire alarm is an embedded system; it will sense only smoke.

An embedded system has three components –

- It has hardware.

- It has application software.

- It has Real Time Operating system (RTOS) that supervises the application software and provide mechanism to let the processor run a process as per scheduling by following a plan to control the latencies. RTOS defines the way the system works. It sets the rules during the execution of application program. A small scale embedded system may not have RTOS.

So we can define an embedded system as a Microcontroller based, software driven, reliable, real-time control system.

Characteristics of an Embedded System

- **Single-functioned** − An embedded system usually performs a specialized operation and does the same repeatedly. For example: A pager always functions as a pager.

- **Tightly constrained** − All computing systems have constraints on design metrics, but those on an embedded system can be especially tight. Design metrics is a measure of an implementation's features such as its cost, size, power, and performance. It must be of a size to fit on a single chip, must perform fast enough to process data in real time and consume minimum power to extend battery life.

- **Reactive and Real time** − Many embedded systems must continually react to changes in the system's environment and must compute certain results in real time without any delay. Consider an example of a car cruise controller; it continually monitors and reacts to speed and brake sensors. It must compute acceleration or de-accelerations repeatedly within a limited time; a delayed computation can result in failure to control of the car.

- **Microprocessors based** − It must be microprocessor or microcontroller based.

- **Memory** − It must have a memory, as its software usually embeds in ROM. It does not need any secondary memories in the computer.

- **Connected** − It must have connected peripherals to connect input and output devices.

- **HW-SW systems** − Software is used for more features and flexibility. Hardware is used for performance and security.

Advantages

- Easily Customizable
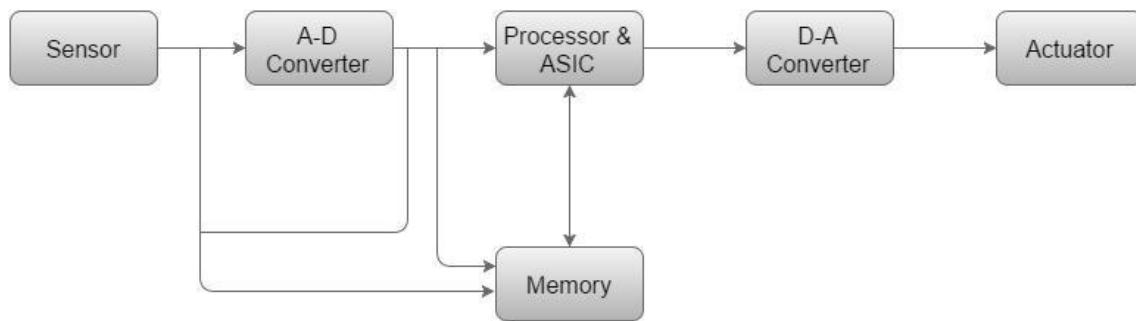- Low power consumption
- Low cost

- Enhanced performance

Disadvantages

- High development effort
- Larger time to market

Basic Sltructure of an Embedded System

The following illustration shows the basic structure of an embedded system −

- **Sensor** − It measures the physical quantity and converts it to an electrical signal which can be read by an observer or by any electronic instrument like an A2D converter. A sensor stores the measured quantity to the memory.

- **A-D Converter** − An analog-to-digital converter converts the analog signal sent by the sensor into a digital signal.

- **Processor & ASICs** − Processors process the data to measure the output and store it to the memory.

- **D-A Converter** − A digital-to-analog converter converts the digital data fed by the processor to analog data

- **Actuator** − An actuator compares the output given by the D-A Converter to the actual (expected) output stored in it and stores the approved output.

Internet Of Things(IOT)

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an IP address and is able to transfer data over a network.

IoT evolved from machine-to-machine (M2M) communication, i.e., machines connecting to each other via a network without human interaction. M2M refers to connecting a device to the cloud, managing it and collecting data.

How does it work?

Devices and objects with built in sensors are connected to an Internet of Things platform, which integrates data from the different devices and applies analytics to share the most valuable information with applications built to address specific needs. These powerful IoT platforms can pinpoint exactly what information is useful and what can safely be ignored. This information can be used to detect patterns, make recommendations, and detect possible problems before they occur.

The information picked up by connected devices enables me to make smart decisions about which components to stock up on, based on real-time information, which helps me save time and money.

Scenario #1: IoT in your home

Imagine you wake up at 7am every day to go to work. Your alarm clock does the job of waking you just fine. That is, until something goes wrong. Your train's cancelled and you have to drive to work instead. The only problem is that it takes longer to drive, and you would have needed to get up at 6.45am to avoid being late. Oh, and it's pouring with rain, so you'll need to drive slower than usual. A connected or IoT-enabled alarm clock would reset itself based on all these factors, to ensure you got to work on time. It could recognize that your usual train is cancelled, calculate the driving distance and travel time for your alternative route to work, check the weather and factor in slower travelling speed because of heavy rain, and calculate when it needs to wake you up so you're not late. If it's super-smart, if might even sync with your IoT-enabled coffee maker, to ensure your morning caffeine's ready to go when you get up.

- **Cache Memory** is a special very high-speed memory. It is used to speed up and synchronizing with high-speed CPU. Cache memory is costlier than main memory or disk memory but economical than CPU registers. Cache memory is an extremely fast memory type that acts as a buffer between RAM and the CPU. It holds frequently requested data and instructions so that they are immediately available to the CPU when needed.
- Cache memory is used to reduce the average time to access data from the Main memory. The cache is a smaller and faster memory which stores copies of the data from frequently used main memory locations. There are various different independent caches in a CPU, which store instructions and data.

- **Level 1 or Register –**
  It is a type of memory in which data is stored and accepted that are immediately stored in CPU. Most commonly used register is accumulator, Program counter, address register etc.

- **Level 2 or Cache memory –**
  It is the fastest memory which has faster access time where data is temporarily stored for faster access.
- **Level 3 or Main Memory –**
  It is memory on which computer works currently. It is small in size and once power is off data no longer stays in this memory.
- **Level 4 or Secondary Memory –**
  It is external memory which is not as fast as main memory but data stays permanently in this memory.