Information and Communication Technology

(A Technical Subject)

Commencing from 2006 January

for

G.C.E. (O/L)

Resource Materials

Unit One to Four

IT Department
National Institute of Education
Maharagama
Sri Lanka

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Unit 01 – Fundamentals of ICT

1.1 Introduction to ICT

1.1.1 Use and importance of ICT in the economy

Today, ICT has become an important part of day-to-day life. Most human activities now take place with the aid of ICT solutions. The reason why is that, ICT gives more effective and speedy solutions to real life problems. In fact, a characteristic feature of this era is that people lead complex lifestyles with grater requirements that they seek rapid suitable solutions. ICT satisfies these requirements in a comprehensive manner and hence we name our current age of the earth, " the ICT age".

A few instances where usage of ICT occurs in our society are:

- Banking systems
  [ATM, Transactions, Tele banking, Credit card payments]
- Telecommunication systems
  [Land & mobile phone operations, Fax, Internet, Telegrams.]
- Transportation systems
  [Air traffic controlling, Ticketing, Cargo operations,]
- Media institute
  [Program manipulations, Transmission controlling, visual creations]
- Medicine
  [Chemical analysis, CT,MRI,US Scanning, ECG, EEG, Surgeries]
- Education
  [CAL, CAD, Presentations, Publications, Explorations, Data bases }
- Security & Defense
  [Signal operations, Missile guidance, and nuclear plant operations]
- Construction industry, Fishing industry, Weather forecasting, etc.

In future, perhaps, other remaining areas of human interaction will also be dealt with through ICT.

Today ICT is also used as a tool or vehicle for the development of the Society. It is used to empower or enhance economic development processes.

In a variety of areas, access to and use of information can contribute to the empowerment of people, reduce poverty and improve lives, notably by:

Providing access to relevant information

- ICT can help improve the economic and social situation of the poor by enabling people
- to obtain relevant information on market prices, weather conditions, medical assistance, land and political rights as well as welfare or credit schemes
- increase their competitiveness and market access
- Train them via e-learning, thus making them responsible for their own development.

Giving a voice

As a consequence of their poverty, the poor often lack an effective voice in public life and policy. ICT helps:

- to increase the voice and participation of the poor in the decision-making processes
- communities to express their cultural identity
- People assert their own rights and interests and pressure decision-makers to be more responsive to their needs.
- to increase the efficiency, transparency and accountability of governments and institutions
- to promote local cultures and cultural diversity through local content

Facilitating communication and network building

By facilitating a new level of “many-to-many” information, ICT offer an interactive and decentralized platform that enables people to

- share knowledge and build networks
- promote their interest and rights more efficiently
- influence more effectively, rapidly and collectively political, decisions that affect their lives
- communicate more effectively, thus enhancing intercultural understanding

1.1.2 Data and Information

Data and information are two different concepts used in computer science.

Data are raw facts that we input into the machine.
Data are not restricted to numerical values. They may be a colour, picture or any object.

Data

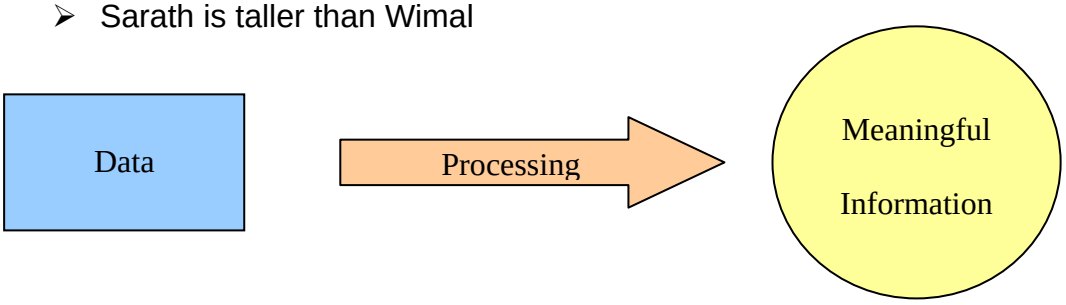
Names	Hights (cm)
Ravi	55
Nimal	45
Amal	85
Sarath	75
Wimal	65

Data

Ravi is 55cm tall
Nimal is 45cm tall
Amal is 85cm tall
Sarath is 75cm tall
Wimal is 65cm tall

Information is data that has been refined and organized by processing and purposeful intelligence
For example, according to the previous example, the following information can be obtained.

- Amal is the tallest one
- Nimal is the shortest one
- Sarath is taller than Wimal



For example, look at the following diagram;

Data

Name	Marks for English
Ravi	55
Nimal	45
Amal	85
Sarath	75
Wimal	65

Process
(Calculate the average)

$$\bar{x} = \frac{\Sigma x}{\Sigma f}$$

$$\bar{x} = \frac{55+45+85+75+65}{5}$$

Information

Average = 65

Now it is clear that raw data has no meaning and after processing it, we get meaningful information (**average = 65**). As such, raw data can produce more information like ***Mode, Medium, etc...***

1.1.3 ICT Tools

ICT tools are components associated with ICT. They are either hardware or software items used to process information. They include;

- Computers and Related Equipment
- Communication Equipment
- Software programs

.

Every year, a lots of ICT tools are manufactured by various companies in the world.
For example, Input output devices, application software etc.

- Bar code readers
  Used in super markets & shops
  to read bar codes which contain
  information about that particular product.

- Bar code printers
  Used to print information about a particular
  product in Barcode format

- Credit card readers
  Used to read credit cards

- Telephones
  For communication and used to
  connect to the Internet.

- Software Edit Photos/Pictures and creating graphic arts.

1.2 Introduction to computers

1.2.1 Evolution of a computer to the present state

The history of computer development is often referred to in reference to the different generations of computing devices. A major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, more powerful and more efficient and reliable devices characterize each generation of the computer. Read about each generation and the developments that led to the current devices that we use today.

i. A Brief History of Computers

Ancient Times

In the beginning, man used his fingers and toes to perform simple computations such as addition and subtraction. Later, man realized that by using some objects to represent digits, it might be possible to perform computations beyond the limited scope of one's own fingers and toes.

The first man-made computing device is the "**Abacus**". In the Abacus, small beads are arranged on a series of vertical rods in a manner that by manipulating them, it is possible with some skill and practice, to make rapid calculations. Addition, subtraction, division and multiplication can be performed on a standard abacus. The abacus is still in use today by shopkeepers in East Asia and some parts of North America.

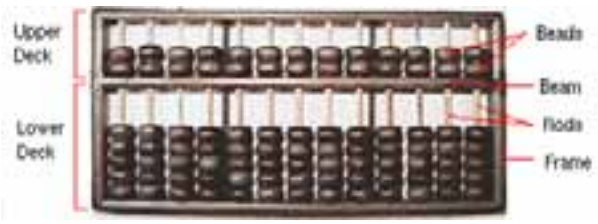


Figure 1.2 – The Abacus

Besides the abacus, early man also invented numbering systems to enable him to easily handle numbers greater than 10. One such numbering system is the decimal numbering system, which is traceable to early Hindu-Arabic influence. This decimal system, with specific digits representing numbers from 0 to 9, came into general use in Europe and has survived ever since.

1600 – 1900

In 1642, Blaise Pascal, a French mathematician, invented an adding machine. The machine has adopted partly the principles of the abacus but did away with the use of the hand to move the beads or counters. Instead, Pascal used wheels to move counters.

Figure 1.3 – Adding Machine, In 1642, Blaise Pascal

The principle of Pascal's machine, such as in the counters of tape recorders and odometers is still being used today. Pascal's machine was one of the first mechanical calculating machines.

In 1674, Gottfried Wilhelm Von Leibnitz made improvements on Pascal's machine. With Leibnitz's improvements, it was possible for the machine to divide and multiply as easily as it could add and subtract.

When the age of industrialization spread throughout Europe, new machines were invented to be used in agricultural and production sites. An invention that made profound changes in the history of industrialization was the mechanical loom invented by a Frenchman named Joseph Jacquard. With the use of cards punched with holes, it was possible for the Jacquard loom to weave fabrics in a variety of patterns.

The idea of using a punched card to store a predetermined pattern to be woven by the loom clicked in the mind of Charles Babbage, an English mathematician who lived in the nineteenth century. He foresaw a machine that could perform all mathematical calculations, store values in its memory and perform logical comparisons among values. He called it the Analytical Engine. Babbage's analytical engine, however, was never built. The technology of that time was not adequate for building Babbage's dream because electronics was not yet known or even thought of.

Figure 1.4 – Babbage's Analytical Engine

Herman Hollerith adopted the punched card concept of Jacquard to devise a system to process census data. Census data were translated into a series of holes in a punched card to represent the digits and the letters of the alphabet. It was then passed through a machine with a series of electrical contacts, which were either turned off or on depending on the existence or non-existence of holes in the punched cards. These different combinations of off/on situations were recorded by the machine and represented a way of tabulating the results of the Census. The Code developed by Hollerith is called the Hollerith Code.

Hollerith's machine was highly successful. It reduced by two thirds the time it took to tabulate the result of the Census manually.

1900 – 1945

Howard Aiken of Harvard University thought that technology in 1937 was just right to implement Babbage's concept. With the combined effort of his colleagues in Harvard and IBM, the Automatic Sequence Controlled Calculator was built in 1944 and it was called MARK I.

MARK I could perform division, multiplication, addition and subtraction in a specified sequence determined by the setting of the switches. MARK I used a typewriter connected to it or punched cards to output results. It contained more than three thousand electro-mechanical relays and weighed five tons. MARK I was used for 15 years.

1946 – 1960

The ENIAC (Electronic Numerical Integrator and Computer) was the first electronic digital computer. It was built in 1946 at the Moore School of Electrical Engineering of the University of Pennsylvania. The ENIAC had no moving parts. It was programmable and had the capability to store calculation steps. The ENIAC used vacuum tubes (about 18,000 in number).

A computer using vacuum tube technology is referred to as a first-generation computer. The ENIAC could perform an addition in 0.2 millisecond. This means that the machine was capable of performing about 5,000 computations per second. The principal drawback of ENIAC was its size and processing ability. It occupied 1,500 square feet of floor space and could process only one program or problem at a time.

In the 1950s, Remington Rand manufactured the UNIVAC I (Universal Automatic Calculator). It could calculate at the rate of 10,000 additions per second. In 1957, the International Business Machine Corporation (IBM) developed IBM 704 which could perform 100,000 calculations per second.

The Age of Transistors

In the late 1950s, transistors were invented and quickly replaced the thousands of vacuum tubes used in electronic computers. Transistor-based computers could perform 200,000 to 250,000 calculations per second. The transistorized computer represents the second generation of the computer.

It was not until the mid-1960s that the third generation of computers came into being. These were characterized by solid state technology and integrated circuitry coupled with extreme miniaturization. The fourth-generation of computers came into being after 1971. These computers were characterized by further miniaturization of circuit, increased multiprogramming and virtual storage memory.

In the 1980s, the fifth-generation of computers were operating at speeds of 3 to 5 million calculations per second (for small-scale computers) and 10 to 15 million instructions per second (for large-scale computers).

The Age of Microcomputers

8080, 8086, 80286, 80386-(SX,DX Bluthonder), 80486, Pentium

The age of microcomputers began in 1975 when a company called MITS introduced the ALTAIR 8800. It was a computer, which can be programmed by flicking switches on the front. It came as a kit and had to be soldered together. It had no software programs, but it was a personal computer available to the consumer for a few thousand dollars when most computer companies were charging tens of thousands of dollars for their computers. In 1977, both Commodore and Radio Shack announced that they were going to make personal computers. Mass production of the APPLE began in 1979, and by the end of 1981, it was the fastest selling of all the personal computers.

GENERATIONS OF COMPUTERS				
	FIRST (early 50's)	SECOND (late 50's)	THIRD (60's)	FOURTH (70's +)
Technology	vacuum tubes	Transistors	Integrated circuits	microchips (LSI, VLSI)
Relative speed	1	100	100	1,000,000 +++
Relative cost	1	0.1	0.01	0.001 ---
RAM capacity (bytes)	1,000-8,000	4,000-64,000	32,000-4,000,000	32,000,000+++
External storage	cards	Tape	magnetic disks	mass storage
Operating System	Single user; jobs scheduled manually	Single user; jobs scheduled automatically	Multiple users; time-sharing	Multiple users; distributed systems

Model (Intel)	Model (Motorola)	YEAR	Speed (MHz) (roughly)
8088			8
8086	68000		4-8
80186	68010		16
80286	68020	1982	20
80386	68030	1986	40
80486	68040	1990	66-75
Pentium MMX	Power Pc	1997	166/200
Pentium II	Power PC G3/G4	1997	350- 450
Pentium III		2000	1200
Pentium IV		2001	1800-2000

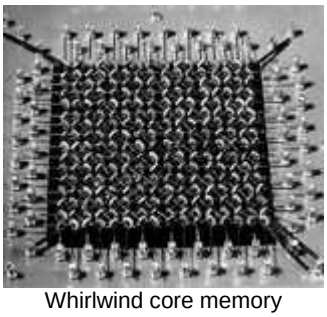
First Generation - 1940-1956: Vacuum Tubes

The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions. First generation computers relied on machine language to perform operations, and they could only solve one problem at a time. Input was based on punched cards and paper tape, and output was displayed on printouts.

The UNIVAC and ENIAC computers are examples of first-generation computing devices. The UNIVAC was the first commercial computer delivered to a business client, the U.S. Census Bureau in 1951.

Atanasoff-Berry Computer 1939,

magnetic drum memory of the Atanasoff-Berry Computer 1939, from Smithsonian NMAH



Whirlwind core memory

first computer bug 1945

UNIVAC 1951, from Smithsonian NMAH

UNIVAC I ca. 1955, from Smithsonian

UNIVAC ad 1955/01/17 from *Time*

UNIVAC ad 1955/02/28 from *Time*

UNIVAC I of 1951 was the first business computer made in the U.S. "Many people saw a computer for the first time on television when UNIVAC I predicted the outcome of the 1952 presidential elections."

Bendix G-15 of 1956, inexpensive at $60,000, for science and industry but could also be used by a single user; several hundred were built - used magnetic tape drive and key punch terminal

IBM 650 that "became the most popular medium-sized computer in America in the 1950's" - rental cost was $5000 per month - 1500 were installed - able to read

punched cards or magnetic tape - used a rotating magnetic drum main memory unit that could store 4000 words, from Smithsonian NMAH

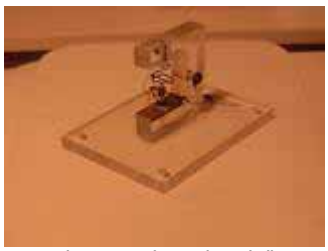
Second Generation - 1956-1963: Transistors

Transistors replaced vacuum tubes and ushered in the second generation of computers. The transistor was invented in 1947 but did not see widespread use in computers until the late 50s. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output.

Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages, which allowed programmers to specify instructions in words. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. These were also the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology.

The first computers of this generation were developed for the atomic energy industry.

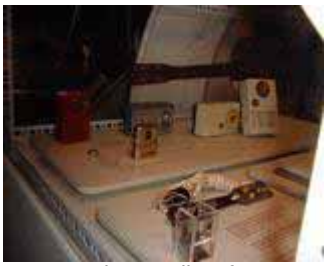

transistor, from Smithsonian NMAH

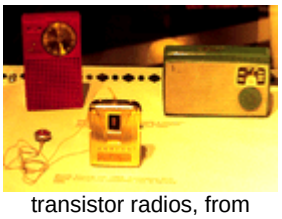

"First transistor (model), December 1947. Constructed by John Bardeen, Walter Brattain and William Shockley at Bell Laboratories," from Smithsonian NMAH


Regency transistor radio 1954 (TL), Zenith transistor hearing aid 1952, from Smithsonian NMAH


Regency transistor radio 1954, from Smithsonian NMAH

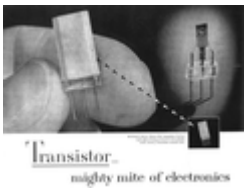

Philco and Emerson transistor radios, from Smithsonian NMAH


transistor radios, from Smithsonian NMAH


transistor radios, from Smithsonian NMAH

Maico hearing aid before and after transistors, from *Fortune* 1953/03

Morton, Shockley, White who developed transistor, from *Fortune* 1953/03



RCA transistor ad, from *Fortune* 1953/03

Third Generation - 1964-1971: Integrated Circuits

The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers.

Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run many different applications at one time with a central program that monitored the memory. Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

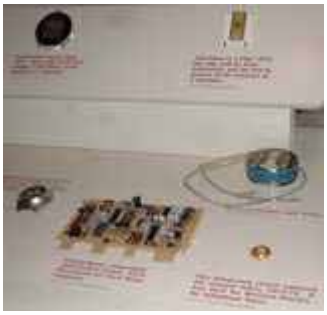
DEC PDP-1 of 1960, from CHM

DEC PDP8/E minicomputer 1973 from SDCM - cu

Anderson Jacobson ADC 260 acoustic coupler 1963, from SDCM

early transistor calculators - Casio "Mini" used chips from TI (left); TI SR-10 calculator showing circuit in transparent case, used a single chip 1972, from Smithsonian NMAH

early transistor calculators - Casio "Mini" used chips from TI (left); TI SR-10 calculator showing circuit in transparent case, used a single chip 1972, from Smithsonian NMAH



IC, from Smithsonian NMAH

IC, from Smithsonian NMAH

Fourth Generation - 1971-Present: Microprocessors

The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971, located all the components of the computer - from the central processing unit and memory to input/output controls - on a single chip.

In 1981 IBM introduced its first computer for the home user, and in 1984 Apple introduced the Macintosh. Microprocessors also moved out of the realm of desktop computers and into many areas of life as more and more everyday products began to use microprocessors.

As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet. Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.

Fifth Generation - Present and Beyond: Artificial Intelligence

Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality. Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.


Microsoft Reader


Michael Crichton displays a handheld computer with his latest bestselling novel "Timeline" in Microsoft Reader form on the screen (AP 5/23/00)


digital insertion ad


digital insertion ad

Jeff Bezos of amazon.com


wearable computers


Apple G4


Linux

1.2.2 Components and Peripherals of a computer system

(See 1.2.4)

1.2.3 Classification of computers

Different types of computers. (According to size)

A number of different dimensions can be used to classify computers into different types. Traditionally, the size and the capabilities of computers are used as the main criterion and the computers are classified into the following types.

- PC – The personal computer (PC) is small in size and is designed for general use by a single person.
    - Desktop – A PC that is not designed for portability. A desktop computer is typically set up in a permanent location.
    - Laptops (Notebooks) – A portable computer that includes a battery to provide power for some specific period of time.
    - Palmtop – More commonly known as Personal Digital Assistants (PDAs). Palmtops are small, lightweight and tightly integrated computers which usually do not have keyboards but rely on touch screen technology for user input. Palmtops are equipped with a battery with reasonable life.
    - Workstation – A desktop computer with a powerful processor, additional memory and enhanced capabilities for performing a special group of tasks, such as 3D graphics.
- Server – A computer that has been optimized to provide services to other computers over a network. Servers usually have powerful processors, lots of memory and large hard drives.
- Mainframe – Mainframes are huge computers, which could fill an entire room or even a whole floor. Over the years, the size of computers has diminished while the power has increased; the term mainframe has fallen out of use. You will still

hear the term used, particularly in large companies to describe the huge machines processing millions of transactions every day.

- Supercomputer – This type of computer is usually very expensive. Although some supercomputers are single computer systems, most comprised multiple high performance computers working parallel as a single system. The best-known supercomputers are built by Cray Supercomputers.

Different types of computers. (According to technology)

DIGITAL COMPUTER

A computer that stores data in terms of digits (numbers) and proceeds in discrete steps from one state to the next. The states of a digital computer typically involve binary digits, which may take the form of the presence, or absence of magnetic markers in a storage medium (*see* memory), on-off switches or relays. In digital computers, even letters, words and whole texts are represented digitally. Unlike analog computers, digital computers can only approximate a continuum by assigning large numbers of digits to a state description and by proceeding in arbitrarily small steps.

Analog computers

Analog computers are based on principles completely different from digital computers. Problem variables are represented by electrical voltages which can vary continuously within a certain range, usually –10 to +10 volts for a transistor-based machine. Electronic circuit modules allow the variables to be added, integrated (with respect to time) and multiplied by a constant. This makes it is possible to solve a system of ordinary linear differential equations by properly combining a number of adders, integrators, amplifiers and potentiometers using flexible chords and a patch panel (see the examples). The top illustration shows a small part of the patch panel of the Museum's EAI Model 680 computer.

Hybrid computer

Hybrid computers are made by combining features of analog computers and digital computers.

1.2.4 Computer Architecture

Components of a Computer System

By considering the functions performed by the various components, a computer can be represented as a collection of logical components as in Figure 1.3. The main hardware components of a modern computer system are the central processing unit (CPU), the main memory, the secondary storage and the input-output devices.

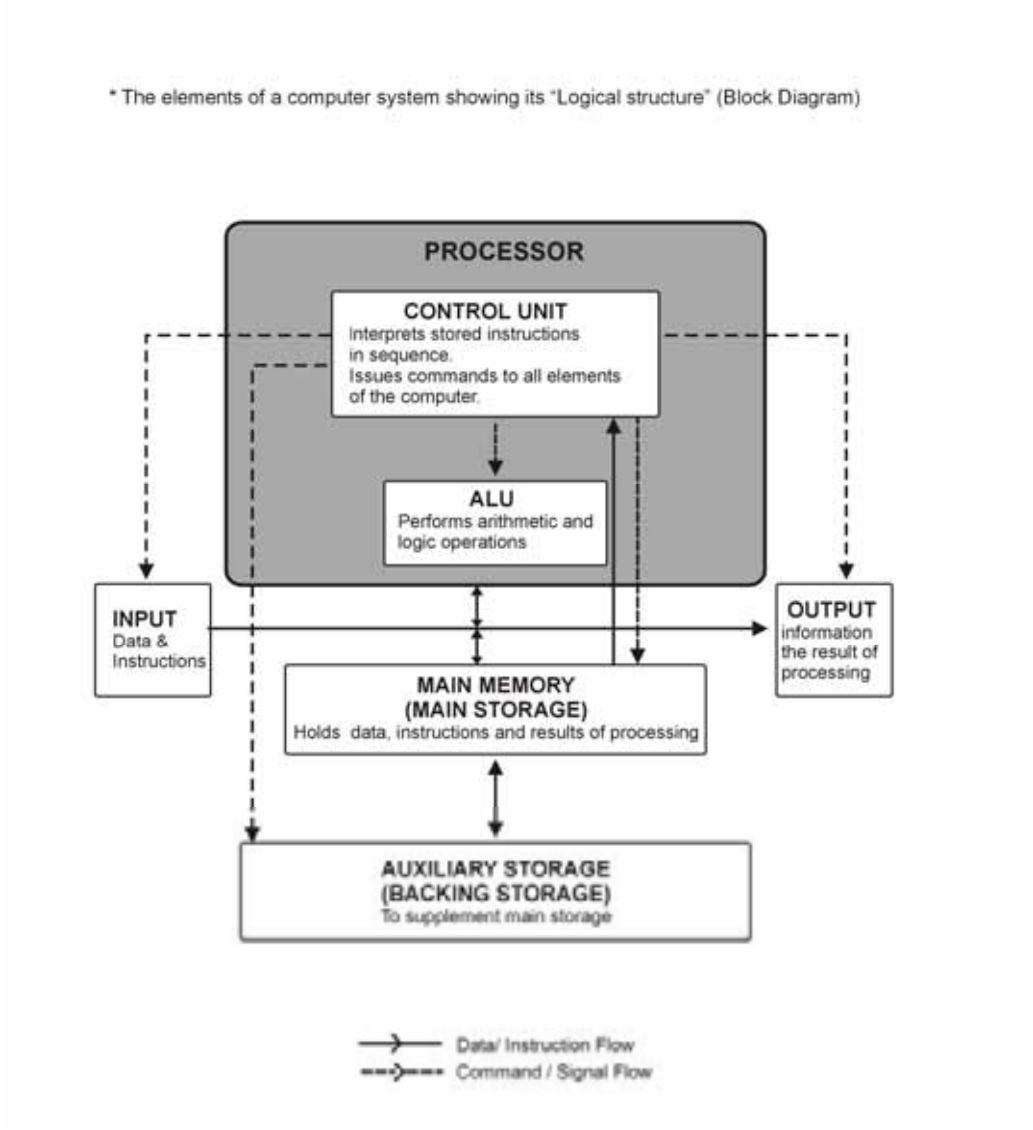


Figure 1.8 – Block Diagram for Computer System

System Unit

The system unit, or the cabinet houses most of the essential components of the computer system such as the power supply, the motherboard, the CPU chip, specialized chips, the system clock, RAM, ROM, expansion boards and bus lines.

Figure 1.9 – System Unit

Central Processing Unit (CPU)

The central processing unit performs the majority of calculations and controls the operation of a computer. CPUs are rated by the speed at which they can execute instructions. The speed of a CPU is measured in Megahertz (MHz), and is also known as the clock speed. The higher the value of the speed the faster the

computer can run programs. The capacity of a CPU is expressed in terms of **word size**. A word is the maximum number of bits that the CPU can manipulate or store at one time.

Figure 1.10 – CPU

Different manufacturers are making CPUs today. Some of these popular CPUs available today are the Intel, AMD, Cyrix and Motorola. The CPU consists of two parts: the control unit (CU) and the arithmetic/logic unit (ALU).

Control Unit (CU)

The control unit controls and directs the operation of the entire computer system. Although it does not perform any actual processing on the data, the control unit acts as a central nervous system for the other components of the computer. It obtains instructions from the program stored in main memory, interprets the instructions, and issues signals, which cause other units in the system to execute them.

Arithmetic-Logic Unit (ALU)

The Arithmetic-Logic unit performs arithmetic operations such as addition, subtraction, multiplication and division on data. It also performs logical operations, which involve comparison of data.
In microcomputers, the entire CPU is typically fabricated on a single chip.

CPU Properties

Property	Meaning	Units
Speed	The number of operations which can be performed per second	MHz
Word Size	The largest number of bits which can be handled in one operation	Bit
Data Path	The largest number of bits which can be transported into the chip in one operation	Bit
Maximum Memory	Amount of memory that CPU can address	MB

Table 1.2: CPU Properties

Mother Board

The mother board is the main circuit board inside the computer. It can be considered as the main communication centre through which all the components of the computer transmit data back and forth. All the main parts including the CPU of the computer are typically plugged into the motherboard. The motherboard also

provides sockets, called **expansion slots**, to plug in special electronic circuit boards to enhance the functionality of the computer. These extra circuit boards are called **expansion cards**, by using which you can customize a computer to suit your needs. One other major function of the motherboard is to supply the necessary power to all its expansion cards.

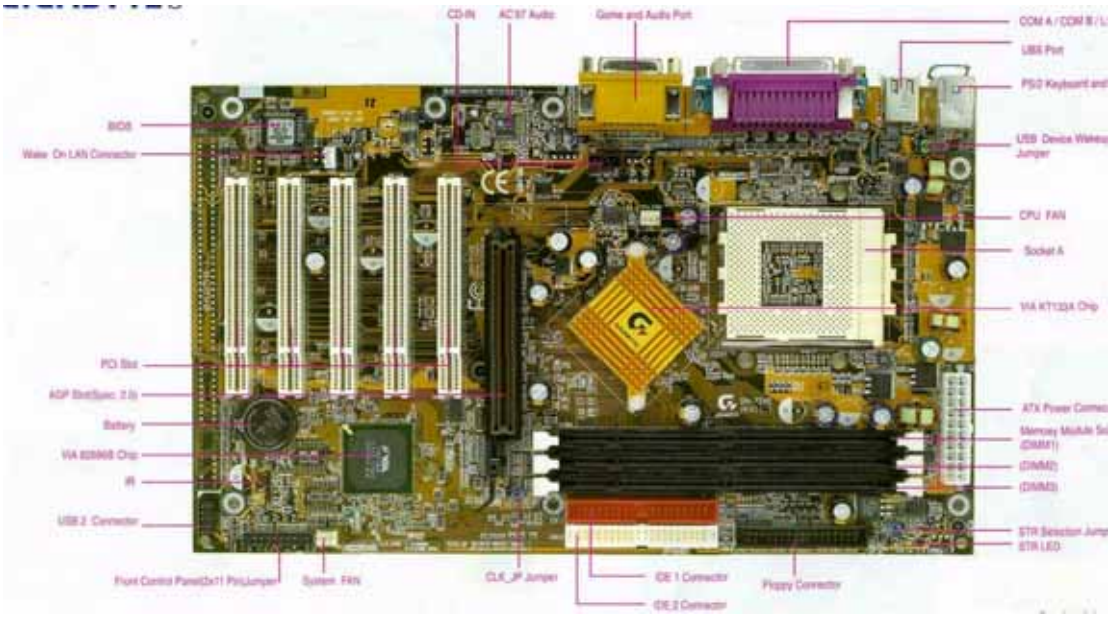


Figure 1.11 – The mother board

System Clock

Computers run to the beat of a clock. A clock in the computer that ticks one million times per second is called a one megahertz (1MHz) clock. Generally a faster clock means faster execution of programs, hence better performance. However the actual performance of a computer depends on many other factors.

Power Supply

The regulated power supply inside the computer transforms mains electricity into DC current used in the computer. It has an internal fan to cool the unit.

Peripheral Devices

Peripheral devices are the components of the computer which are situated outside the main casing of the computer. Peripheral devices are typically connected to the computer by using **ports**.

ii. Different Types of Ports

A typical computer may provide a number of different types of ports to connect external devices to it. Some of these different port types and their typical usages are explained in the following sections.

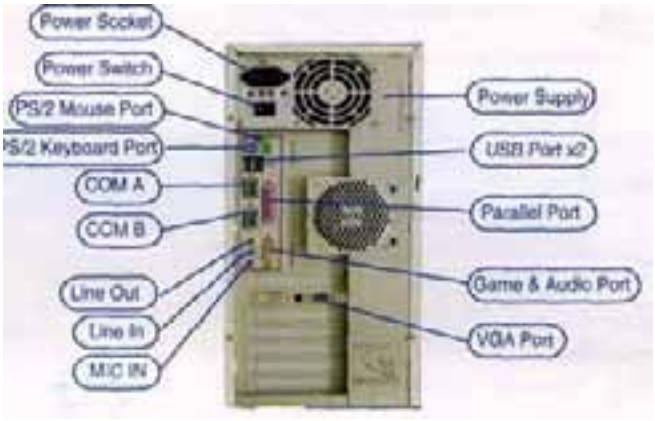


Figure 1.12 –System Unit, Ports Layouts

Serial Port

A serial port is used to connect external modems or an older computer mouse to the computer. There are two serial port versions : 9-pin version , or 25-pin version. Serial port is a male port and the typical data transfer rate over a serial port is 115 kilobits per second.

Video Card Port

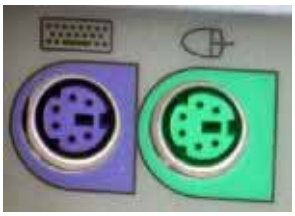
This connector is used to connect a computer display monitor to a computer's video card. The port is a female port and has 15 holes.

Parallel Port

A Parallel port has 25 holes and is commonly known as the printer port. They are used to connect external devices such as scanners and printers.

PS/2 Port

A PS/2 port, also referred to as a mouse port, is used to connect a mouse or keyboard with the computer. Most computers come with two PS/2 ports, one for the keyboard and the other for the mouse.



USB Port

A universal serial bus (USB) port is a fairly new port - introduced around 1997. This port can be used to connect all kinds of external devices, such as external hard drives, printers and mice, scanners. USB-compliant devices can draw power from a USB port. USB 2.0 connectors were introduced in 2003 and are capable of transferring data at 480 Mbps.

Ethernet (Network) Port

This port is used to connect the computer to a network or to Internet. Data travels through this port at speeds of either 10 Megabits or 100 Megabits depending on the speed of the network card in the computer. Little monitor lights on these devices flicker when the port is in use.

iii. Storage

Generally, computers provide many different types of storage systems. The different types of storage systems in a computer can be arranged in a hierarchy according to speed and their costs as shown in Figure 1.12. In this figure, as we move down the hierarchy, the cost to store a bit generally decreases, whereas the access time generally increases.

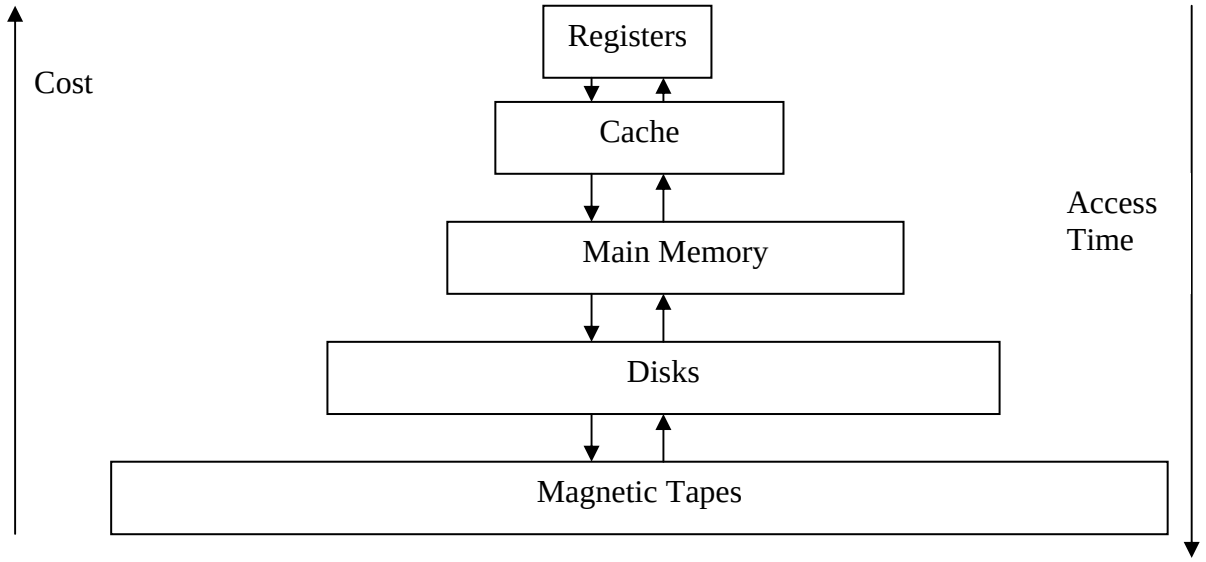


Figure 1.13 – Storage Systems Comparison

The smallest unit of data that can be stored in a computer is a bit. A bit will have the value '0' or '1' . A large collection of such '0's or '1's is what makes up data in a computer.

Smallest Unit - 1 bit
8 bits - 1 byte
1024 bytes - 1 kilobyte (KB)
1024 kilobytes - 1 megabyte (MB)
1024 megabytes - 1 gigabyte (GB)
1024 gigabytes - 1 terabyte

(In computer jargon, One Kilo = 2^{10} =1024)

The capacity of a particular storage device and the space taken up by a file are always measured using these units.

Memory

The programs and data must be in the main memory to be used by the CPU. The main memory is the only large storage area that the CPU can access directly. Memory of a computer is measured in Megabytes.

The three basic types of memory used in a computer are **Cache Memory**, **Random Access Memory (RAM)** and **Read Only Memory (ROM)** .

Cache Memory

The CPU contains a small amount of internal memory to keep data temporally for its immediate computations. This memory is called Level 1 cache. If the data required by the CPU is not in Level 1 cache, the Level 2 cache is searched. The Level 2 cache is situated typically outside the processor chip. The advantage of cache memory over normal RAM is that the cache can be searched quicker than the normal RAM.

Random Access Memory (RAM)

RAM or the main memory is the computer's short-term memory that temporarily holds data and instructions, which will be needed shortly by the CPU. Data and instructions can be stored and retrieved from anywhere in the RAM, and the time taken for such operations is approximately the same irrespective of the locations they are stored in the RAM. RAM is volatile, which means that it loses its data when the computer is turned off. RAM is supplied in modules; small circuit boards which can be plugged into the motherboard in special sockets.

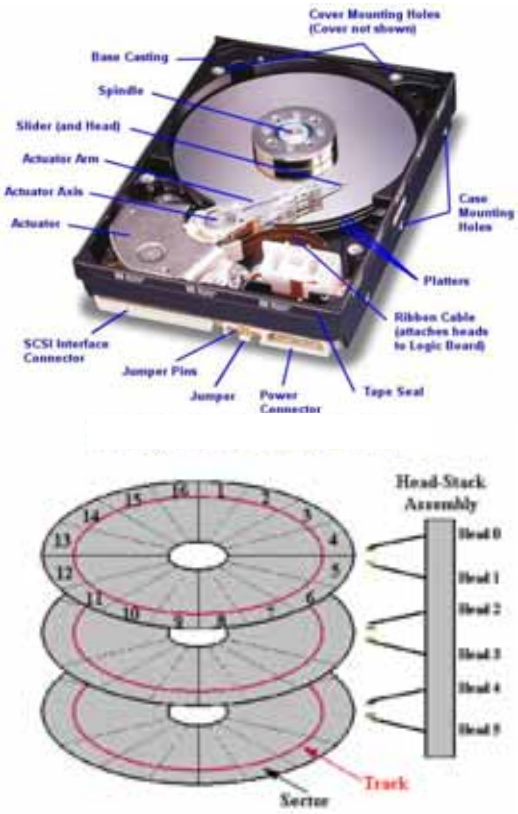


Figure 1.14 - Drive Physical and

Read Only Memory (ROM)

A type of data storage device, which is manufactured with fixed contents. ROM is also known as **firmware.** ROM is non-volatile storage in contrast to RAM. It retains its contents even when the power is switched off. ROM stores critical programs such as the program that boots the computer. In addition, ROM is used extensively in calculators and peripheral devices such as laser printers.

Secondary Storage

Secondary or auxiliary storage devices are used to store large volumes of information more permanently. They can be used as input and output devices. There are many types of secondary storage devices.

Hard Disks

A hard disk drive is a device housed inside the computer, on which data is stored for later retrieval. Most computers will have at least one hard disk. A hard disk consists of multiple disk "platters" (magnetic surfaces) on which data is electronically 'written'. Data can be written or read from the hard disk. These surfaces on which data is written are usually sealed inside a drive (casing), to prevent contamination and moisture. Hard disks are considered the most reliable method of storage. Hard disk storage capacities range from a few hundred

megabytes to many gigabytes. The speed of a hard drive is measured in terms of average access time, the speed at which the hard drive finds data. The average access time is measured in milliseconds (1/1000 of a second).

While hard disk drives are usually installed inside the system unit of the computer, there also are portable hard drives that can be connected to the computer externally. Such hard drives are useful as they can be used to transfer large quantities of data between different computers.

Floppy Disk

A floppy disk or a diskette is a round flat removable piece of plastic plate coated with a Ferric Oxide layer, and encased in a protective plastic cover, called the disk jacket. The Ferric Oxide layer is capable of holding a magnetic field. Data is stored on a floppy disk by means of a disk drive, which alters the magnetic orientation of the particles in the Ferric Oxide layer. Reading data from a diskette means that the data stored as a magnetic pattern on a diskette is converted to electronic signals and transmitted to the memory of the computer. Writing data on a diskette means electronic information is transformed into magnetic patterns and recorded magnetically on the diskette.

Floppy disks are made to be removable and easy to carry. They are more sensitive and unreliable than hard disks. Floppy disks are also slower than hard disks and the storage capacity is typically 1.44 megabytes.

Evolution of Diskettes				
Year Introduced	Physical Size (in inches)	R/W Capability	Maximum Capacity	Number of sides used
1970s	8	R	100 Kilobytes	Single
1973	8	R/W	250 Kilobytes	Double
1976	5.25	R/W	100 Kilobytes	Single
	5.25	R/W	1.2 Megabytes	Double
1980	3.5	R/W	1.44 Megabytes	Double

Table 1.3 - Evolution of Diskettes

Zip disks and Jaz disks

These disks are very similar to floppy disks except that they can be used to store large amounts of data. Zip disk capacities range from 100 to 750 MB and Jaz disks come in 1 & 2 GB capacities. Both these disks are removable and portable and provide much better performance than floppy disks.

Magneto optical disk

Magneto optical disk drives use a combination of a laser, to heat the surface of the disk, and a magnetic head, to record data. While these disks are high performance, they are expensive. Magneto optical disks have capacities ranging from 128 MB to several gigabytes.

Magnetic Tape

Magnetic tapes are similar to audiotapes and store data in a serial manner (i.e. data is stored one after the other on the tape). These tapes can store large amounts of data but are primarily used for backup purposes because the access speeds are slow.

CD/ DVD

A compact disc is a plastic disc where data is optically 'written' on its surface. The data written on the disc is read using a CD-ROM drive which uses lasers for this purpose. Usually once the data has been 'written' (or 'burnt') on to the CD, it is not possible to change it, hence Read Only Memory. The faster the CDROM drive can read a CD, the faster the computer will be able to get data from the CD. Digital Versatile Discs (DVD) use a similar concept to CDs except that they are able to use multiple surfaces on a single disc and so can be used to store larger amounts of data. A typical CD can store 650 to 700 MB of data while a DVD can store from 2GB to 8 GB of data. Some CDs are re-writeable. To 'write' on a CD, a drive called 'CD Writer' must be used.

Formatting

Hard disks and Diskettes must be formatted before saving data on them. Formatting can be considered as an initialization process that prepares the disk or diskette electronically so that it can store data or programs.

Data Hierarchy

Data in storage can be organized into a hierarchy of categories.

- Character : a single letter, number or a special character.
- Field : Typically, a sequence of characters.
- Record : Collection of related fields
- File : Collection of related records
- Databases : Collection of interrelated files.

Input Devices

Input devices enable data to be fed into the computer in a form that the computer can use. Input devices are categorized into two types: keyboard entry devices and direct entry devices. A device through which data can be entered to the computer by pressing keys is called a keyboard entry device whereas all the other types of input devices are called direct entry devices.

Keyboard

The keyboard is the most commonly used input device and has been used since computers were first introduced. They are intelligent devices and contain their own chips. Each key is a switch, which closes when that particular key is pressed. The microprocessor scans the keyboard hundreds of times a second to see if a key has been pressed; if it has, a code that corresponds to that key is sent to the Processing Unit. The CPU then translates this code into the ASCII code (the code that computers use to represent characters on the computer keyboard), which is then used by the computer program.

Mouse

A mouse is another popular input device that forms an essential part of a computer system. Its movements on the desktop are translated into digital information, which in turn is fed to the computer, causing the cursor to move on the screen. Underneath the mouse there is a ball which rotates when the mouse is moved by the user and sensors pick up this movement. A mouse usually has two or three buttons, and these are used to make selections on the screen. The Mouse is classified as a pointing device. Joysticks, Touch Screens and Light Pens are a few other examples for pointing devices.

A newer type of mouse is the optical mouse. An optical mouse uses a light-emitting diode (LED), an optical sensor, and a digital signal processing (DSP) in place of the traditional mouse ball and electro-mechanical transducer. Movement is detected by sensing changes in reflected light, rather than by interpreting the motion of a rolling sphere.

Figure 1.15 – Mice

Microphone

A microphone can be used to record sound into a computer. Microphones are also used for voice communication through a computer, for example, for making telephone calls through a computer.

Camera

Digital Cameras store the images digitally rather than on film. Digital still cameras can be connected to a computer and the pictures taken on them can be transferred while digital motion cameras or web cams can be used to create video and for video conferencing purposes.

Figure 1.16 – Digital Camera

Scanner

Scanners are input devices normally used to scan text or pictures. The scans are then stored in a computer's memory where they can then be accessed and modified using a desktop publishing package, before being printed. Both black and white, and colour scanners are available.

Optical character recognition (OCR) is where the text on a page is scanned and then converted and fed into a word processing package so that it can be modified according to the needs of the user. Scanners often come with OCR software. OCR software may not recognize certain characters, be they handwritten, typed fonts or symbols.

Figure 1.17 – Scanner

Other Devices

A variety of devices exist which allow people to input different kinds of information into a computer. Some such devices are:

- Fingerprint reader - Used to capture a fingerprint of a person into the computer
- Magnetic Ink Character Recognition (MICR) - Used to recognize characters printed in special ink. e.g. on cheques
- Environment Sensors - Movement, Temperature, Humidity, etc., can be monitored through a computer using these devices.

Output Devices

Output devices translate information processed by the computer into a form that either humans or other machines can understand. There are a variety of output devices, which can be connected to a computer. Some of the common output devices are explained in the following sections.

Monitor

The most common form of output is the computer screen. It is more correctly called the 'monitor' and sometimes referred to as the visual display unit or VDU.

The quality of a computer monitor is based on the following properties:

- Resolution: Resolution is the number of pixels, which the screen can display. A 'pixel' is the 'picture element' and refers to the smallest area of the screen that the computer can change.
- The number of colours it can display (dependent on the computer as well)
- Radiation output.

Different types of display screens

- CRT monitor – A cathode-ray tube and associated electronics connected to the video output of a computer. These have higher resolution than TVs. Larger monitors with high resolution are used for specialized application such as desktop publishing and CAD.

- Liquid crystal display (LCD) – LCDs are screens made from two glass/plastic plates with liquid in between. LCDs are commonly used for calculators and laptop computers, as they are far flatter than is possible with cathode ray screens used in TVs and standard computer monitors.

Figure1.18- CRT/LCD Monitors

Main differences of LCDs as compared with CRT monitors are :

- Take s very little space
- Small energy consumption
- Sharp pictures
- No flicker or geometric distortion
- Fairly expensive
- Limited viewing angle
- Slower response time

Printers

Many different types of printer are in use today. Two primary technologies used for printing are impact printing and non-impact printing. Impact Printers use a print head containing a number of metal pins which strike an inked ribbon placed between the print head and the paper. The non-impact printers are much quieter than impact printers as their printing heads do not strike the paper.

Three most common printer types are:

Dot matrix printers, Inkjet printers and Laser printers.

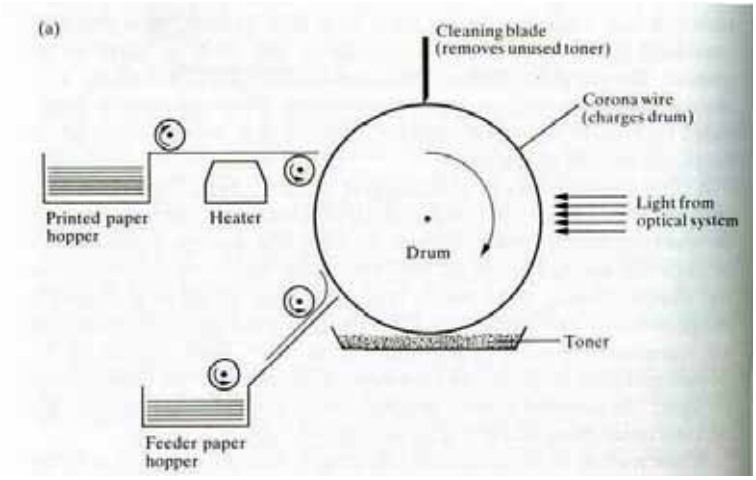
- **Dot matrix printers** - These printers work by firing a matrix of tiny pins (which are located in the print head), through a ribbon similar to that found on a typewriter. Such printers are cheap and have the lowest running cost compared to any other type of printer. As the head moves across the paper the correct pins are fired out to hit an inked ribbon and form the shape of the character required. The greater the number of pins, the higher the quality of the print. Dot matrix printers are impact printers and are used to print multipart stationery. So to print several copies of a document at the same time you will need to use a dot matrix printer.

Figure 1.19 – Dot Matrix

- **Inkjet printers -** Inkjet printers can produce high quality text and graphics. They are quieter than dot matrix printers. The technology involves ink flowing through the appropriate nozzles (usually in an array of 64) where it is then heated and a bubble is formed. This expands to release a tiny droplet of ink onto the paper.

Figure 1.20 -Inkjet

- **Laser printers**



Laser printer and it's functionality

These non-impact printers offer high-speed printing and an excellent quality of text and graphics. A laser beam is used to form an image on a rotating, charged metal drum. This then picks up toner from the toner cartridge and transfers it onto paper. Very soon afterwards heat and pressure are applied so the toner sticks to the paper. Since they are page printers they are very fast. Colour laser printers are now available and are mainly used for desktop publishing. Although they are expensive, they are likely eventually to come into widespread use.

Speakers / Headphones

Speakers or headphones may be used to get sound output from a computer. There are different types of speakers ranging from simple speakers, which provide simple sound to speakers, which can provide theatre-like surround sound.

Speakers and Headphones

1.3 Software

Software refers to instructions which are used by the computer to perform various tasks. The word programme is synonymous with software. Software is created with programming languages and related utilities. Software is generally classified into two types: system software and application software.

Application Programs
Utilities
Operating System
Physical Devices

Abstract view of the Components of a computer system

1.3.1

System Software

System software is responsible for controlling, integrating and managing the individual hardware components of a computer system so that other software and the users of the system see it as a functional unit without having to be concerned with the low-level details of the computer hardware.

System **software can be further classified as:**

- Operating Systems
- Utilities and Service Programs

Operating Systems (OS)

The Operating System manages the resources and the basic operations of the computer. Without an operating system the computer would not work. The operating system (or a part of it) is loaded into the main memory when the computer is switched on and handles many tasks, which we are unaware of when we use the computer. A part of the operating system remains in main memory until the computer is turned off.

There are several operating systems used with personal computers such as Windows 98, Windows XP, Linux and Mac OS. Different operating systems are designed for different hardware platforms or for different functions.

Operating systems may provide different types of user interfaces such **as Command Line Interface** and **Graphical User Interface (GUI).** In the command line interface, users communicate with the operating system by typing commands using the keyboard. One of the main disadvantages of the command line interface is that the user has to memorize the commands exactly.

The graphical user interface was first developed for Apple Macintosh Computers. In the graphical user interface, a user invokes a command by means of graphical objects shown on the screen and the system translates the user actions to the operating system commands and executes them on behalf of the user.

The general-purpose operating systems are typically supplied on CD-ROMs and must be installed before using the computer. Some computers such as hand held computers come with pre-installed operating systems on the computers' ROM. Such operating systems provide only limited capabilities and are virtually impossible to be upgraded.

Utilities and Service Programs

Another category of software is utility software, which is a collection of useful programs that enhance the capabilities of the operating systems. These software programs are designed to perform various tasks. Some examples of utility software are Norton Utilities and Download Accelerator.

Device Drivers

Virtually every hardware component located inside or connected externally to a computer requires associated software component to enable that hardware to communicate and function with the operating system, other applications and other hardware components of the computer. This software component is referred to as driver software of that hardware component. Until you install the proper software derive for a hardware component that hardware component remains logically isolated from the rest of the components of the computer.

1.3.2 Application Software

Application software is designed to perform useful general-purpose tasks. For example, an application program called Solitaire is a single program that lets you play a card game. Application software can be grouped as customized software or as application packages. Customized software is generally designed for a particular customer whereas application packages are “off the shelf” programs designed for the general public.

Common types of application software are:

- Word Processing
- Spreadsheet
- Database Management System
- Presentation Software
- Desktop Publishing and Graphic Design
- Web Design and Development

Booting the Computer

The process of loading the operating system into the computer’s main memory from the hard disc, floppy disk or CD is called **booting**. A programme known as the **boot routine** or **bootstrap loader** is in change of the booting process and this boot routine is stored permanently in the computer’s electronic circuitry, typical in ROM. Another series of programmes which start up prior to the booting process are the **diagnostic routines.** These programs test the main memory, the CPU and other parts of the system to make sure that they are running properly.

1.4 Networking of Computers

Network
A network is a collection of entities that exchange information or goods. A few examples of networks are railway system, nervous system of animals, telephone system.

Computer Network

A network consists of two or more computers that are linked in order to share resources (such as printers and CD-ROMs), exchange files, or allow electronic communication. The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

A communications network is a system of interconnected computers, and communication devices that can communicate with one another and share resources. At the most elementary level, a computer network consists of two computers connected with each other by a cable to allow them to share data. A device connected to a network is called a node. A node may be a device such as a computer, a printer, workstation etc.

1.4.1 Advantages of Networks

Networks offer several advantages over stand alone systems. Some of these advantages are listed below:

Speed. Sharing and transferring files within Networks is very rapid. Thus saving time, while maintaining the integrity of the file.

Cost. Individually licensed copies of many popular software programs can be costly. Networkable versions are available at a considerable saving. Shared programs, on a network allows for easier upgrading of the program on one single file server, instead of upgrading individual workstations.

Security. Sensitive files and programs on a network are password protected (established for specific directories to restrict access to authorized users) or designated as "copy inhibit," so that you do not have to worry about illegal copying of programs.

Centralized Software Management. Software can be loaded on one computer (the file server) eliminating that need to spend time and energy installing updates and tracking files on independent computers throughout the building.

Resource Sharing. Resources such as, printers, fax machines and modems can be shared.

Electronic Mail. E-mail aids in personal and professional communication. Electronic mail on a LAN can enable staff to communicate within the building without having tot to leave their desks.

Flexible Access. Access their files from computers throughout the firm.

Access to databases: Users can access numerous databases by making them available on the network.

Workgroup Computing. Workgroup software (such as Microsoft BackOffice) allows many users to work on a document or project concurrently.

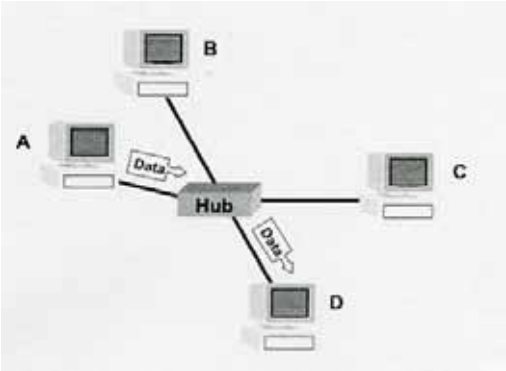
Disadvantages of Network

- Server faults stop applications being available
- Network faults can cause loss of data.
- Network fault could lead to loss of resources
- User work dependent upon network
- System open to hackers
- Decisions tend to become centralized
- Could become inefficient
- Could degrade in performance
- Resources could be located too far from users
- Network management can become difficult

Common Network Elements

The different types of components that you can find in a network are:

- Servers: Computers that provide shared resources to the network users
- Clients: Computers that access shared network resources provided by the users
- Communication Media: The media through which data is being transmitted.
- Network Operating system: Software that manages the activities of a network
- Shared resources: Any service or resource made available for use by the members of the network.
- Modem: used to connect a computer to another computer over phone lines.
- Hub: A hub can be thought of as a junction box, permitting new computers to be connected to a network as easily as plugging a power cord into an electrical socket. Hubs are commonly available in 4, 8, 16 port sizes, enabling anywhere from 4 to 16 network devices to be plugged into a network. There is no need to connect all the ports of a hub to network devices simultaneously. When no cables are plugged in, the signals bypass the unused ports. Some hubs have an additional interface port that connects to another hub, increasing the size of the network.



- Switch: An enhanced version of the hub. Typically a switch can distribute the communication load so all the computers connected to the switch can communicate effectively.

1.4.2 TYPES OF NETWORKS

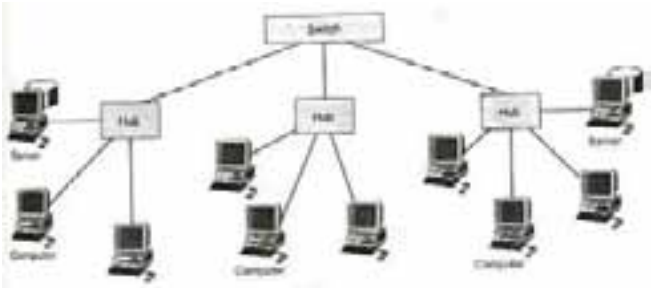
Network Topologies

Networks can be laid out in a number of different ways. The physical layout of a network is called its topology. The basic network topologies are star, ring, and bus. These basic topologies can be combined in a variety of ways to build complex hybrid network topologies.

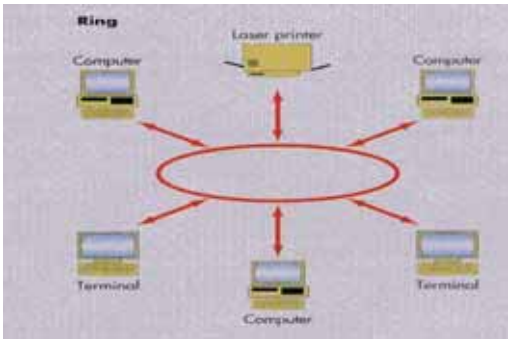
The decision on the best network structure required for an organization depends on its budgetary restrictions, types of resources to be connected and the productivity needs.

Star Topology

In a star network all computers and other communications devices are connected to a central point such as a hub, file server or a host computer.



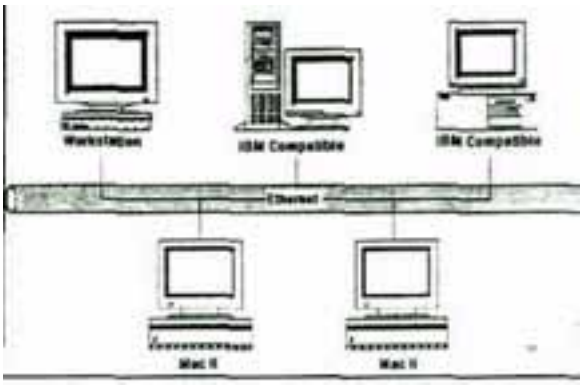
Ring Topology

In a 

ring network all communications devices are connected in a continuous ring. Messages are passed around the ring until they reach the right destination.

Bus Topology

In a bus network communications devices are connected to a common channel. There is no central computer and the communications devices transmit messages to the other devices.



iv. Communication Media

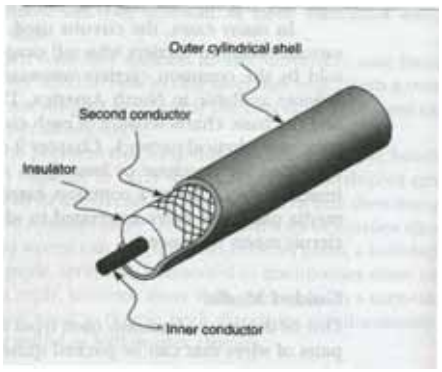
The communication media is the matter or substance that carries the voice or data. Many different types of transmission media are currently in use. All these different media types can be grouped into two categories: guided media and radiated media. The Guided media are those in which the data flows through physical media and the radiated media are those in which the data are broadcast through the air.

Guided Media

- Twisted-pair wire

A twisted-pair wire consists of two insulated copper wires, twisted around each other and covered in another layer of plastic insulation

- Coaxial cable



A Coaxial cable consists of insulated copper wire wrapped in a metal shield, which is then wrapped in an outer external cover. Often many coaxial cables are bundled together.

- Fiber-Optical Cable: consists of hundreds of thin glass wires that transmit pulsation beams of light.

Radiated Media

- Radio Transmission: Radio transmission use the same basic principle as standard radio transmission. When using radio transmission each device/computer on the network should be equipped with a radio transmitter/receiver on a specific frequency that does not interfere with commercial radio stations. The transmitters are very low power and are designed typically to transmit a signal to a very short distance, typically up to 500 feet.
- Infrared Transmission: Infrared transmission uses low-frequency light waves, below the visible spectrum, to transmit data through the air. Infrared transmitters are seldom used to transmit data to and from portable or handheld computers.
- Microwave Transmission: Microwave is a high-frequency beam with short wave length. Microwave can be transmitted over a direct line-of-sight path between any two points. This transmission medium is typically used for long-distance data/voice transmission.
- Satellite Transmission: In satellite transmission, singles are transmitted to a satellite 500 to 22,000 miles is space. One disadvantage of satellite transmission is the delay that occurs in transmission, which is known as the propagation delay.

Data Transmission Types

In a network data can be transmitted in two different ways, **serial transmission** and in **parallel transmission**.

Serial Data Transmission: Bits are transmitted sequentially, one after the other.

Parallel Data Transmission: Bits are transmitted through separate channels simultaneously.

The standard unit of measure used to specify the speed of the data flow through a network is bits per second (bps).

Network Interface Card (NIC)

A network Interface Card provides the physical connection between the computer and a network cable and enables access to a network. Most modern computers come with NIC cards pre-installed, and ready to be connected to networks.

TYPES OF NETWORKS

The three basic types of networks include: LAN, MAN and WAN.

Local Area Network (LAN)

A network is said to be Local Area Network (LAN) if it is confined relatively to a small area. It is generally limited to a building or a geographical area, expanding not more than a mile apart to other computers.

LAN configuration consist of:

- **A file server** - stores all of the software that controls the network, as well as the software that can be shared by the computers attached to the network.

- **A workstation** - computers connected to the file server (Mac or PCs). These are less powerful than the file server

- **Cables** - used to connect the network interface cards in each computer.

Metropolitan Area Network (MAN)

Metropolitan Area Network (MAN) covers larger geographic areas, such as cities. Often used by local libraries and government agencies often to connect to citizens and private industries.

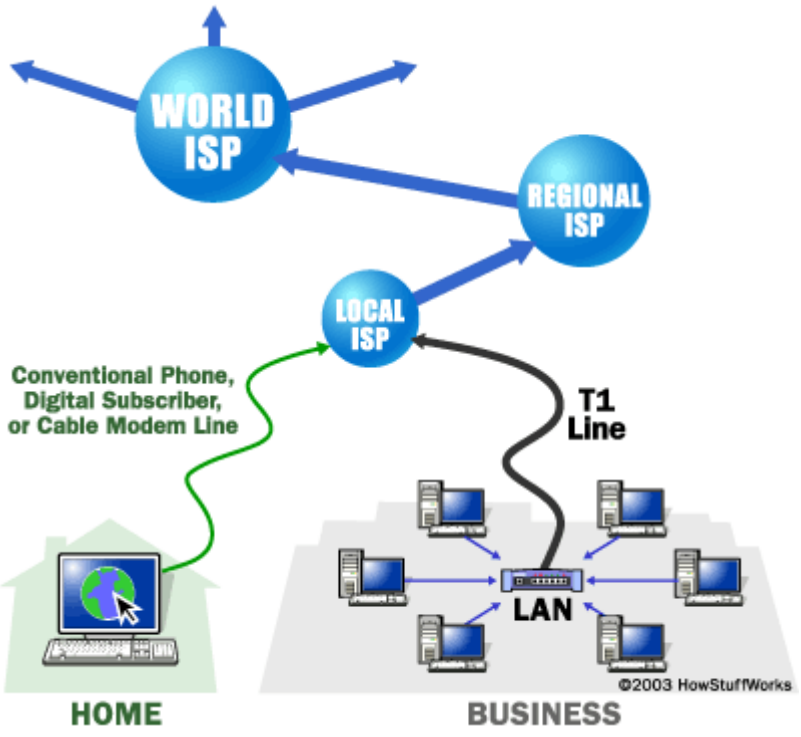
Wide Area Network (WAN)

Wide Area Networks (WANs) connect larger geographic areas, such as London, the UK, or the world. In this type of network dedicated transoceanic cabling or satellite uplinks may be used.

Internet

The Internet is a network of autonomous computer networks that spans the globe. It provides an infrastructure for global electronic information exchange. Today the Internet is used by millions of people to facilitate various activities such as business, education and plain communication. The Internet grew out of a United States Department of Defense project, the ARPANET (Advanced Research Project Agency Network) started in late 1960s. Its main objective was to provide network links between universities, research organizations and remote computer centers.

No person, government or an entity owns or controls the Internet. Instead, a nongovernmental international volunteer organization called the Internet Society (ISOC) controls the standards and the future of the Internet. The following figure shows how the Internet is structured. At the bottom level are the organizations and home users connected to the Internet. Typically users connect to the Internet through local Internet Service Providers (ISPs). The ISPs are in turn connected to



the Internet Backbone through regional networks. Typically ISPs lease high-bandwidth lines that connect into the Internet and rent that bandwidth to Internet users.

ISP's Computer

Typically a home user (client) connects to the Internet via telephone lines. If the telephone network is analog a **modem** is needed in between the computer and the telephone line to convert digital signals generated by the computer to analog signals that are being transmitted by the telephone network. When a client registers with an ISP for Internet usage he will get an account. To access the Internet by using this account, the client has to dial the ISP and log on to this account. Once logged on, he can access the Internet.

On the Internet information is available mainly through three mediums: the World Wide Web (WWW), Usenet News (News) and Electronic Mail (e-mail). The WWW is built on top of the Internet. It can be viewed as a large notice board with posters and printed notices stuck to it. On the WWW Web servers provide information on the Internet. A user can access the information provided by web browsers by using a web browser.

***Types of resource available on the Internet*.**
Different types of resources are available on the Internet. Some of the common types of information available on the Internet are:

- Different types of information such as text, sounds, pictures, and short movie clips.
- Information at all levels -- storybooks and games for children, university course materials, business information, fine art, and lots of things that are just plain fun.
- Actual business information -- including electronic shopping malls.
- Games that you can play alone or with other people all over the world. Programs to help you find the information that you want.

v. Internet Browsers

The information in the WWW is viewed using a **Browser** such as Netscape Navigator or Microsoft Internet Explorer. A browser will provide several means of navigating or finding your way around the WWW. It will also provide the means of displaying various resources found on the Internet, from **HTML** hypertext web pages to pictures, sounds and movies. Often the browser requires helper or plug-in programs to display a particular type of resource, such as QuickTime and Shockwave.

Microsoft Internet Explorer

- The window above can be resized and moved by dragging the edge of the window. Note that the contents re-arrange themselves to fit the new window size.
- At the top of the window is a toolbar of useful shortcuts such as go back a page, go home, reload a page, print a page or stop loading a page. All of these commands and other less common ones are also available in the **menus.**

- Below the toolbar is the address bar telling you where this page is stored, which will be explained in the section on **URLs.**
- Scroll bars let you move up and down a page if it will not all fit on the screen at once.
- The status indicator in the upper right corner animates to show when a transfer is in progress. If the icon is changing, then the system is trying to get something for you -- just be patient.
- The status message field (along the very bottom of the window) shows you information about a targeted page or a transfer in progress.
- The progress bar (behind the status message field) fills with colours as a file is being transferred. This helps you to tell how much longer you have to wait before you get the entire file.

Unit two

Data Representation and Internal Operations of the Computer

2.1 Introduction to Number Systems

Background and history

Man's earliest number or counting system was probably developed to help determine how many possessions a person had. As daily activities became more and more complex, numbers became more important in trade, time, distance, and all other phases of human life. As you have seen already, numbers are extremely important in your personal life. You realize that you need more than your fingers and toes to keep track of the numbers in your daily routine. Ever since people discovered that it was necessary to count objects, they have been looking for easier ways to count them. The abacus, developed by the Chinese, is one of the earliest known calculators. It is still in use in some parts of the world. Blaise Pascal (French) invented the first adding machine in 1642. Twenty years later, an Englishman, Sir Samuel Moreland, developed a more compact device that could multiply, add, and subtract. About 1672, Gottfried Wilhelm von Leibniz (German) perfected a machine that could perform all the basic operations (add, subtract, multiply, divide), as well as extract the square root. Modern electronic digital computers still use von Liebniz's principles.

What is a Number System?

Unit and Number

The terms unit and number when used with the decimal system are almost self-explanatory by definition. The unit is a single object; that is, an apple, a dollar, a day. A number is a symbol representing a unit or a quantity. The figures 0, 1, 2, and 3 through 9 are the symbols used in the decimal system. These symbols are called Arabic numerals or figures. Other symbols may be used for different number systems. For example, the symbols used with the Roman numeral system are letters. V is the symbol for 5, X for 10, M for 1,000, and so forth.

A number is a symbol showing position in a series and a concept of quantity

A number system is a definite set of symbols (digits), which can be used to represent any value.

This can further be used to do mathematical operations and various other functions related to the values they represent.

Functions of number systems;

- Representing values
- Counting
- Performing calculations
- Comparing amounts
- Determining order.

There are two types of number systems

1. Non-positional number systems

   Eg. Roman number systems (I, V, X, C, L, D) – Values are represented basically on the symbol

2. Positional number systems

Eg. Hindu –Arabic number system(0, 1, 2, 3, 4, 5, 6, 7, 8, 9 etc.) – Values are mainly represented on the place value of the symbols For example, the number 123 has a very different value from the number 321, although the same digits are used in both numbers.

The study of number systems is not just limited to computers. We apply numbers every day, and knowing how numbers work will give us an insight into how a computer manipulates and stores numbers.

Inside the computer all the information is handled through two distinct values, ie.0 and 1. It may be an electronic semiconductor, Magnetic material, Optical device or anything which can have two distinct states can be used to represent data in the computer. This state of being active or inactive, positive or negative, is generally called binary state. In digital data transmission also this *binary* nature is applied.

Symbolic and place value

. •Weighting Factor

The weighting factor is the multiplier value applied to each column position of the number. For instance, decimal has a weighting factor of TEN, in that each column to the left indicates a multiplication value increase of 10 over the previous column on the right, i.e.; as each column moves to the left, there is an increase by a multiple factor of 10.

$$312 = 300 + 10 + 2$$
$$= 3 * 100 + 1 * 10 + 2 * 1$$
$$= 3 * 10^2 + 1 * 10^1 + 2 * 10^0$$

Weighting factors

•Base Values

The base value of a number system is the number of different values the set has before repeating itself. For example, decimal has a base of ten values, 0 to 9.

•Binary = 2 (0, 1)

•Octal = 8 (0 - 7)

•Decimal = 10 (0 - 9)
•Hexadecimal = 16 (0 - 9, A-F)
Suppose the base of the number system is n. Then the number of Digits or symbols of that number system = n , from 0 to n-1.

- Abacus was the first device which denoted and did operations using numbers.

2.1.1 Decimal, Binary, Octal, Hexadecimal Number Systems

Decimal Number system

•This number system uses TEN different symbols to represent values(0-9). The set of values used in decimal are;

0 1 2 3 4 5 6 7 8 9

When representing large values and doing calculations, if the highest digit (9) is exceeded, a carry over which is transferred to the next column (to the left) occurs.
Lets 17+4

17
18 +1
19 +2
20 +3
21 +4

When 9 is exceeded, we go back to the beginning of the set (0), and carry a value of 1 over to the next column on the left Each place is raised to the power of 10.

eg. **3 8 2 0 6_{10}**

= **10^4X3 10^3X8 + 10^2 X2 + 10^1 X 0 + 10^0 X 6**

= **30000 + 8000 + 200 + 00 + 6**

= **38206_{10}**

Binary Number system

A number system with only two digits, i.e. 0 and 1. We can use these two symbols to represent any value.

Decimal notation	**Binary notation**
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
11	1011
12	1100
.	
.	
.	
31	11111
32	100000 etc.

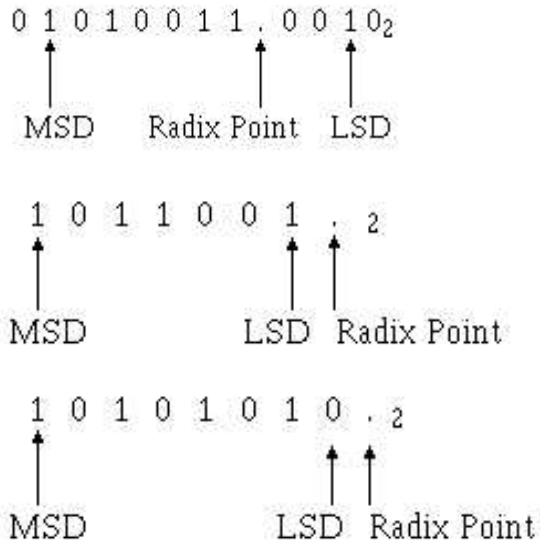
Calculation of the value of a Binary number

1		0		1		1_2	
2^3	x1 +	2^2	x0 +	2^1	x1 +	2^0	
8x1	+	4x0		2x1		1x1	
8	+	0	+	2	+	1	= 11

$1011_2 = 11_{10}$

Most Significant Digit(MSD) and Least Significant Digit(LSD)

The first nonzero digit you encounter is the MSD, and the last nonzero digit is the LSD. If the number is a whole number, then the first digit to the left of the radix point is the LSD.



Octal number system

•The octal number system uses EIGHT digits to represent numbers. The 8 distinct digits are,

0 1 2 3 4 5 6 7

•With 0 having the least value and 7 having the greatest value

•Columns are used in the same way as in the decimal system, in that the left most column is used to represent the greatest value

•Octal numbers are represented with a suffix 8

•Each column represents a power of 8,

Eg. $176_8 = 1 * 8^2 + 7 * 8^1 + 6 * 8^0$

$= (1 * 64) + (7 * 8) + (6 * 1)$

$= 64 + 56 + 6$

$= 126_{10}$

Hexadecimal number system

•The hexadecimal number system uses SIXTEEN values to represent Numbers. The 16 distinct values are, 0 1 2 3 4 5 6 7 8 9 A B C D E F, where A = 10, B = 11, .., F = 15

•With '0' having the least value and 'F' having the greatest value.

•Hexadecimal numbers are represented with the suffix 16.
•Each column represents a power of 16,

$176_{16} = (1 * 16^2) + (7 * 16^1) + (6 * 16^0)$
$= (1 * 256) + (7 * 16) + (6 * 1)$
$= 256 + 112 + 6$
$= 374_{10}$

2.1.2 Conversions between number systems

Decimal into binary conversion

- Divide the decimal number as far as possible (until you get 1 as quotient)
- Write the remainders starting from the bottom

25_{10} = 2 | 25
2 | 12 - 1
2 | 6 - 0
2 | 3 - 0
1 - 1

$25_{10} = 1\ 1\ 0\ 0\ 1_2$

Binary into Decimal - conversion

The place values have to be multiplied by the digit(either 0 or 1) and the results added.

1	0	0	1	1	The binary number
2^4	2^3	2^2	2^1	2^0	Place values

As such the binary number 10011 represents the value

(1 * 2^4) + (0 * 2^3) + (0 * 2^2) + (1 * 2^1) + (1 * 2^0)

= 16 + 0 + 0 + 2 + 1

= 19

$1\ 1\ 0\ 1\ 1_{\ 2}$ (binary)
$2^4+2^3+0+2^1+2^0 = 16+8+0+2+1$
$= 27_{10}$ (decimal)

and

$1\ 0\ 1\ 1\ 0\ 1\ 0\ 1_{\ 2}$ (binary)
$2^7+0+2^5+2^4+0+2^2+0+2^0 = 128+0+32+16+0+4+0+1$
$= 181_{10}$ (decimal)

Decimal to Octal - Conversion

Repeated Division by 8

177/8 = 22+ remainder of 1 1 (Least Significant Bit)

22/ 8 = 2 + remainder of 6 6

2 / 8 = 0 + remainder of 2 2 (Most Significant Bit)

Result $177_{10} = 261_8$

Octal to Decimal - Conversion

eg. $24.6_8 = 2 \times (8^1) + 4 \times (8^0) + 6 \times (8^{-1}) = 20.75_{10}$

Binary-To-Octal / Octal-To-Binary Conversion

Octal Digit	0	1	2	3	4	5	6	7
Binary Equivalent	000	001	010	011	100	101	110	111

Each Octal digit is represented by three bits or binary digits.

eg. $100\ 111\ 010_2 = (100)\ (111)\ (010)_2 = 4\ 7\ 2_8$

Hexadecimal to Decimal Conversion

The hexadecimal system uses base 16. Thus, it has 16 possible digit symbols. It uses the digits 0 through 9 plus the letters A, B, C, D, E, and F as the 16 digit symbols.

16^3	16^2	16^1	16^0		16^{-1}	16^{-2}	16^{-3}
=4096	=256	=16	=1	.	=1/16	=1/256	=1/4096
Most **S**ignificant **D**igit				Hexadec. point			**L**east **S**ignificant **D**igit

eg. $2AF_{16} = 2 \times (16^2) + 10 \times (16^1) + 15 \times (16^0) = 687_{10}$

Convert decimal to hexadecimal

Repeat Division

This method uses repeated division by 16. Eg. convert 378_{10} to hexadecimal and binary:

378/16	= 23+ remainder of 10	A (Least Significant Bit)
23/ 16	= 1 + remainder of 7	7
1 / 16	= 0 + remainder of 1	1 (Most Significant Bit)
Result	378_{10} =	17A
		= $0001\ 0111\ 1010_2$
	Convert to Binary	= 0000 0001 0111 1010 (16 bits)

Binary-To-Hexadecimal /Hexadecimal-To-Binary Conversion

To convert a binary number into the hexadecimal equivalent;

1. First, group the bit string into four digits
2. Then, write the equivalent decimal value for each four digit set
3. If the number is greater than 9, assign A to F (from 10 to 15)

Each Hexadecimal digit is represented by **four** bits of binary digit.

eg. $1011\ 0010\ 1111_2 = (1011)\ (0010)\ (1111)_2 = B\ 2\ F_{16}$

A hexadecimal number can be written in binary numbers directly. Write in four digit groups.

$A408F_{16}$

A = 10 = 1010 4= 0100 0= 0000 8= 1000
F=15=1111

So; $A408F_{16} = 1010010000000011111_2$

Hexadecimal Digit	0	1	2	3	4	5	6	7
Binary Equivalent	0000	0001	0010	0011	0100	0101	0110	0111

Hexadecimal Digit	8	9	A	B	C	D	E	F
Binary Equivalent	1000	1001	1010	1011	1100	1101	1110	1111

Questions:

What is a number? 1). A quantity of objects 2).A counting system based on symbols 3).The decimal system 4). A symbol representing a unit or a quantity

A number system uses the symbols 0 through 4. What is its base?

1). 6 2). 5 3). 3 4). 4

Which of the following symbols is NOT an Arabic figure?

1). C 2). 2 3). 7 4). 9

To which power of ten the 1 in 1572_{10} is equal to?

1). 10^1 2). 10^2 3). 10^3 4). 10^4

2.2 Data Representation

2.2.1 Bites and Bytes

As you know, the fundamental unit of data within a computer system is a BInary digit, or BIT. A bit is the smallest element of information used by a computer. A bit holds ONE of TWO possible values,

Value	Meaning
0	OFF
1	ON

A bit which is OFF is also considered to be FALSE or NOT SET; a bit which is ON is also considered to be TRUE or SET.

Because a single bit can only store two values, bits are combined together into large units in order to hold a greater range of values

Other terms connected to bits are:-

BYTE - which is a group of eight bits.
KILOBYTE - which is 1024 bytes.
MEGABYTE - which is 1024 kilobytes.
GIGABYTE - which is 1024 megabytes
TERABYTE - - which is 1024 gigabytes etc.

Because the computer is a binary machine, all the information it deals with directly must be stored and represented as binary. This in turn is represented electronically, at the hardware level, as high and low voltages - a high for a binary 1 and a low for a binary 0.

When data are stored in a binary machine it may be stored **serially** - as on the tracks of a disk, or it may be stored in a **parallel** fashion - as in the main memory of the computer.

When data are stored serially it is usually much slower to access, but is more efficient in terms of cost. Conversely, when it is stored parallel, it is accessed faster, but uses devices which generally cost much. Additionally, because parallel access requires a greater number of signal paths, the devices use more resources anyway.

Data come in many different forms:- numbers, alphanumeric characters (letters, numbers, and punctuation marks), control codes, communication codes and so on, all of which may be represented in binary.

If, for example, we take the binary value:- 01100011, which is a single byte of data, then this may be used to represent various different things to a computer system

depending upon whether the machine is currently processing numbers, instructions or alphanumeric characters.

The machine is **programmed internally** to know the difference between the various data types at the moment of processing.

In our example above, the binary value could be used either to represent the binary equivalent of 99, or it could be used to represent the character ‘c’ in ASCII.

ASCII stands for American Standard Code for Information Interchange, and is the accepted standard for representing alphanumeric data. That is, each letter, number and punctuation mark has an ASCII code, and this is “understood” by input/output devices like the screen and keyboard which are connected to our computer systems.

2.2.2 ASCII and BCD

ASCII (American Standard Code for Information Interchange)

American Standard Code for Information Interchange. Usually refers to the coding system that assigns numerical values to characters such as letters, numbers, punctuation marks, and other symbols. Basic ASCII allows only 7 bits per character (for a total of 128 characters). The first 32 characters are "unprintable" (line feed, form feed, etc.). Extended ASCII adds an additional 128 characters that vary between computers, programs and fonts

ASCII Table (7-bit)

(ASCII = American Standard Code for Information Interchange)

Decimal	Octal	Hex	Binary	Value
000	000	000	00000000	NUL (Null char.)
001	001	001	00000001	SOH (Start of Header)
002	002	002	00000010	STX (Start of Text)
003	003	003	00000011	ETX (End of Text)
004	004	004	00000100	EOT (End of Transmission)
005	005	005	00000101	ENQ (Enquiry)
006	006	006	00000110	ACK (Acknowledgment)
007	007	007	00000111	BEL (Bell)
008	010	008	00001000	BS (Backspace)
009	011	009	00001001	HT (Horizontal Tab)
010	012	00A	00001010	LF (Line Feed)
011	013	00B	00001011	VT (Vertical Tab)
012	014	00C	00001100	FF (Form Feed)
013	015	00D	00001101	CR (Carriage Return)
014	016	00E	00001110	SO (Shift Out)
015	017	00F	00001111	SI (Shift In)
016	020	010	00010000	DLE (Data Link Escape)
017	021	011	00010001	DC1 (XON) (Device Control 1)
018	022	012	00010010	DC2 (Device Control 2)

019	023	013	00010011	DC3 (XOFF)(Device Control 3)
020	024	014	00010100	DC4 (Device Control 4)
021	025	015	00010101	NAK (Negative Acknowledgement)
022	026	016	00010110	SYN (Synchronous Idle)
023	027	017	00010111	ETB (End of Trans. Block)
024	030	018	00011000	CAN (Cancel)
025	031	019	00011001	EM (End of Medium)
026	032	01A	00011010	SUB (Substitute)
027	033	01B	00011011	ESC (Escape)
028	034	01C	00011100	FS (File Separator)
029	035	01D	00011101	GS (Group Separator)
030	036	01E	00011110	RS (Request to Send)(Record Separator)
031	037	01F	00011111	US (Unit Separator)
032	040	020	00100000	SP (Space)
033	041	021	00100001	! (exclamation mark)
034	042	022	00100010	" (double quote)
035	043	023	00100011	# (number sign)
036	044	024	00100100	$ (dollar sign)
037	045	025	00100101	% (percent)
038	046	026	00100110	& (ampersand)
039	047	027	00100111	' (single quote)
040	050	028	00101000	((left/opening parenthesis)
041	051	029	00101001	) (right/closing parenthesis)
042	052	02A	00101010	* (asterisk)
043	053	02B	00101011	+ (plus)
044	054	02C	00101100	, (comma)
045	055	02D	00101101	- (minus or dash)
046	056	02E	00101110	. (dot)
047	057	02F	00101111	/ (forward slash)
048	060	030	00110000	0
049	061	031	00110001	1
050	062	032	00110010	2
051	063	033	00110011	3
052	064	034	00110100	4
053	065	035	00110101	5
054	066	036	00110110	6
055	067	037	00110111	7
056	070	038	00111000	8
057	071	039	00111001	9
058	072	03A	00111010	: (colon)
059	073	03B	00111011	; (semi-colon)
060	074	03C	00111100	< (less than)
061	075	03D	00111101	= (equal sign)
062	076	03E	00111110	> (greater than)
063	077	03F	00111111	? (question mark)
064	100	040	01000000	@ (AT symbol)
065	101	041	01000001	A
066	102	042	01000010	B
067	103	043	01000011	C
068	104	044	01000100	D
069	105	045	01000101	E
070	106	046	01000110	F
071	107	047	01000111	G
072	110	048	01001000	H
073	111	049	01001001	I
074	112	04A	01001010	J
075	113	04B	01001011	K
076	114	04C	01001100	L

077	115	04D	01001101	M	
078	116	04E	01001110	N	
079	117	04F	01001111	O	
080	120	050	01010000	P	
081	121	051	01010001	Q	
082	122	052	01010010	R	
083	123	053	01010011	S	
084	124	054	01010100	T	
085	125	055	01010101	U	
086	126	056	01010110	V	
087	127	057	01010111	W	
088	130	058	01011000	X	
089	131	059	01011001	Y	
090	132	05A	01011010	Z	
091	133	05B	01011011	[	(left/opening bracket)
092	134	05C	01011100	\	(back slash)
093	135	05D	01011101	]	(right/closing bracket)
094	136	05E	01011110	^	(caret/cirumflex)
095	137	05F	01011111	_	(underscore)
096	140	060	01100000	`	
097	141	061	01100001	a	
098	142	062	01100010	b	
099	143	063	01100011	c	
100	144	064	01100100	d	
101	145	065	01100101	e	
102	146	066	01100110	f	
103	147	067	01100111	g	
104	150	068	01101000	h	
105	151	069	01101001	i	
106	152	06A	01101010	j	
107	153	06B	01101011	k	
108	154	06C	01101100	l	
109	155	06D	01101101	m	
110	156	06E	01101110	n	
111	157	06F	01101111	o	
112	160	070	01110000	p	
113	161	071	01110001	q	
114	162	072	01110010	r	
115	163	073	01110011	s	
116	164	074	01110100	t	
117	165	075	01110101	u	
118	166	076	01110110	v	
119	167	077	01110111	w	
120	170	078	01111000	x	
121	171	079	01111001	y	
122	172	07A	01111010	z	
123	173	07B	01111011	{	(left/opening brace)
124	174	07C	01111100	|	(vertical bar)
125	175	07D	01111101	}	(right/closing brace)
126	176	07E	01111110	~	(tilde)
127	177	07F	01111111	DEL	(delete)

BCD (Binary Coded Decimal) Number System

You should now be familiar with the Binary, Decimal and Hexadecimal Number System. If we view single digit values for hex, the numbers 0 - F, they represent the values 0 - 15 in decimal, and occupy a nibble. Often, we wish to use a binary equivalent of the decimal system. This system is called Binary Coded Decimal or BCD which also occupies a nibble. In BCD, the binary patterns 1010 through 1111 do not represent valid BCD numbers, and cannot be used.

Conversion from Decimal to BCD is straightforward. You merely assign each digit of the decimal number to a byte and convert 0 through 9 to 0000 0000 through 0000 1001, but you cannot perform repeated division by 2 as you did to convert decimal to binary.

Let us see how this works. Determine the BCD value for the decimal number 5,319. Since there are four digits in our decimal number, there are four bytes in our BCD number. They are:

Thousands	**Hundreds**	**Tens**	**Units**
5	**3**	**1**	**9**
0 0 0 0 0 1 0 1	**0 0 0 0 0 0 1 1**	**0 0 0 0 0 0 0 1**	**0 0 0 0 1 0 0 1**

Since computer storage requires a minimum of 1 byte, you can see that the upper nibble of each BCD number is wasted storage. BCD is still a weighted position number system so that you may perform mathematics, but we must use special techniques in order to obtain a correct answer.

2.3 Logic gates and circuits

2.3.1 Logic Gates

A logic gate is an arrangement of switches used to calculate operations in Boolean algebra. It is an elementary building block in a digital circuit. Most logic gates have two inputs and one output. At any given moment, every terminal is in one of the two binary conditions low (0) or high (1), represented by different voltage levels. The logic state of a terminal can, and generally does, change often, as the circuit processes data.

In most logic gates, the low state is approximately zero volts (0 V), while the high state is approximately five volts positive (+5 V).

Computers operate on the principle of logic and use the **TRUE** and **FALSE** logic conditions of a logical statement to make a programmed decision. The conditions of a statement can be represented by symbols or variables.

In computers, electronic circuits operating in two LOGIC STATES represent these two conditions. These logic states are 0 (zero) and 1 (one). 0 and 1 represent the FALSE and TRUE conditions of a statement, respectively.

There are five basic logic gates: AND, OR, NOT, NAND and NOR.

2.3.1.1 The AND gate

The AND gate has two or more inputs. The output from the AND gate is 1 if and only if all of the inputs are 1, otherwise the output from the gate is 0. The AND gate is drawn as follows

The output from the AND gate is written $A \cdot B$.

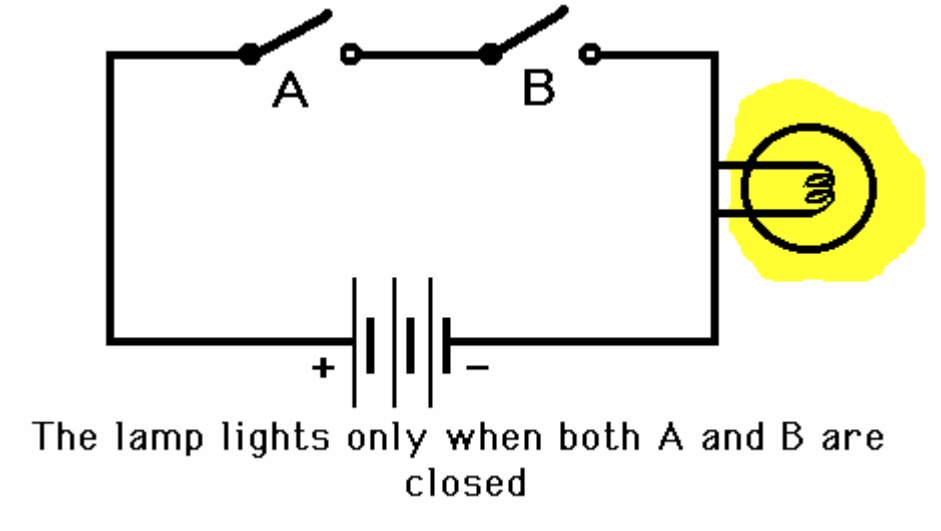
Truth table

A table that defines a logic circuit by listing all combinations of input values, and indicating the true output values for each combination.

The truth table for a two-input AND gate looks like

A	B	A·B
0	0	0
0	1	0
1	0	0
1	1	1

It is also possible to represent an AND gate with a simple analogue circuit, where a bulb is lit when A and B are closed.



The lamp lights only when both A and B are closed

2.3.1.2 The OR gate

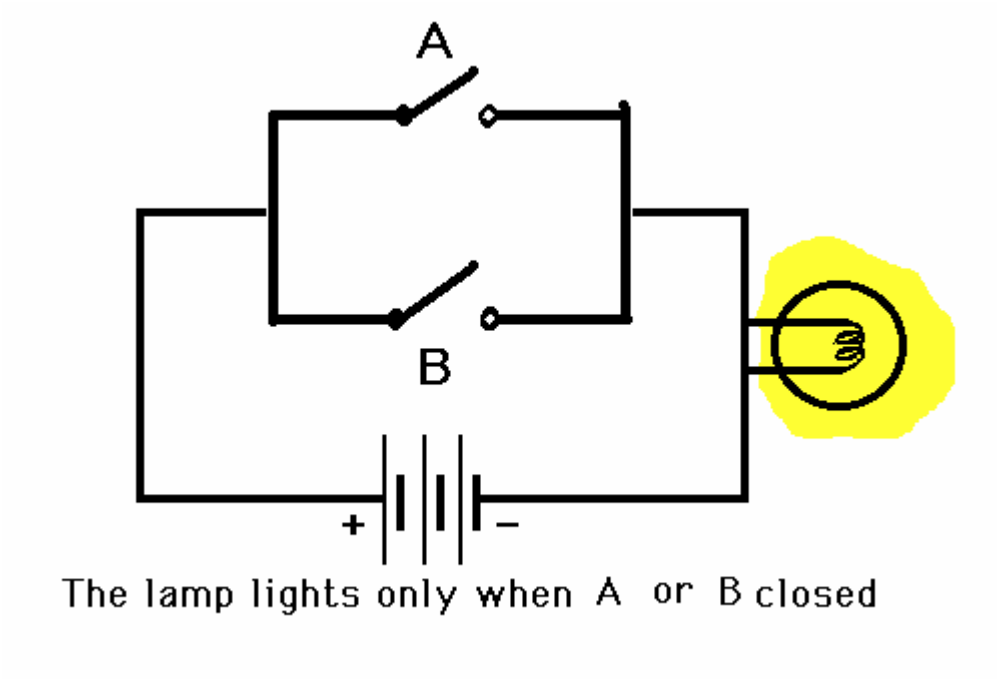
The OR gate has two or more inputs. The output from the OR gate is 1 if any of the inputs is 1. The gate output is 0 if and only if all inputs are 0. The OR gate is drawn as follows

The output from the OR gate is written $A+B$.

The truth table for a two-input OR gate looks like

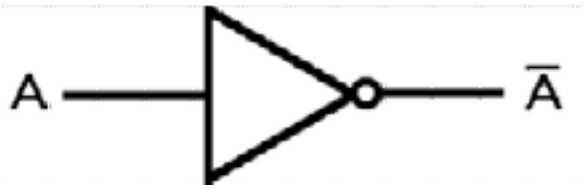
A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

The following diagram represents an OR gate with a simple analogue circuit, where a bulb is lit when A or B is closed.



2.3.1.3 The NOT gate

The NOT gate is unique in that it has only has one input. This is how it looks



The input to the NOT gate A is inverted i.e the binary input state of 0 gives an output of 1 and the binary input state of 1 gives an output of 0.

$\overline{A}$ is known as "NOT A" or alternately, the complement of A.

The truth table for the NOT gate appears as below

A	$\overline{A}$
0	1
1	0

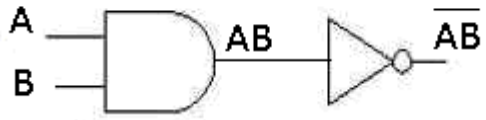
2.3.2 Combination of gates

These three gates are adequate to accomplish all possible logical functions and operations in the microprocessor.

Some combinations of the three basic AND, OR and NOT gates are used so commonly that they have been given names and logic symbols of their own. i.e. NAND, NOR, these gates are constructed using basic AND, OR and NOT gates.

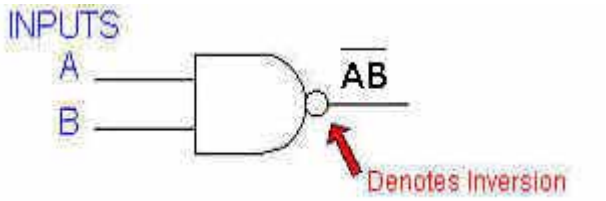
2.3.2.1 The NAND (NOT AND) Gate

A simple circuit consisting of an AND gate in series with an inverter is illustrated below.



.

This simple circuit is referred to as a NAND gate because the output is a NOT AND output. The circuit has its own symbol as illustrated below.



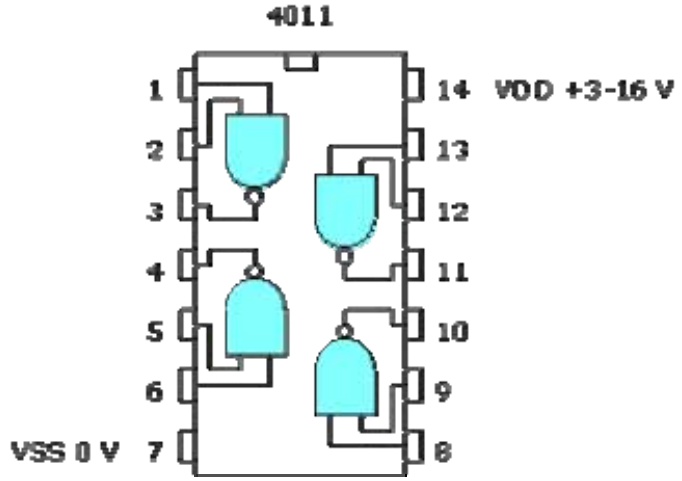
A NAND gate is cheaper to manufacture as a single circuit on a chip compared to the cost of manufacturing an AND gate and a NOT gate using separate circuits on separate chips. In fact microprocessors mostly use NAND gates because of their relatively low cost.

Truth Table for a NAND Gate

A	B	$\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

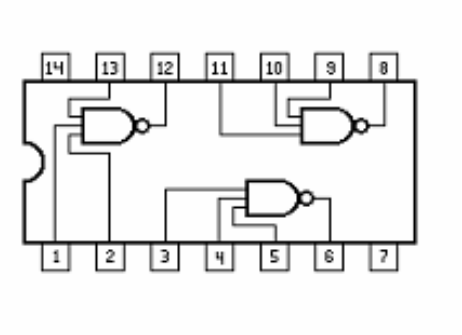
The NAND gate can be considered to have the NOT AND function. The outputs for a NAND gate are the complements or inversions of the corresponding outputs for an AND gate.

As with an AND gate, there is no limit to the number of inputs that may be applied to a NAND function, as such, there is no functional limit to the number of inputs a NAND gate may have. However, for practical reasons, commercial NAND gates are most commonly manufactured with 2, 3, or 4 inputs, to fit in a 14-pin or 16-pin package. In the diagram below, four separate 2 input NAND gates are wired in a chip containing 14 pins.



Note that there is no separate symbol for NAND in Boolean logic. Using symbols, the AND function is designated with a multiplication sign (.), or usually no sign, with an overbar over the entire expression to indicate the NAND function.

For example, using symbols, $\overline{AB}$ can be read as NAND AB, although this is usually read as NOT AB or NOT A AND B.
Here is a 14 pin integrated circuit chip containing three input NAND gates. The truth table for a 3-input NAND gate is also listed below.



14-pin IC chip

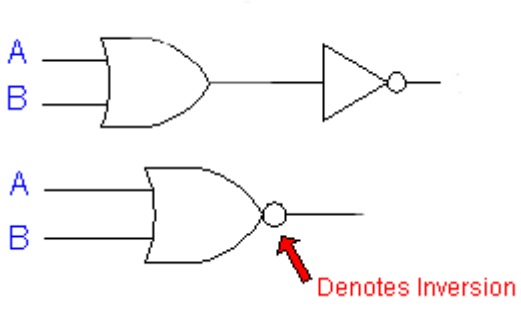
A	B	C	ABC	$\overline{ABC}$
0	0	0	0	1
0	0	1	0	1
0	1	0	0	1
0	1	1	0	1
1	0	0	0	1
1	0	1	0	1
1	1	0	0	1
1	1	1	0	1

The truth table for a 3-input NAND gate for the circuit above.

2.3.2.2 The NOR (NOT OR) Gate

We saw above that an AND gate in series with an inverter [NOT gate] is referred to as a NAND gate.
Similarly, an OR gate in series with an inverter [NOT gate] is referred to as a NOT OR or simply, NOR gate.

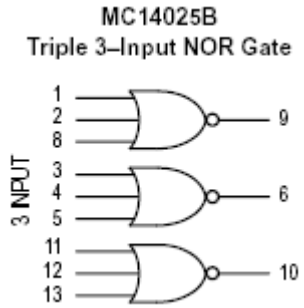
An OR gate in series with an inverter: is called a NOR gate which has its own special symbol:



The NOR gate is an OR gate where the output is inverted. There is no separate Boolean symbol for NOR.
In symbols, the NOR function is designated by a plus sign (+), with an overbar over the entire expression to indicate the inversion. In logical diagrams, the symbol

$\overline{A + B}$ read as NOT A OR B or simply A NOR B which represents the output of a 2-input NOR gate.

A NOR gate can have any number of inputs, but practical commercial NOR gates are mostly limited to 2, 3, and 4 inputs, as with other gates at this level, to fit into standard IC packages.
The Motorola MC14025B 14 pin chip is shown below. This chip contains three 3-input NOR gates. The truth table for each gate has also been completed as shown below.



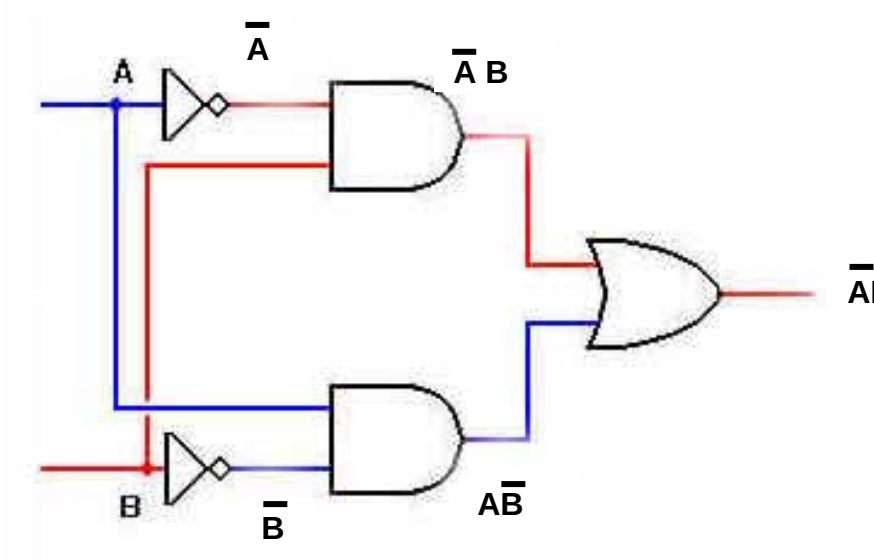
A	B	C	A + B + C	$\overline{A + B + C}$
0	0	0	0	1
0	0	1	1	0
0	1	0	1	0
0	1	1	1	0
1	0	0	1	0
1	0	1	1	0
1	1	0	1	0
1	1	1	1	0

These gates, as with the other derived logic gates, can be formed from a combination of the three basic gates: AND, OR and NOT. However, because of their functional importance, these gates again are treated as basic gates along with their own unique symbols.

Design simple circuits

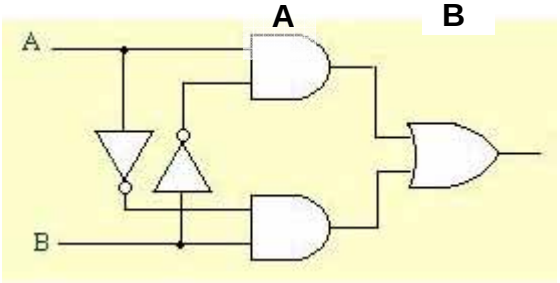
Input		Intermediate Values				Output
A	B					
0	**0**	**1**	**1**	**0**	**0**	**0**
0	**1**	**1**	**0**	**1**	**0**	**1**
1	**0**	**0**	**1**	**0**	**1**	**1**
1	**1**	**0**	**0**	**0**	**0**	**0**

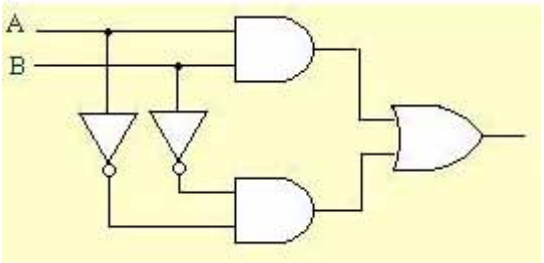
Example



Write the Boolean equation for the following

$\overline{A}$ $\overline{B}$ $\overline{A}$ B $A\overline{B}$ $\overline{A}B+A\overline{B}$





2.4.0 Boolean Algebra

Algebra is branch of mathematics which describes basic arithmetic relations using variables. When numbers are in binary form, the algebra that deals with these is called Boolean Algebra. George Boole the famous mathematician has developed this further.

Normally algebra consists of numbers and a set of basic rules called axioms. An axiom is an initial rule or statement that is accepted as true without proof. Theorems can be derived using axioms.

Boolean arithmetic
Exploration of Boolean algebra by adding numbers together:

0 + 0 = 0
0 + 1 = 1
1 + 0 = 1
1 + 1 = 1

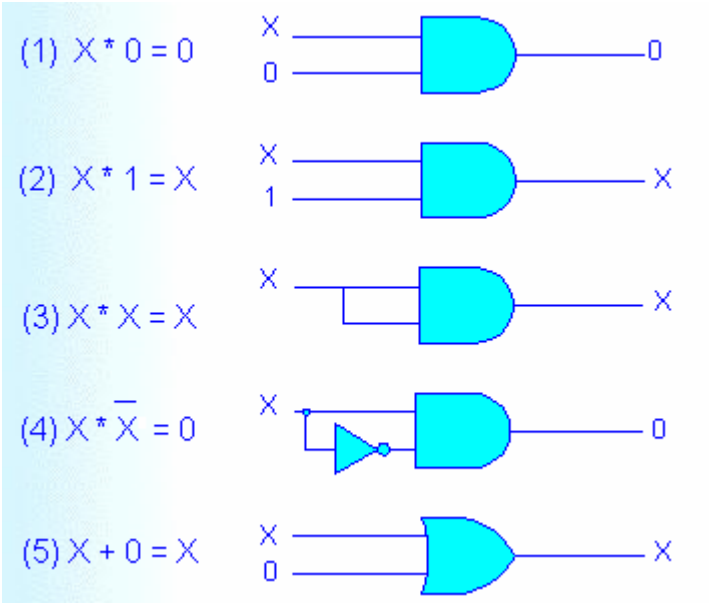
Derive **X + 0 = X**
X + X = X
X + 1 = 1

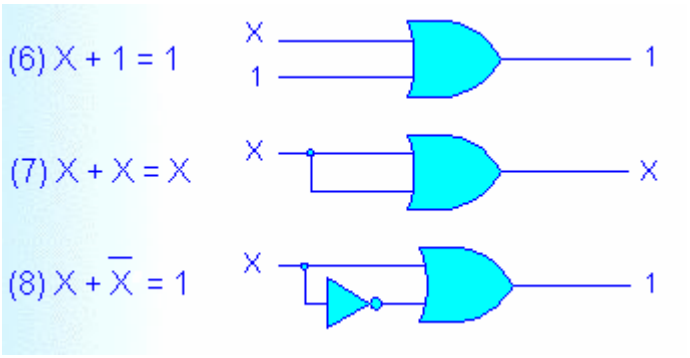
0 × 0 = 0
0 × 1 = 0
1 × 0 = 0
1 × 1 = 1

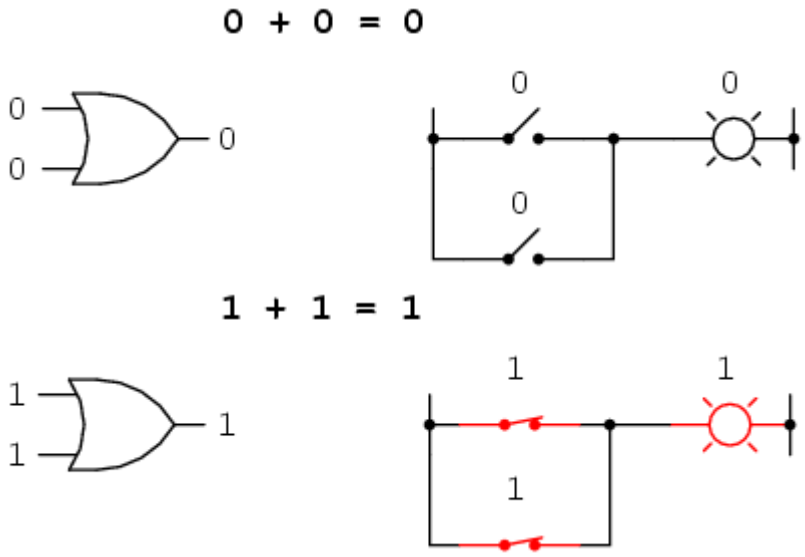
Derive **0 . X = 0**
X . X = X
X . 1 = X

X . X = 0

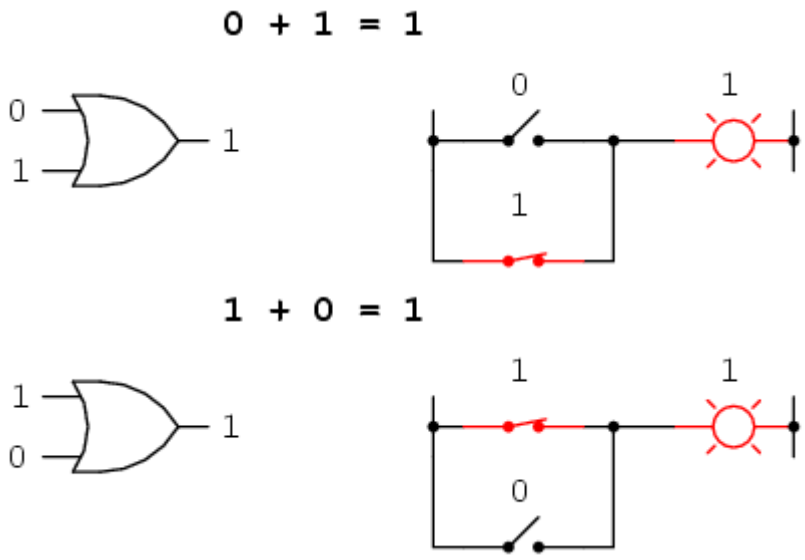
The following diagram shows how axioms are derived.







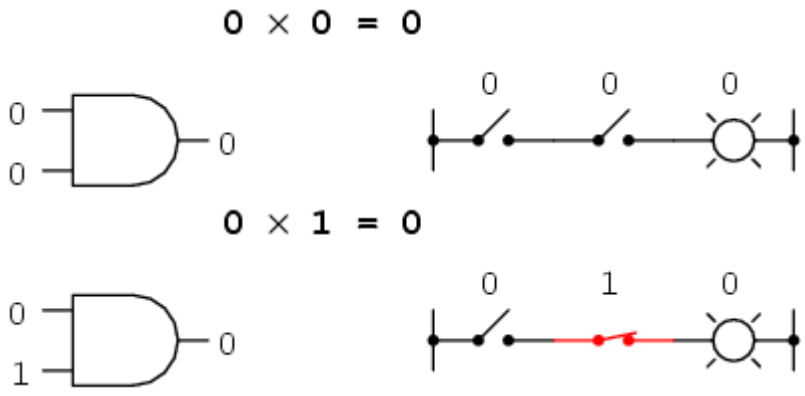
X + X = X, axiom is derived from the two diagrams above



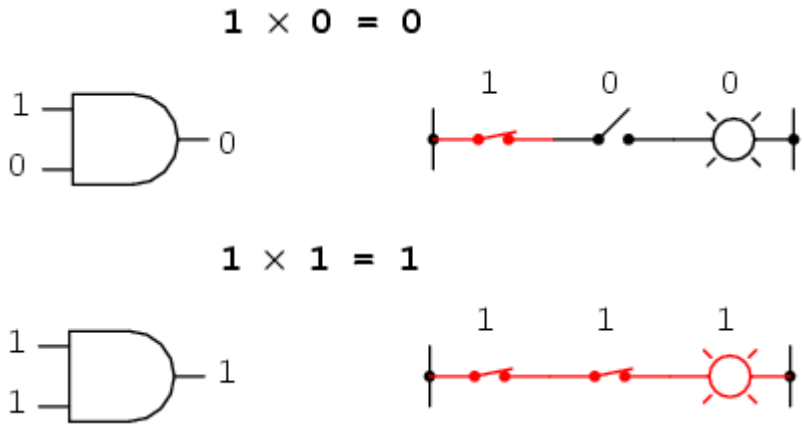
Axiom $\bar{X} + X = 1$ is derived, from the two diagrams above.

Multiplication is valid in Boolean algebra, and fortunately it is the same as in real-number algebra: Anything multiplied by 0 is 0, and anything multiplied by 1 remains unchanged:

This is the same pattern found in the truth table for an AND gate. In other words, Boolean multiplication corresponds to the logical function of an "AND" gate, as well as in switch contacts in series.,



Axiom 0 . X = 0, is derived from the two diagrams above



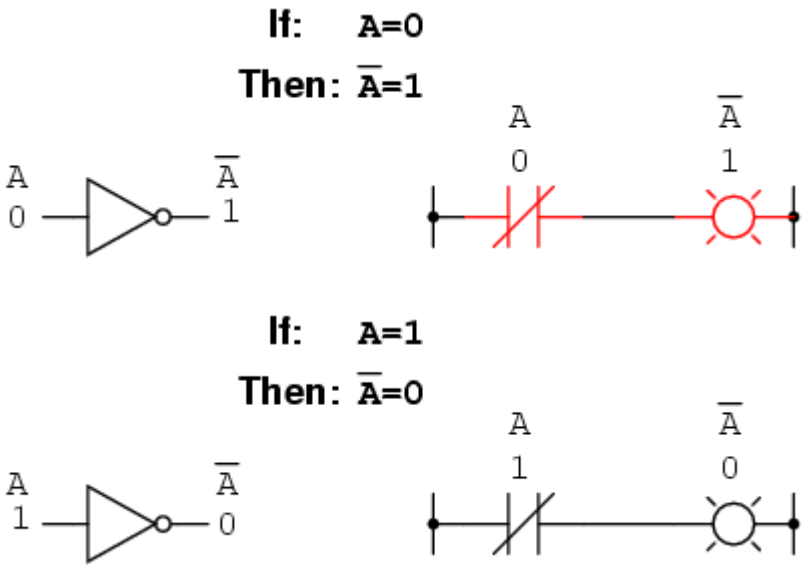
Axiom. 1 . X = X, derived from the two diagrams above.

Boolean algebra uses capital letters to denote variables. A variable is allowed to possess only one of two possible values, either 1 or 0, each and every variable has a complement: Boolean notation uses a bar above the variable character to denote complementation, like this:

If: A=0
Then: $\overline{A}$=1

If: A=1
Then: $\overline{A}$=0

In written form, the complement of "A" is denoted as "A-not" or "A-bar". Sometimes a "prime" symbol is used to represent complementation.



Multivariable Theorems

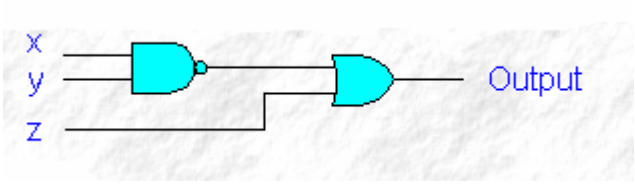
The theorems presented below involve more than one variable:

9. x + y = y + x (commutative law)
10. x * y = y * x (commutative law)
11. x+ (y+z) = (x+y) +z = x+y+z (associative law)
12. x (yz) = (xy) z = xyz (associative law)
13. a. x (y+z) = xy + xz
    b.(w+x)(y+z) = wy + xy + wz + xz
14. x + xy = x
15. x + x'y = x + y

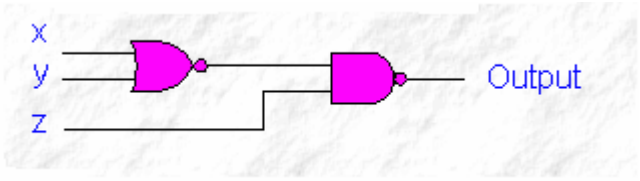
Choose the correct answers in the following questions.

What function are implemented by the following circuits shown below

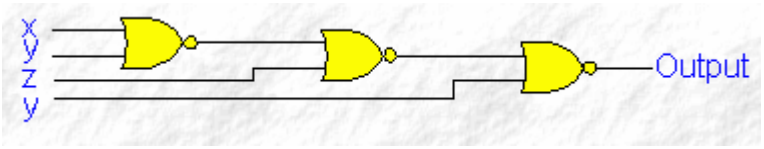
1.



2.



3.



DeMorgan's theorems

DeMorgan's theorems are extremely useful in simplifying expressions in which a product or sum of variables is inverted.

The two theorems are:

(16) (x+y)' = x' * y'

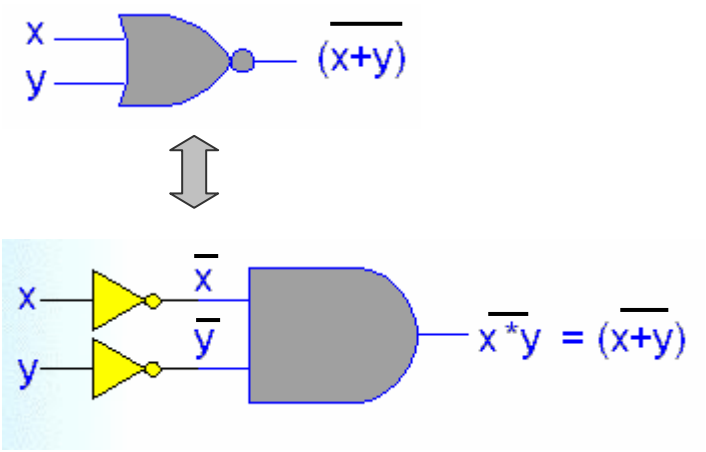
(17) (x*y)' = x' + y'

Theorem (16) says that when the OR sum of two variables is inverted, this is the same as inverting each variable individually and then AND in these inverted variables.

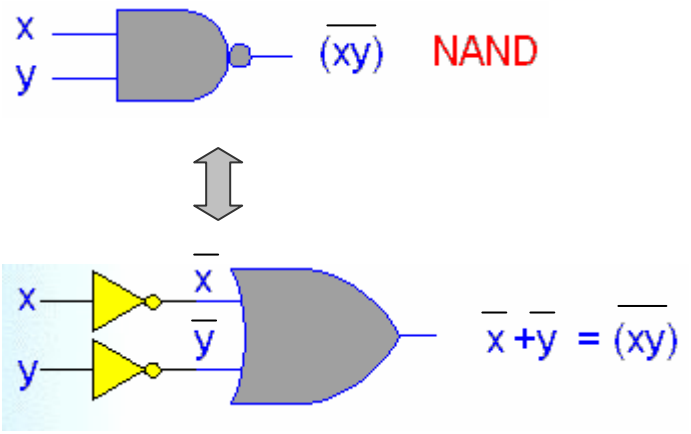
Theorem (17) says that when the AND product of two variables is inverted, this is the same as inverting each variable individually and then OR in them.

Implications of DeMorgan's Theorem

For (16): (x+y)' = x' * y'

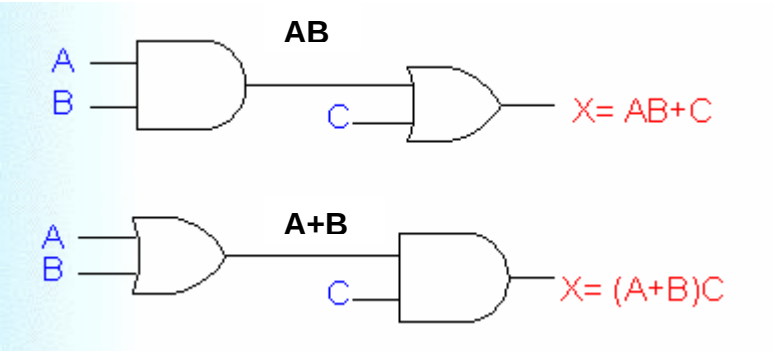


For (17): $\overline{(x*y)} = \overline{x} + \overline{y}$

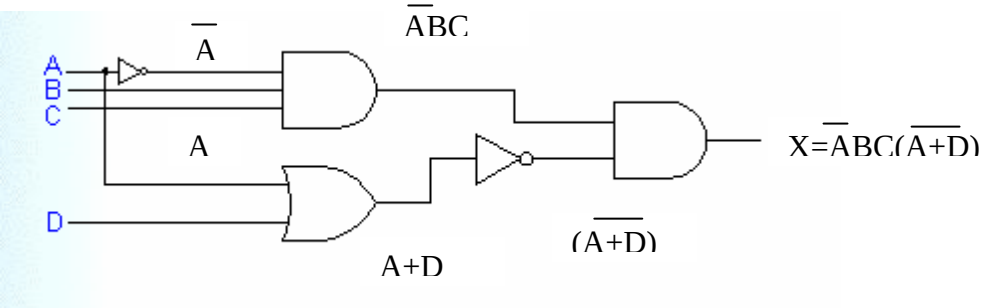


Any logic circuit, no matter how complex, may be completely described using the Boolean operations, because the OR gate, AND gate, and NOT circuit are the basic building blocks in digital systems.

This is an example of a circuit using Boolean expression



Whenever an INVERTER is present in a logic-circuit diagram, its output expression is simply equal to the input expression with a bar (-) over it.



Creating Circuits using Boolean Expression

If the operation of a circuit is defined by a Boolean expression, a logic-circuit diagram can he implemented directly from that expression.

Suppose we wanted to construct a circuit whose output is y = AC+BC + ABC. This Boolean expression contains three terms (AC, BC, ABC), which are OR together. This tells us that a three-input OR gate is required with inputs that are equal to AC, BC, and ABC, respectively.

Each OR-gate input is an AND product term, which means that an AND gate with appropriate inputs can be used to generate each of these terms. Note the use of an INVERTER to produce the A and C terms required in the expression.

1) Boolean Logic uses _____ to determine how bits are compared and simulate _____ .

A) Operators, Gates
B) Buffers, AND
C) Truth Tables, Off
D) NOR, NAND

2) The _____ operation says if and only if all inputs are on, the output will be on. The output will be off if any of the inputs are off.

A) OR
B) NAND
C) NOR
D) AND

3) The _____ operation says if any input is on then the output will be on.

A) NOT
B) OR
C) NOR
D) XOR

4) If all of the inputs are on, the output will be off. This is called _____.

A) NAND
B) NOR
C) Truth Tables
D) On

5) This operation says that if any input is on, the output will be off. Which operation is this?

A) Boolean Logic
B) XOR
C) NOR
D) AND

6) _____ says that if the inputs are different then the output will be on.

A) Gates
B) Low
C) NXOR
D) XOR

7) _____ simply changes the input to the opposite (0 to 1 or 1 to 0).

A) Operator
B) NOT
C) AND
D) OR

Answers

1. A) Operators, Gates
2. D) AND

3. B) OR
4. A) NAND
5. C) NOR
6. D) XOR
7. B) NOT

References:-

- http://www.eelab.usyd.edu.au/digital_tutorial/chapter4/4_0.html
- http://www.dcs.napier.ac.uk/~petert/hnd/hd1o1.doc
- http://www.sweetscape.com/010editor/manual/NumberSystems.htm
- http://www.dotlessbraille.org/numbersystems.htm

Unit 3: Generic Software

3.1 Word processing, desktop publishing

3.1.1 Introduction to word processing, desktop publishing and graphics software

Introduction to word processing

A Word processing package is one of the application software packages which helps us to prepare documents with texts, graphics, and images.. etc . There are many kinds of word processing packages.

Eg.
1.Word pro

2.word star

3.word perfect

4. Ms word 98/2000/xp/2003

Introduction to Ms word

Ms Word is an advanced word processing product by Microsoft. Ms Word is a major upgrade to an already fully featured package, apart from integrating information from non-Word programs like spread sheet , data bases, graphic sources etc . Ms Word has added many internet based facilities like E-mail, designing web pages etc.

Ms Word gives you tools to create professional quality documents and share information easily. This new version of word is loaded with helpful, time saving features that will allow you to focus on the content of your documents rather than on how to use the software. Word automatically determines what language a user is typing and applies the correct proofing tools like auto correct, spell checker, grammar check etc.

Introduction to desktop publishing

Desktop publishing is the process of using the computer and specific types of software to combine texts and graphics to produce documents. Desktop publishing can be used to prepare forms, magazines, reports, advertisements, brochures, leaflets, books, newsletters, manuals and posters etc….

Desktop publishing software is a tool for both graphic designers and non- graphic designers to create visual communication for professional or desktop printing.

Eg.

- Corel draw
- Page maker
- Publisher
- Photoshop

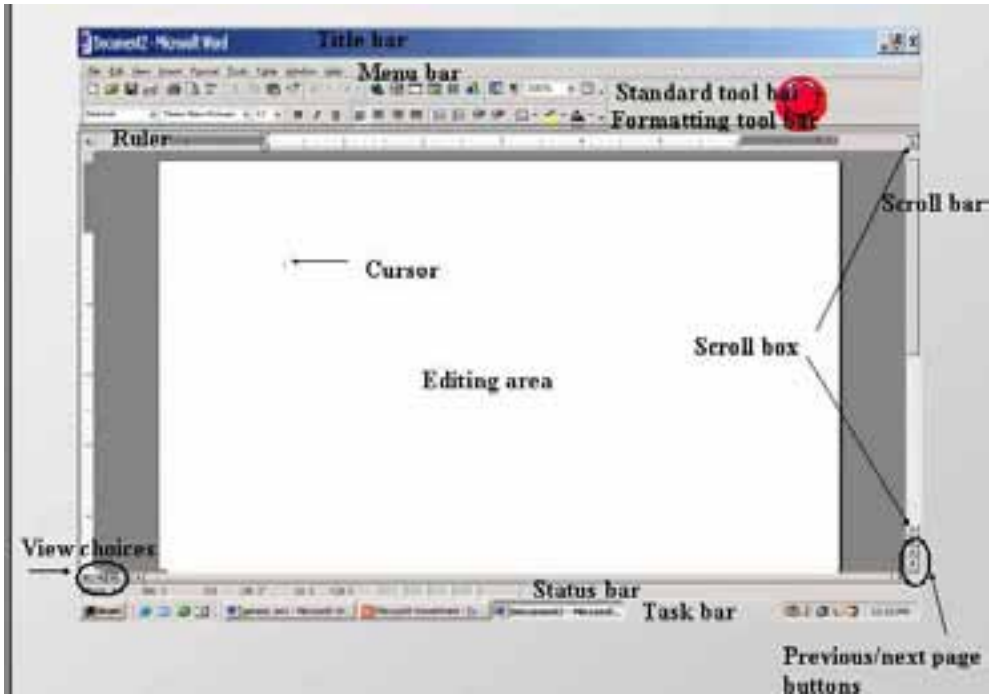
Getting started to Ms word

Let's work with Ms word 2000.

You can use any of the following ways to open Ms word 2000

1. Start-programs-ms office-ms word, or
2. Double click on the ms word icon on the desk top, or
3. Right click on the ms word icon on the desk top and click open.

Screen Layout

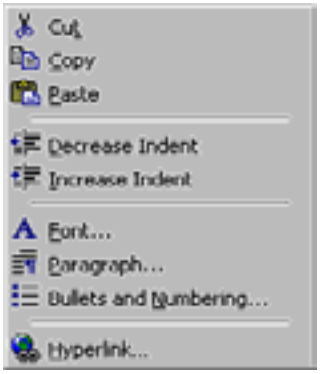


Menus

The menus in Word 2000 display only the commands you have recently used. To view all options in each menu, you must click the double arrows at the bottom of the menu. The images below show the Format menu collapsed (left) and expanded (right) after the double arrows at the bottom of the menu were clicked:

Shortcut Menus

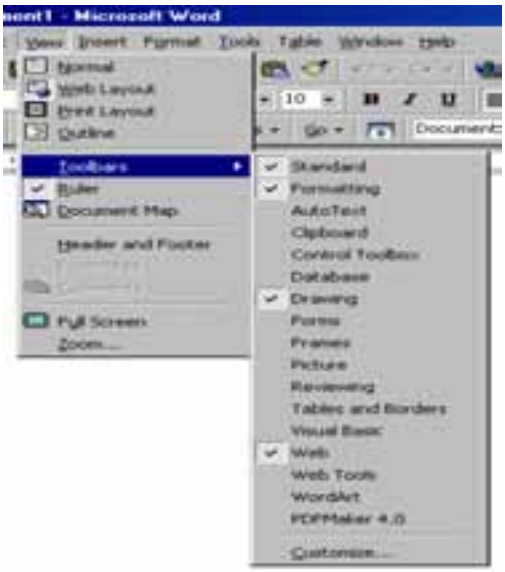
View shortcut menus by right clicking with the mouse to be faster than using the options on the menu bar. The options on this menu will vary depending on the element that was right-clicked. For example, right clicking on a bulleted list produces the shortcut menu below.



"Decrease Indent" and "Increase Indent" are only applicable to lists and therefore only appear on the list shortcut menu. The shortcut menus are helpful because they only display the options that can be applied to the item that was right-clicked and, therefore, prevent searching through the many menu options.

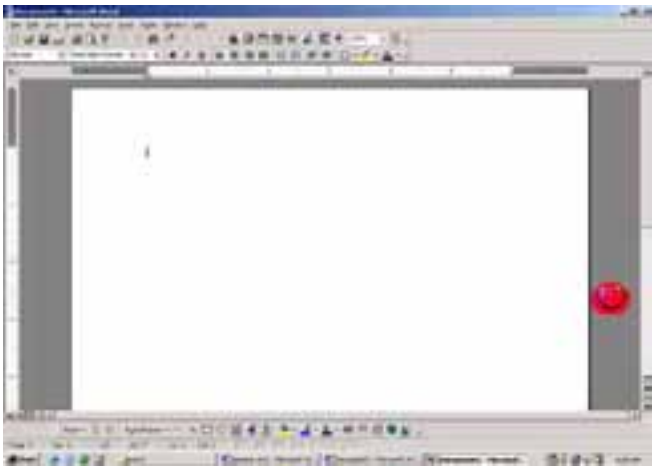
Toolbars

Many toolbars displaying shortcut buttons are also available to make editing and formatting quicker and easier. Select **View| Toolbars** from the menu bar to select the toolbars. The toolbars that are already displayed on the screen are checked. Add a toolbar simply by clicking on the name.



Create a New Document

- Click the New Document button on the tool bar. , or
- Choose **File| New** from the menu bar, or
- Press **CTRL+N** (depress the **CTRL** key while pressing "N") on the keyboard.



This is the new document window.

Typing Text

To enter text, just start typing! The text will appear where the blinking cursor is located. Move the cursor by using the arrow buttons on the keyboard or positioning the mouse and clicking the left button. The keyboard shortcuts listed below are also helpful when moving through the text of a document:

Cursor movement	
To go to the previous character	Left Arrow
To go to the next character	Right Arrow
To go to the upper character	Up Arrow
To go to the below character	Down Arrow
To go to the beginning of the next word	Ctrl+ Right Arrow
To go to the beginning of the previous word	Ctrl+ Left Arrow
To go to the beginning of the paragraph	Ctrl+ up Arrow
To go to the beginning of the next paragraph	Ctrl+ down Arrow
Go to beginning of line	HOME
Go to end of line	END
Go to beginning of document	CTRL+Home
Go to end of document	CTRL+End

Selecting Text

To change any attributes of text it must be highlighted first. Select the text by dragging the mouse over the desired text while keeping the left mouse button depressed, or hold down the **SHIFT** key on the keyboard while using the arrow buttons to highlight the text. The following table contains shortcuts for selecting a portion of the text:

Selection	**Technique**
Whole word	double-click within the word
Whole paragraph	triple-click within the paragraph
Several words or lines	drag the mouse over the words, or hold down **SHIFT** while using the arrow keys
Entire document	choose **Edit|Select All** from the menu bar, or press **CTRL+A**

Selection	**Technique**
Whole word	double-click within the word
Whole paragraph	triple-click within the paragraph

Deselect the text by clicking anywhere outside of the selection on the page or press an arrow key on the keyboard.

Deleting Text

Use the **BACKSPACE** and **DELETE** keys on the keyboard to delete text. Backspace will delete text to the left of the cursor and Delete will erase text to the right. To delete a large selection of text, highlight it using any of the methods outlined above and press the **DELETE** key.

Undo **ctrl+z**
Feel free to experiment with various text styles. You can always undo your last action by clicking the **Undo** button on the standard toolbar or selecting **Edit |Undo...** from the menu bar. Click the **Redo** button on the standard toolbar or select
Edit| Redo(ctrl+y)... to erase the undo action.

Moving (Cutting) Text

Highlight the text that will be moved and select **Edit|Cut** from the menu bar, click the **Cut** button on the standard tool bar, or press **CTRL+X** at once. This will move the text to a clip board .To move a small amount of text a short distance, the drag-and-drop method may be quicker. Highlight the text you want to move, click the selection with the mouse, drag the selection to the new location, and release the mouse button.

Copying Text

To copy text, choose **Edit|Copy**, click the **Copy** button on the standard toolbar, or press **CTRL+C** to copy the text to the clipboard.

Paste Text

To paste cut or copied text, move the cursor to the location you want to move the text to and select **Edit| Paste** from the menu bar, click the **Paste** button on the standard toolbar, or press CTRL+V.

The Clipboard

The last 12 elements that were cut or copied are placed onto Word's clipboard. You can view the elements on the clipboard by selecting View |Toolbars |Clipboard from the menu bar.

Place the mouse arrow over each element in the clipboard to view the contents of each item and click on an element to add its contents to the document. Click **Paste All** to add all of the items to the document at once. Click the **Clear Clipboard** button (the icon with an "X" over the clipboard image) to clear the contents of the clipboard.

Save a Document

- Click the Save button on the menu bar. **, or**
- Select **File| Save** from the menu bar, or
- Press **CTRL+S** on the keyboard.

Type the name of the document and save in the suitable folder

Close a Document

Close the current document by selecting **File|Close** or click the Close icon if it's visible on the Standard Toolbar.

Open an Existing Document

- Click the Open File button on the tool bar. **,or**
- Choose **File |Open** from the menu bar, or
- Press **CTRL+O** on the keyboard. Each method will show the Open dialog box. Choose the file and click the **Open** button.

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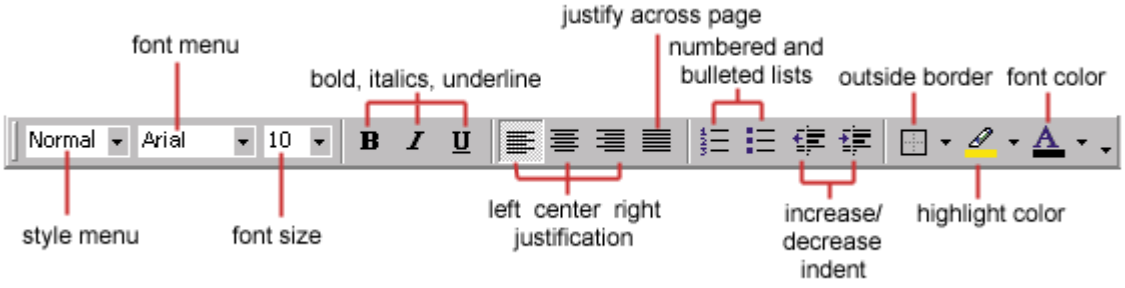
3.1.2 Formatting a document, working with graphics and drawing objects, creating and customizing tables

Formatting Text

The formatting toolbar is the easiest way to change many attributes of text. If the toolbar as shown below isn't displayed on the screen, select **View|Toolbars** and choose **Formatting**.



- **Font Face** - Click the arrowhead to the right of the font name box to view the list of fonts available. Scroll down to the font you want and select it by clicking on the name once with the mouse.
- **Font Size** - Click on the white part of the font size box to enter a value for the font size or click the arrowhead to the right of the box to view a list of font sizes available. Select a size by clicking on it once.
- **Font Style** - Use these buttons to bold, italicize, and underline text.
- **Alignment** - Text can be aligned to the left, center, or right side of the page or it can be justified across the page.

- **Numbered and Bulleted Lists** - Lists are explained in detail later in this tutorial.
- **Increase/Decrease Indent** - Change the indentation of a paragraph in relation to the side of the page.
- **Outside Border** - Add a border around a text selection.
- **Highlight Color** - Use this option to change the color behind a text selection. The color shown on the button is the last color used. To select a different color, click the arrowhead next to the image on the button.

- **Text Color** - This option changes the color of the text. The color shown on the button is the last color chosen. Click the arrowhead next to the button image to select another color.

- The **Font** dialog box allows you to choose from a larger selection of formatting options. Select **Format |Font** from the menu bar to access the box.

Format Painter 

A handy feature for formatting text is the **Format Painter** located on the standard toolbar. For example, if you have formatted a paragraph heading with a certain font face, size, and style and you want to format another heading the same way, you do not need to manually add each attribute to the new headline. Instead, use the Format Painter by following these steps:

- Place the cursor within the text that contains the formatting you want to copy.
- Click the **Format Painter** button in the standard toolbar. Notice that your pointer now has a paintbrush beside it.
- Highlight the text you want to add the same format to with the mouse and release the mouse button.

To add the formatting to multiple selections of text, double-click the **Format Painter** button instead of clicking once. The format painter then stays active until you press the **ESC** key to turn it off.

Paragraph Attributes

Format a paragraph by placing the cursor within the paragraph and selecting

Format /Paragraph from the menu bar.

Columns

To quickly place text in a column format, click the **Columns** button on the standard toolbar and select the number of columns by dragging the mouse over the diagram.

For more column options, select **Format |Columns** from the menu bar. The **Columns** dialog box allows you to choose the properties of the columns. Select the number and width of the columns from the dialog box.

Drop Caps

A drop cap is a large letter that begins a paragraph and drops through several lines of text as shown below.

Add a drop cap to a paragraph by following these steps:

- Place the cursor within the paragraph whose first letter will be dropped.
- Select **Format| Drop Cap** from the menu bar.
- The **Drop Cap** dialog box allows you to select the position of the drop cap, the font, the number of lines to drop, and the distance from the body text.
- Click **OK** when all selections have been made.
- To modify a drop cap, select **Format| Drop Cap** again to change the attributes, or click on the letter and use the handles to move and resize the letter.

To create a bulleted or numbered list, use the list features provided by Word.

Bulleted and Numbered Lists

- Click the **Bulleted List** button or **Numbered List** button on the formatting toolbar.
- Type the first entry and press **ENTER**. This will create a new bullet or number on the next line. If you want to start a new line without adding another bullet or number, hold down the **SHIFT** key while pressing **ENTER**.
- Continue to typing entries and press **ENTER** twice when you are finished typing to end the list.

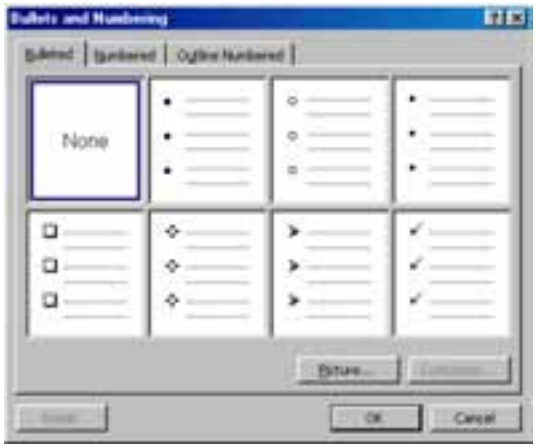
Use the **Increase Indent** and **Decrease Indent** buttons on the formatting toolbar to create lists of multiple levels.
NOTE: You can also type the text first, highlight the section, and press the **Bulleted List** or **Numbered List** buttons to add the bullets or numbers.

Nested Lists

To create a nested list, such as a numbered list inside of a bulleted list, follow these steps:

- Type the list and increase the indentation of the items that will make up the nested list by clicking the **Increase Indent** button for each item.

- Highlight the items and click the **Numbered List** button on the formatting toolbar.



Formatting Lists

Using the Bullets and Numbering dialog box can change the bullet image and numbering format.

- Highlight the entire list to change all the bullets or numbers, or
  Place the cursor on one line within the list to change a single bullet.

- Access the dialog box by selecting **Format| Bullets and Numbering** from the menu bar or by right-clicking within the list and selecting **Bullets and Numbering** from the shortcut menu.

- Select the list style from one of the seven choices given, or click the **Picture...** button to choose a different icon. Click the **Numbered** tab to choose a numbered list style.

- Click **OK** when finished.

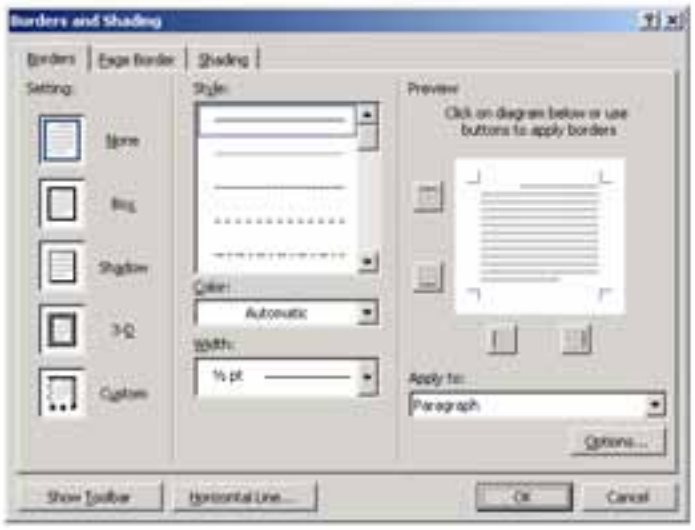
Tables are used to display data and there are several ways to build them in Word. Begin by placing the cursor where you want the table to appear in the document and choose one of the following methods.

Borders and Shading

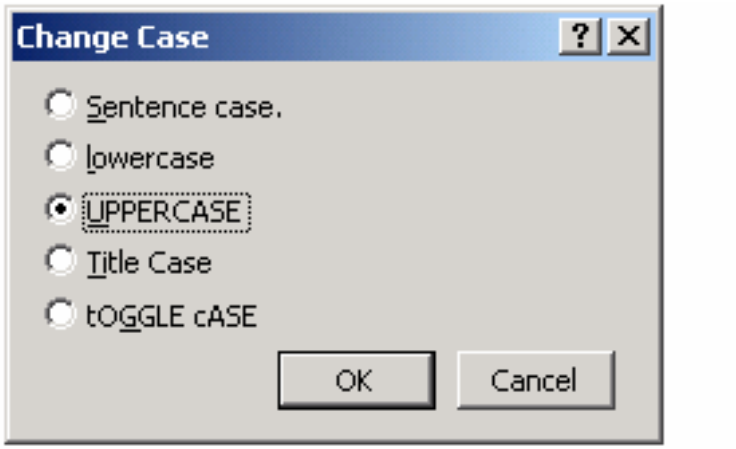
- Access the dialog box by selecting **Format| Borders and Shading** from the menu bar ,or

- Right-click within the text and select from the shortcut menu.

Select the suitable tab to insert the border style, page border style or shading style to the document. And then select the colour ,width , pattern and other options .



Change case
When the text entered is not in the appropriate case ,it can be changed using this facility. First select the text and then go to **Format| change case**

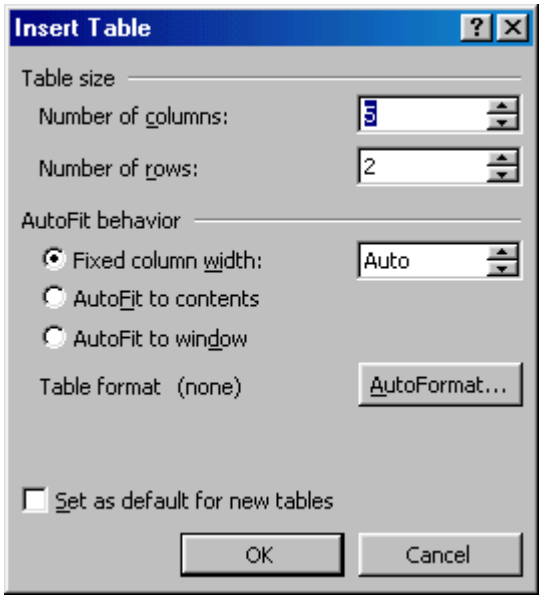


Insert a Table

There are two ways to add a table to the document using the Insert feature:

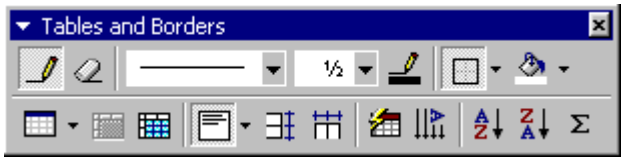
- Click the **Insert Table** button on the standard toolbar. Drag the mouse along the grid, highlighting the number of rows and columns for the table.

- Or, select **Table |Insert |Table** from the menu bar. Select the number of rows and columns for the table and click **OK**.



Draw the Table
A table can also be drawn onto the document:

- Draw the table by selecting **Table| Draw Table** from the menu bar. The cursor is now the image of a pencil and the **Tables and Borders** toolbar has appeared.



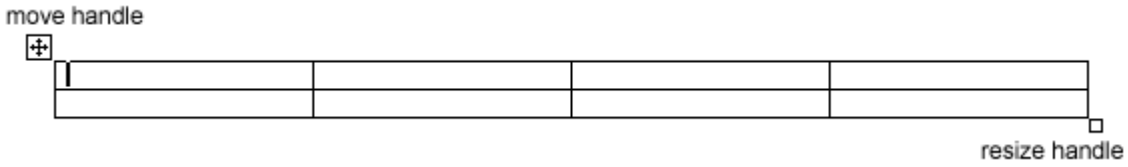
- Draw the cells of the table with the mouse. If you make a mistake, click the **Eraser** button and drag the mouse over the area to be deleted.
- To draw more cells, click on the **Draw Table** button .

Inserting Rows and Columns
Once the table is drawn, insert additional rows by placing the cursor in the row you want to be adjacent to. Select **Table| Insert| Rows Above** or **Rows Below**. Or, select an entire row and right-click with the mouse. Choose **Insert Rows** from the shortcut menu.

Much like inserting a row, add a new column by placing the cursor in a cell adjacent to where the new column will be added. Select **Table |Insert| Columns to the Left** or **Columns to the Right**. Or, select the column, right-click with the mouse, and select **Insert Columns**.

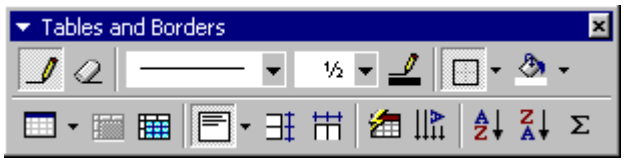
Moving and Resizing a Table

A four-sided moving arrow and open box resizing handle will appear on the corners of the table if the mouse is placed over the table. Click and drag the four-ended arrow to move the table and release the mouse button when the table is positioned where you want it. Click and drag the open box handle to resize the table. Change the column widths and row heights by clicking the cell dividers and dragging them with the mouse.



Tables and Borders Toolbar

The Tables and Borders toolbar allows you to add border styles, shading, text effects, alignment, and more options to your table. Access the toolbar by clicking **Table| Draw Table** or **View| Toolbars |Tables and Borders**.



You will need to highlight the cells of the table you want to format. Click and drag the mouse over the cells, or use the following shortcuts:

Selection	Menu Method	Mouse Method
One cell	**Table |Select| Cell**	Click the bottom, left corner of the cell when a black arrow appears
One row	**Table |Select| Row**	Click outside the table to the left of the row
One column	**Table |Select |Column**	Click outside the table above the column when a black arrow appears
Several rows	**(none)**	Click outside the table to the left of the row and drag the mouse down
Several columns	**(none)**	Click outside the table above the column
Entire table	**Table| Select| Table**	Triple-click to the left of the table

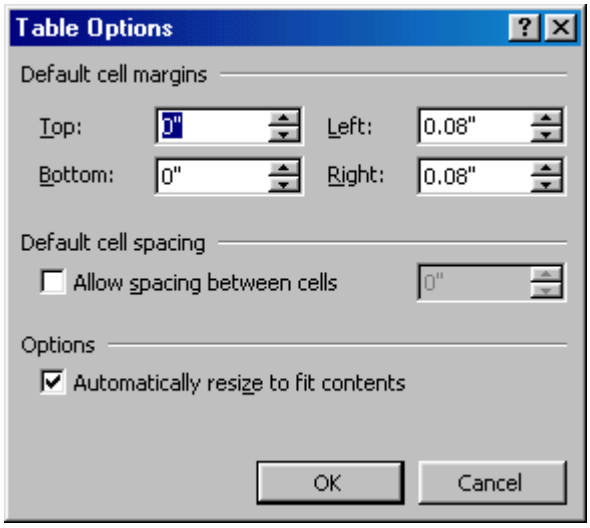
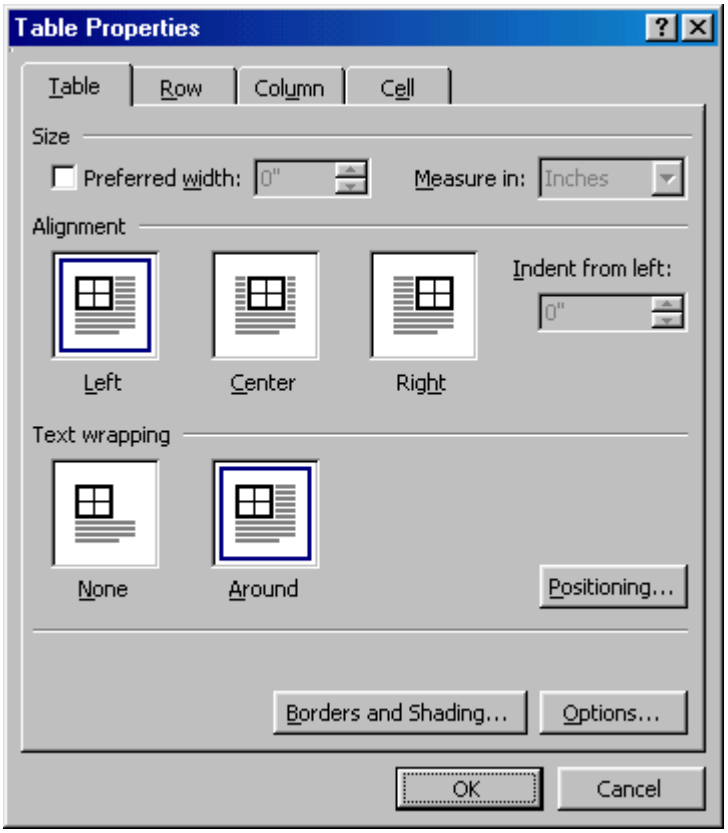


Table Properties

Use the **Table Properties** dialog box to modify the alignment of the table with the body text and the text within the table. Access the box by selecting **Tables| Table Properties**.



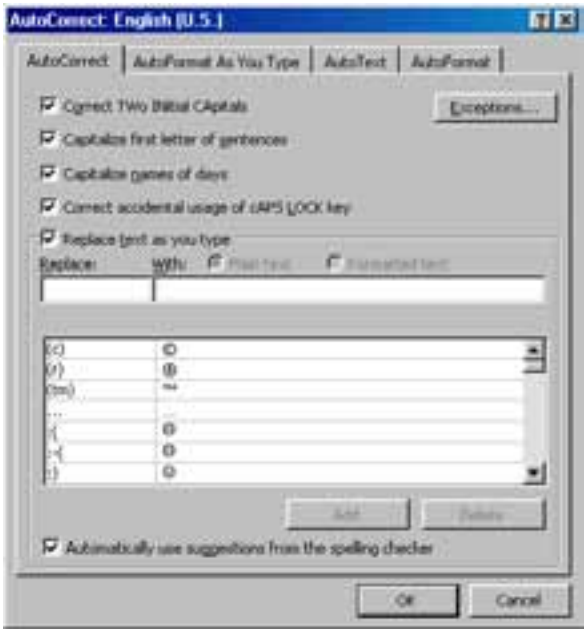
- **Size** - Check the **Preferred width** box and enter a value if the table should be an exact width.

- **Alignment** - Highlight the illustration that represents the alignment of the table in relation to the text of the document.
- **Text wrapping** - Highlight "None" if the table should appear on a separate line from the text or choose "Around" if the text should wrap around the table.
- **Borders and Shading** - Select from a number of border styles, colors, and widths. Click the **Shading** tab to change the background color and pattern.
- **Options** - Click the **Options** button on the **Table Properties** window. To change the spacing between the document text and the table borders under **Default cell margins**. Check the **Allow spacing between cells** and enter a value to add space between the table cells.

AutoCorrect

Word automatically corrects many commonly misspellt words and punctuation marks with the AutoCorrect feature. To view the list of words that are automatically corrected, select **Tools |Auto Correct**. This may be a hidden feature so click the double arrows at the bottom of the **Tools** menu listing if the AutoCorrect choice is not listed.

Many options including the accidental capitalization of the first two letters of a word and capitalization of the first word of the sentence can be automatically corrected from this page. If there are words you often misspell, enter the wrong and correct spellings in the **Replace** and **With** fields.



Spelling and Grammar Check

Word will automatically check for spelling and grammar errors as you type unless you turn this feature off. Spelling errors are noted in the document with a red

underline. Grammar errors are indicated by a green underline. To disable this feature, select **Tools| Options** from the menu bar and click the **Spelling and Grammar tab** on the dialog box. Uncheck **"Check spelling as you type"** and **"Check grammar as you type"**, and click **OK**.

To use the spelling and grammar checker, follow these steps:

- Select **Tools| Spelling and Grammar** from the menu bar.
- The **Spelling and Grammar** dialog box will notify you of the first mistake in the document and misspellt words will be highlighted in red.

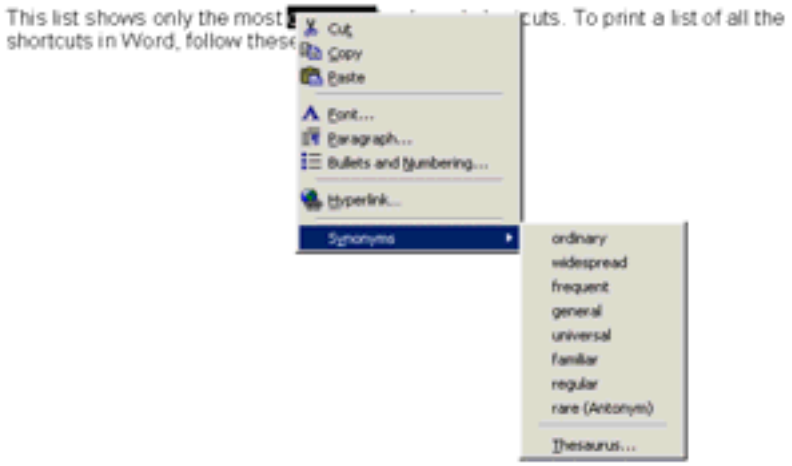
- If the word is spellt correctly, click the **Ignore** button or click the **Ignore All** button if the word appears more than once in the document.
- If the word is spellt incorrectly, choose one of the suggested spellings in the **Suggestions** box and click the **Change** button or **Change All** button to correct all occurrences of the word in the document. If the correct spelling is not suggested, enter the correct spelling in the **Not In Dictionary** box and click the **Change** button.
- If the word is spellt correctly and will appear in many documents you type (such as your name), click the **Add** button to add the word to the dictionary so it will no longer appear as a misspelled word.

As long as the **Check Grammar** box is checked in the **Spelling and Grammar** dialog box, Word will check the grammar of the document in addition to the spelling. If you do not want the grammar checked, remove the checkmark from this box. Otherwise, follow these steps for correcting grammar:

- If Word finds a grammar mistake, it will be shown in the box as the spelling errors. The mistake is highlighted in green text.

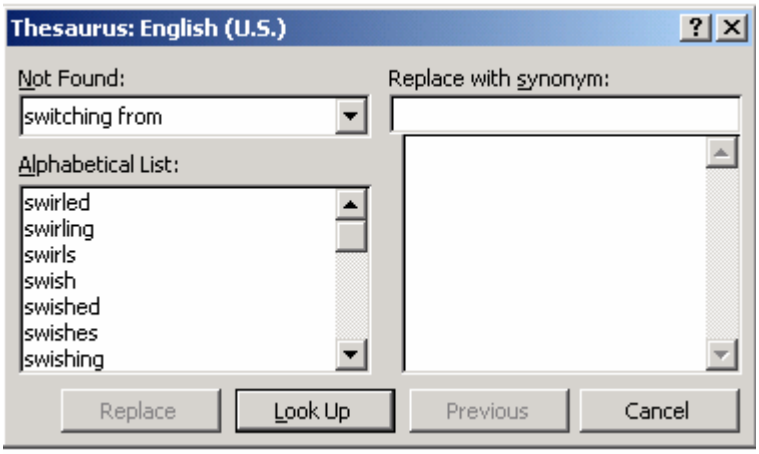
- Several suggestions may be given in the **Suggestions** box. Select the correction that best applies and click **Change**.
- If no correction is needed (Word is often wrong more than it is right), click the **Ignore** button.

Synonyms
Word 2000 has a new feature for finding synonyms. Simply right-click on the word and select **Synonyms** from the shortcut menu. From the list of suggested words, highlight the word you would like to use or click **Thesaurus...** for more options.



Thesaurus
To use the thesaurus, select **Tools |Language |Thesaurus** from the menu bar or select it from the **Synonyms** shortcut menu as detailed above.

A list of meanings and synonyms are given on the windows. Double-click on the words in the **Meanings** box or click the **Look Up** button to view similar words. Double-click words in the **Replace with Synonym** box to view synonyms of those words. Highlight the word you would like to add and click the **Replace** button.



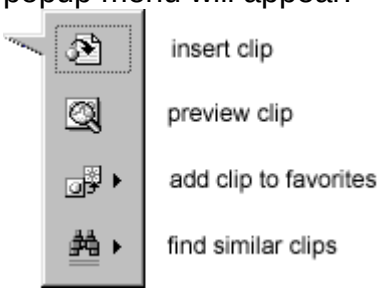
Adding Clip Art

To add a clip art image from the Microsoft library to a document, follow these steps :Select **Insert| Picture |Clip Art** from the menu bar.

- To find an image, click in the white box following **Search for clips**. Delete the words "Type one or more words. . ." and enter keywords describing the image you want to use.

- **- OR -**
  Click one of the category icons.

- Click once on the image you want to add to the document and the following popup menu will appear:



  - **Insert Clip** to add the image to the document.
  - **Preview Clip** to view the image full-size before adding it to the document. Drag the bottom, right corner of the preview window to resize the image and click the "**x**" close button to end the preview.

  - **Add Clip to Favorites** will add the selected image to your favorites directory that can be chosen from the **Insert ClipArt** dialog box.
  - **Find Similar Clips** will retrieve images similar to the one you have chosen.
- Continue selecting images to add to the document and click the **Close** button in the top, right corner of the **Insert ClipArt** window to stop adding clip art to the document.

Add An Image from a File

Follow these steps to add a photo or graphic from an existing file:

- Select **Insert| Picture |From File** on the menu bar.
- Click the down arrow button on the right of the **Look in:** window to find the image on your computer.

- Highlight the file name from the list and click the **Insert** button.

Editing A Graphic

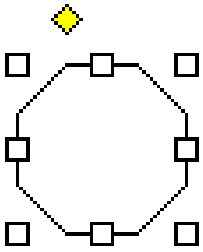
Activate the image you wish to edit by clicking on it once with the mouse. Nine handles will appear around the graphic. Click and drag these handles to resize the image. The handles on the corners will resize proportionally while the handles on the straight lines will stretch the image. More picture effects can be changed using the Picture toolbar. The **Picture toolbar** should appear when you click on the image. Otherwise, select **View| Toolbars |Picture** from the menu bar to activate it.

- **Insert Picture** will display the image selection window and allow you to change the image.
- **Image Control** allows to to make the image grayscale, black and white, or a watermark.
- **More/Less Contrast** modifies the contrast between the colors of the image.
- **More/Less Brightness** will darken or brighten the image.
- Click **Crop** and drag the handles on the activated image to delete outer portions of the image.
- **Line Style** will add a variety of borders to the graphic.
- **Text Wrapping** will modify the way the document text wraps around the graphic.
- **Format Picture** displays all the image properties in a separate window.
- **Reset Picture** will delete all the modifications made to the image.

Auto Shapes

The AutoShapes toolbar will allow you to draw many different geometrical shapes, arrows, flow chart symbols, stars, and banners on the document. Activate the AutoShapes toolbar by selecting **Insert| Picture |AutoShapes** or **View| Toolbars |AutoShapes** from the menu bar, or clicking the **AutoShapes** button on the Drawing toolbar. Click each button on the toolbar to view the options for drawing the shape.

- **Lines -** After clicking the Lines button on the AutoShapes toolbar, draw a ***straight line***, ***arrow***, or ***double-ended arrow*** from the first row of options by clicking the respective button. Click in the document where you would like the line to begin and click again where it should end. To draw a ***curved line*** or ***freeform shape***, select curved lines from the menu (first and second buttons of second row), click in the document where the line should appear, and click the mouse every time a curve should begin. End creating the graphic by clicking on the starting end or pressing the **ESC** key. To ***scribble***, click the last button in the second row, click the mouse in the document and hold down the left button while you draw the design. Let go of the mouse button to stop drawing. **Basic Shapes** - Click the Basic Shapes button on the AutoShapes toolbar to select from many ***two- and three-dimensional shapes***, ***icons***, ***braces***, and ***brackets***. Use the drag-and-drop method to draw the shape in the document. When the shape has been made, it can be resized using the open box handles and other adjustments specific to each shape can be modified using the yellow diamond handles.



- **Block Arrows** - Select Block Arrows to choose from many types of ***two- and three-dimensional arrows***. Drag-and-drop the arrow in the document and use the open box and yellow diamond handles to adjust the arrowheads. Each AutoShape can also be rotated by first clicking the **Free Rotate** button on the drawing toolbar  . Click and drag the green handles around the image to rotate it.

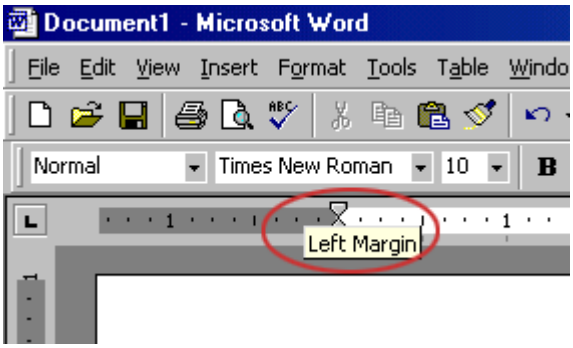
- **Flow Chart** - Choose from the flow chart menu to add ***flow chart elements*** to the document and use the line menu to draw connections between the elements.
- **Stars and Banners** - Click the button to select ***stars***, ***bursts***, ***banners***, and ***scrolls***.
- **Call Outs** - Select from the ***speech and thought bubbles***, and ***line call outs***. Enter the call out text in the text box that is made.
- **More AutoShapes** - Click this button to choose from a list of clip art categories.

Each of the submenus on the AutoShapes toolbar can become a separate toolbar. Just click and drag the gray bar across the top of the submenus off of the toolbar and it will become a separate floating toolbar.

Page Margins

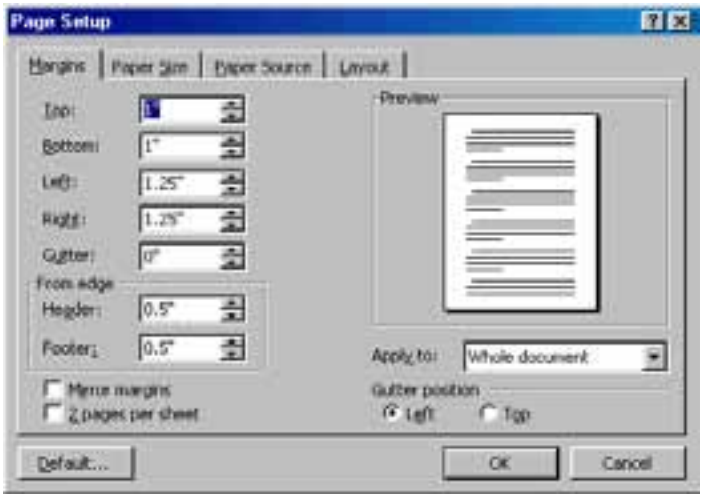
The page margins of the document can be changed using the rulers on the page and the **Page Setup** window. The ruler method is discussed first: Move the mouse over the area where the white ruler changes to gray.

- When the cursor becomes a double-ended arrow, click with the mouse and drag the margin indicator to the desired location.
- Release the mouse when the margin is set.



The margins can also be changed using the **Page Setup** dialog box:

- Select **File| Page Setup** and choose the **Margins tab** in the dialog box.



- Enter margin values in the **Top**, **Bottom**, **Left**, and **Right** boxes. The **Preview** window will reflect the changes.
- If the document has **Headers** and/or **Footers**, the distance this text appears from the edge of the page can be changed.
- Click **OK** when finished.

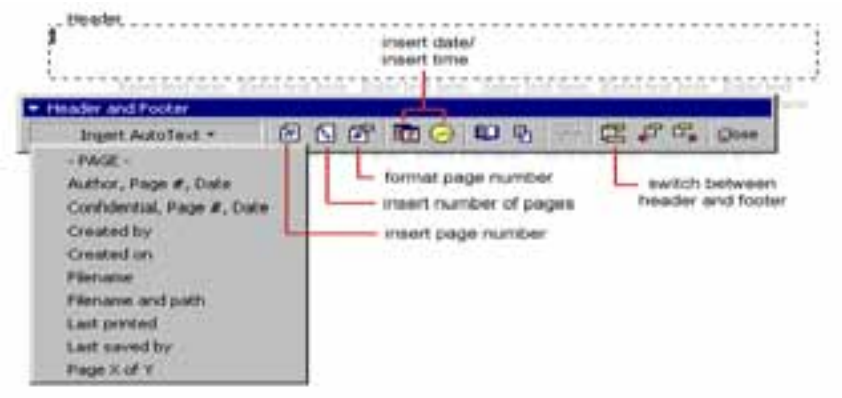
Page Size and Orientation
Change the orientation page within the Page Setup dialog box.

- Select **File |Page Setup** and choose the **Paper Size** tab.

- Select the proper paper size from the drop-down menu.
- Change the orientation from **Portrait** or **Landscape** by checking the corresponding radio button.

Headers and Footers
A header is text that is added to the top margin of every page such as a document title or page number and a footer is text added to the bottom margin. Follow these steps to add or edit headers and footers in the document:

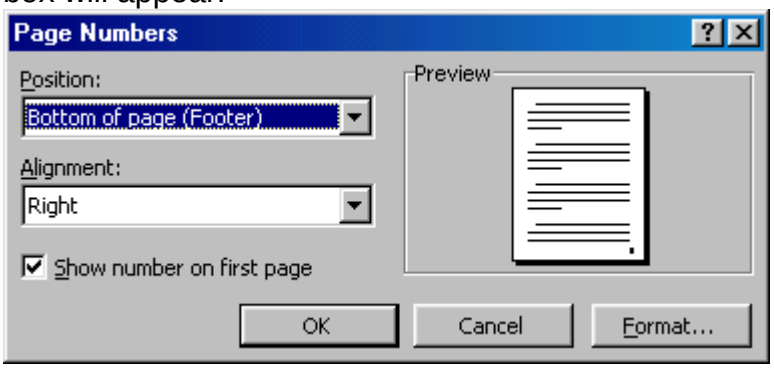
- Select **View| Header and Footer** from the menu bar. The Header and Footer toolbar will appear and the top of the page will be highlighted as shown below.
- Type the heading in the **Header** box. You may use many of the standard text formatting options such as font face, size, bold, italics, etc.
- Click the **Insert AutoText** button to view a list of quick options available.
- Use the other options on the toolbar to add page numbers, the current date and time.
- To edit the footer, click the **Switch Between Header and Footer button** on the toolbar.
- When you are finished adding headers and footers, click the **Close button** on the toolbar.



Page Numbers

Follow these instructions for another way to add page numbers to a document.

- Select **Insert|Page Numbers** from the menu bar and the following dialog box will appear.



- Select the position of the page numbers by choosing "Top of page" or "Bottom of page" from the **Position** drop-down menu.
- Select the alignment of the page numbers in the **Alignment** drop-down menu.

- If you do not want the page number to show on the first page (if it is a title page, for example), uncheck the **Show number of first page** box.
- Click **OK** when finished.

Print Preview and Printing

Preview your document by clicking the Print Preview button on the standard toolbar or by selecting **File| Print Preview**. When the document is ready to print,

Click the Print button from the Print Preview screen or select **File| Print**.

Keyboard shortcuts

Keyboard shortcuts can save time and the effort of switching from the keyboard to the mouse to execute simple commands. Print this list of Word keyboard shortcuts and keep it by your computer for a quick reference.

Note: A plus sign indicates that the keys need to be pressed at the same time.

Action	Keystroke

Action	Keystroke

Document actions	
Open a file	CTRL+O
New file	CTRL+N
Close a file	CTRL+W
Save As	F12
Save	CTRL+S or SHIFT+F12
Print Preview	CTRL+F2
Print	CTRL+P
Show/Hide paragraph symbols	CTRL+*
Spelling and grammar	F7
Help	F1
Find	CTRL+F
Replace	CTRL+H
Go To	CTRL+G

Text Style	
Font face	CTRL+SHIFT+F
Font size	CTRL+SHIFT+P
Bold	CTRL+B
Italics	CTRL+I
Underline	CTRL+U
Double underline	CTRL+SHIFT+D
Word underline	CTRL+SHIFT+W
All caps	CTRL+SHIFT+A
Change case	SHIFT+F3
Subscript	CTRL+=
Superscript	CTRL+SHIFT+=
Make web hyperlink	CTRL+K

Cursor movement	
Select all - entire document	CTRL+A
Select from cursor to beginning of line	SHIFT+Home
Select from cursor to end of line	SHIFT+END
Go to beginning of line	HOME
Go to end of line	END
Go to beginning of document	CTRL+Home
Go to end of document	CTRL+End

Formatting

Cut	CTRL+X
Copy	CTRL+C
Paste	CTRL+V
Undo	CTRL+Z
Redo	CTRL+Y
Format painter	CTRL+SHIFT+C
Left alignment	CTRL+L
Center alignment	CTRL+E
Right alignment	CTRL+R
Justified	CTRL+J
Delete previous word	CTRL+Backspace
Apply bulleted list	CTRL+SHIFT+L
Indent	CTRL+M
Page break	CTRL+Enter

Tables	
Go to next cell	Tab
Go to previous cell	SHIFT+Tab
Go to beginning of column	ALT+PageUp
Highlight to beginning of column	ALT+SHIFT+PageUp
Go to end of column	ALT+PageDown
Highlight to end of column	ALT+SHIFT+PageDown
Go to beginning of row	ALT+Home
Highlight to beginning of row	ALT+SHIFT+Home
Go to end of row	ALT+End
Highlight to end of row	ALT+SHIFT+End
Column break	CTRL+SHIFT+Enter

Miscellaneous	
Copyright symbol - ©	ALT+CTRL+C
Date field	ALT+SHIFT+D
Go to footnotes	ALT+CTRL+F
Show/Hide ¶	CTRL+SHIFT+8
Thesaurus	SHIFT+F7

All Shortcuts

This list shows only the most common keyboard shortcuts. To print a list of all the shortcuts in Word, follow these steps:

- Select **Tools| Macro| Macros** from the menu bar.
- From the **Macros In** drop-down menu, select **Word Commands**.
- Select **List Commands** from the macro listing.
- Click the **Run** button.
- Choose **Current Menu and Keyboard Settings** from the popup window and click **OK**.
- Word will automatically open a new document containing a table of keystrokes. **Print** the document.

3.3 Electronic Spreadsheets

3.3.1 Introduction to the Electronic Spreadsheets

A spreadsheet is a sheet that contains a large number of rows and columns like a table. A Collection of sheets is called a Workbook. It helps to arrange numbers in a formal mathematical manner so that it can be used for mathematical, financial, statistical & Scientific calculations. It helps to analyze data using Sorting, Filtering, Charts and Pivot tables

Various Spreadsheet Packages

- VisiCalc(VISIble CALculator)
- VPP 3D
- SuperCalc • MultiPlan
- Lotus 1-2-3 •Quattro Pro •Fox pro
- Lotus Improv- intelligent speared Sheet

Use of a Spreadsheet Package

In a Business

1. The marketing Department uses Speared Sheet to keep track of sales
    - They can use the information to calculate commission to the sales staff and project materials and product requirements for purchasing
2. The purchasing department uses it to keep track of purchases from individual vendors and prices paid for specific products.
3. Personnel departments use it to keep track of information about Employees.
4. The Payroll department uses it to keep track of salary information, allowances and loans.
5. The Accounts department uses it to calculate the monthly account balance.

In engineering analysis

1. A civil engineering department uses it to determine the dimensions of drainage channels or to calculate the stress on a concrete beam on a bridge.
2. An Electrical engineer uses it to calculate the voltage or capacities in the design of electrical circuits.
3. A Mechanical engineer use it to calculate heat absorption or pressure on water.

In science

1. A Scientist uses it to analyze their research data and to take a decision regarding research

In Graphics & Presentations

Spread Sheets are excellent tools for creating graphs and presentation materials because these capabilities are built into them. With most spreadsheet programs creating a graph is very simple.

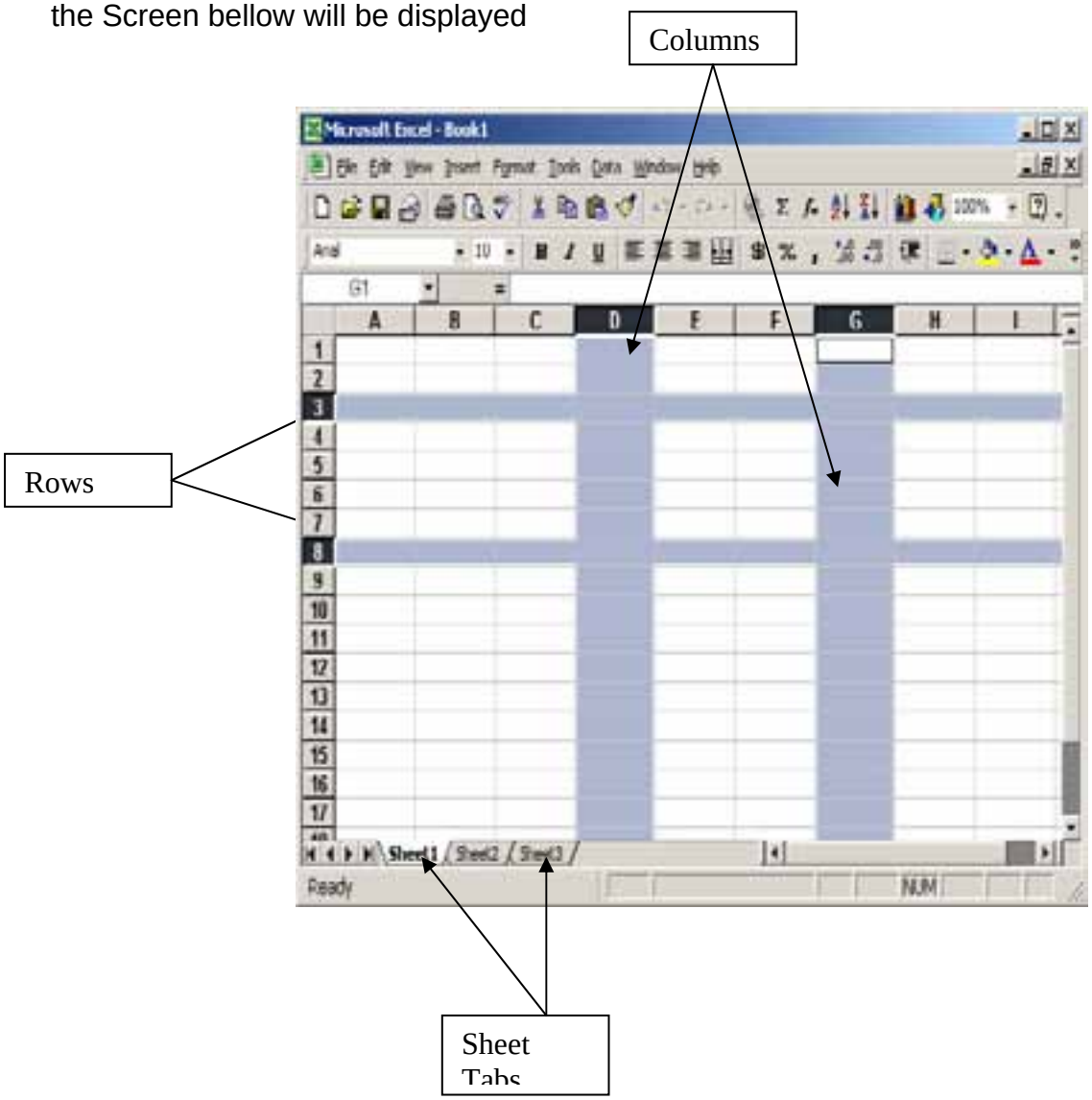
Opening Work Book and Creating a New Work Sheet

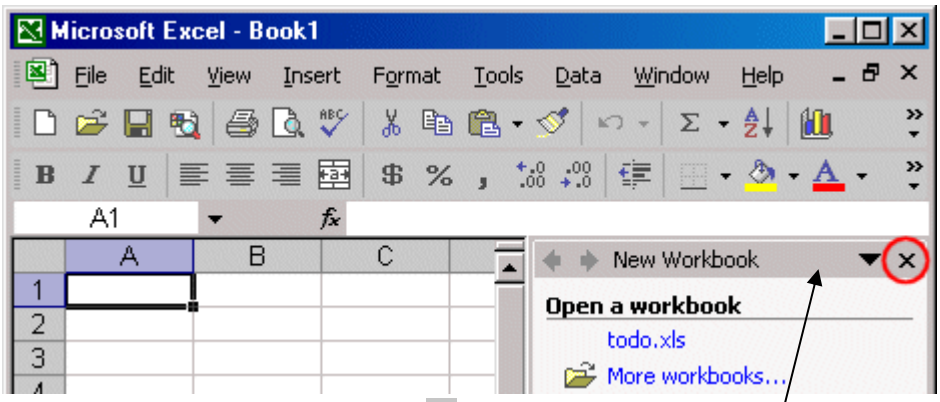
Introduction to Microsoft Excel Window

To open Microsoft Excel

1. Click Start
2. Then Click Microsoft Excel under program menu item

the Screen bellow will be displayed





Then, if necessary, click on the ✕ in the upper right corner of the task pane to close the task pane.

Task Pane

The Title Bar

Title bar, which is located at the very top of the screen, displays the name of the workbook you are currently using. At the top of your screen, you should see "Microsoft Excel - Book1" or a similar name.

The Menu Bar

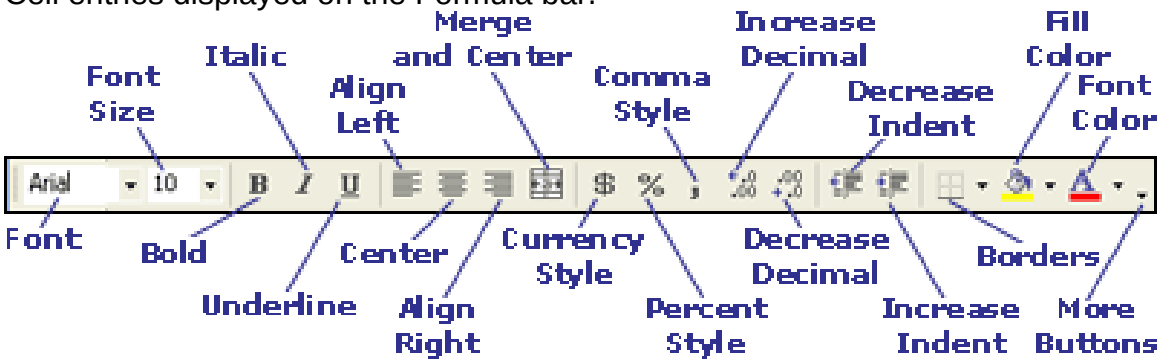
The Menu bar is located below the Title bar. The menu begins with the word File, Edit, View, Insert, Format, Tools, Data, Window, and Help. You can use a menu to give instructions to the software.

Point and click with your mouse to a menu item, then you will see a drop-down menu open. Use left and right arrow keys on your keyboard to move left and right across the Menu bar. Up and Down arrow keys are used to move up and down the drop-down menu.

To choose an option, highlight the item on the drop-down menu and press Enter or click item.

The Name Box and Formula Bar

The cell address is displayed in the Name box on the left side of the Formula bar.
Cell entries displayed on the Formula bar.



Cell addressing

The A1 vs. the R1C1 reference style

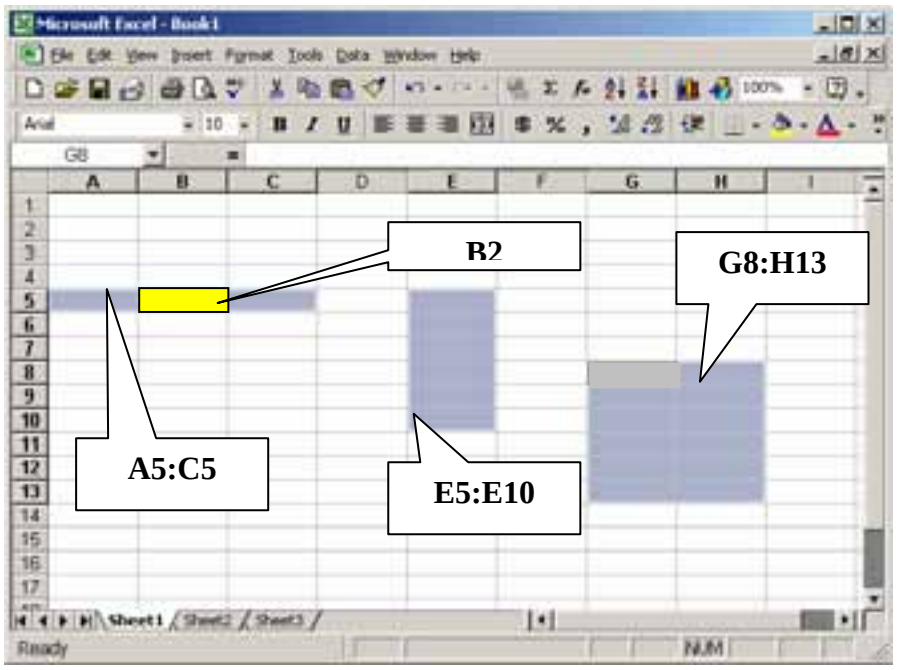
The A1 reference style

Excel uses the A1 reference style, which refers to columns with letters (A through IV, for a total of 256 columns) and refers to rows with numbers (1 through 65536). These letters and numbers are called row and column headings. To refer to a cell, enter the column letter followed by the row number. For example, D50 refers to the cell at the intersection of column D and row 50. To refer to a range of cells, enter the reference for the cell in the upper-left corner of the range, a colon (:), and then the reference to the cell in the lower-right corner of the range. The following are examples of references.

To refer to	Use
The cell in column A and row 10	A10
The range of cells in column A and rows 10 through 20	A10:A20
The range of cells in row 15 and columns B through E	B15:E15
All cells in row 5	5:5
All cells in rows 5 through 10	5:10
All cells in column H	H:H
All cells in columns H through J	H:J
The range of cells in columns A through E and rows 10 through 20	A10:E20

The R1C1 reference style

You can also use a reference style where both the rows and the columns on the worksheet are numbered. In the R1C1 style, Excel indicates the location of a cell with an "R" followed by a row number and a "C" followed by a column number



3.3.2 Insert Data into a worksheet

Text is any combination of numbers, spaces, and nonnumeric characters

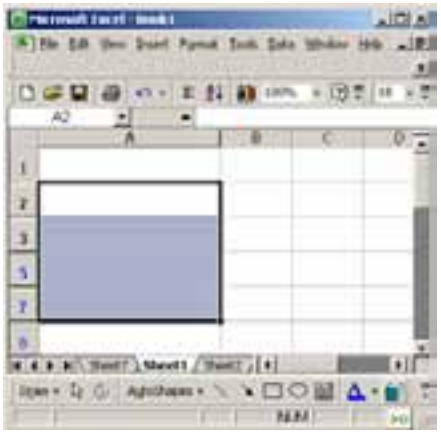
Eg. 10xy, 127NH, A12-976, 208 4675.

All text is left aligned in a cell.

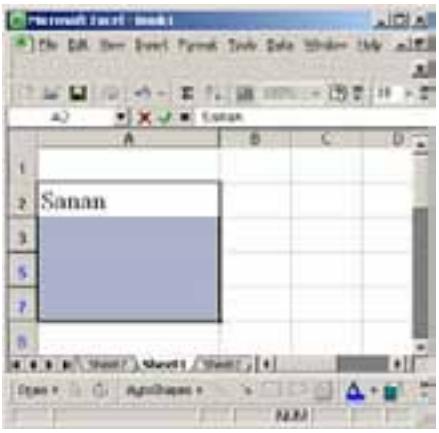
Enter the same data into several cells at once

1. Select the cells where you want to enter data.

   The cells can be adjacent or nonadjacent



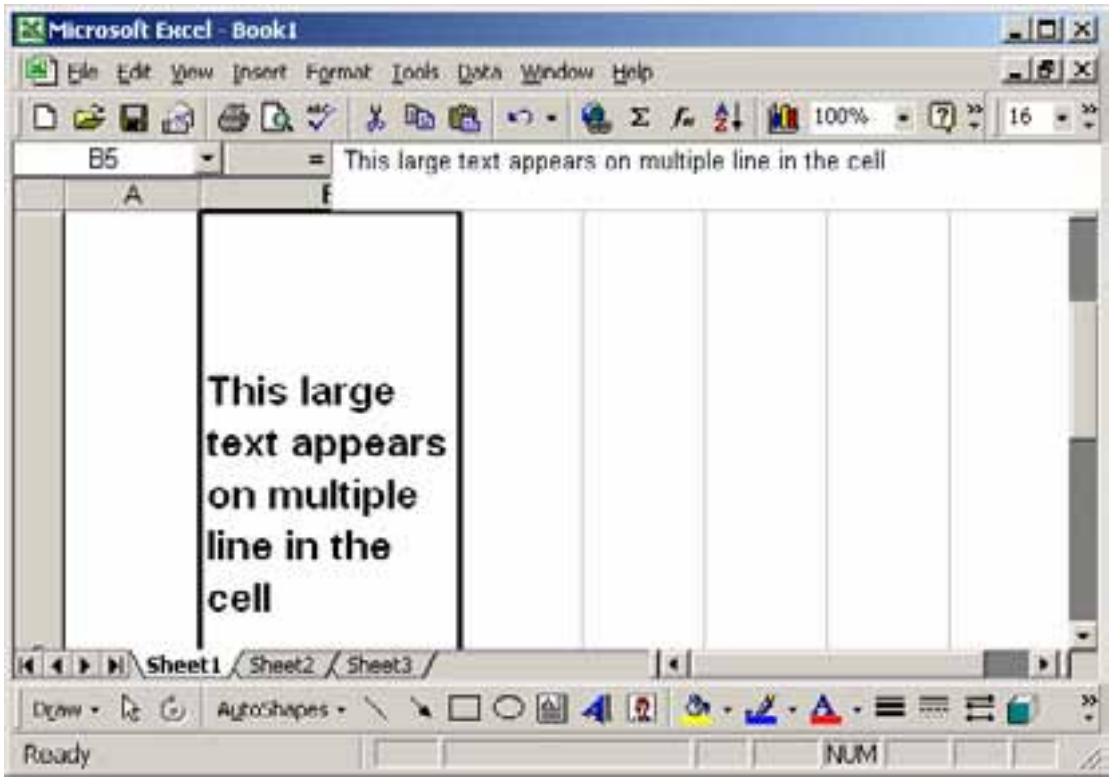
2.Type data



2. Press CTRL+ENTER.

To display all the texts on multiple lines in a cell

1. Select the cell B5
2. Type " This large text appears on multiple line in the cell"
3. Press ALT+ENTER



Keys for moving and scrolling in a worksheet or workbook

Press	To
Arrow keys	Move one cell up, down, left, or right
CTRL+arrow key	Move to the edge of the **current data region**
HOME	Move to the beginning of the row
CTRL+HOME	Move to the beginning of the worksheet
CTRL+END	Move to the last cell on the worksheet, which is the cell at the intersection of the rightmost used column and the bottom-most used row (in the lower-right corner), or the cell opposite the home cell, which is typically A1
PAGE DOWN	Move down one screen
PAGE UP	Move up one screen

ALT+PAGE DOWN	Move one screen to the right
ALT+PAGE UP	Move one screen to the left
CTRL+PAGE DOWN	Move to the next sheet in the workbook
CTRL+PAGE UP	Move to the previous sheet in the workbook
CTRL+F6 or CTRL+TAB	Move to the next workbook or window
CTRL+SHIFT+F6 or CTRL+SHIFT+TAB	Move to the previous workbook or window
F6	Move to the next pane in a workbook that has been split
SHIFT+F6	Move to the previous pane in a workbook that has been split
CTRL+BACKSPACE	Scroll to display the active cell
F5	Display the **Go To** dialog box
SHIFT+F5	Display the **Find** dialog box
SHIFT+F4	Repeat the last **Find** action (same as **Find Next**)
TAB	Move between unlocked cells on a protected worksheet

Keys for moving in a worksheet with End mode on

Press	To
END	Turn **End mode** on or off
END, arrow key	Move by one block of data within a row or column
END, HOME	Move to the last cell on the worksheet, which is the cell at the intersection of the rightmost used column and the bottom-most used row (in the lower-right corner), or the cell opposite the home cell, which is typically A1
END, ENTER	Move to the last cell to the right in the current row that is not blank; unavailable if you have selected the **Transition navigation keys** check box on the **Transition** tab (**Tools** menu, **Options** command)
ENTER	Move from top to bottom within the selection (down), or move in the direction that is selected on

	the **Edit** tab (**Tools** menu, **Options** command)
SHIFT+ENTER	Move from bottom to top within the selection (up), or move opposite to the direction that is selected on the **Edit** tab (**Tools** menu, **Options** command)
TAB	Move from left to right within the selection, or move down one cell if only one column is selected
SHIFT+TAB	Move from right to left within the selection, or move up one cell if only one column is selected
CTRL+PERIOD	Move clockwise to the next corner of the selection
CTRL+ALT+RIGHT ARROW	Move to the right between nonadjacent selections
CTRL+ALT+LEFT ARROW	Move to the left between nonadjacent selections

Keys for inserting, deleting, and copying a selection

Press	To
CTRL+C	Copy the selection
CTRL+X	Cut the selection
CTRL+V	Paste the selection
DELETE	Clear the contents of the selection
CTRL+HYPHEN	Delete the selection
CTRL+Z	Undo the last action
CTRL+SHIFT+PLUS SIGN	Insert blank cells

Tips on entering numbers

Numbers

A number can contain only the following characters:
0 1 2 3 4 5 6 7 8 9 + - ( ) , / $ % . Ee
Excel ignores leading plus signs (+) and treats a single period as a decimal. All other combinations of numbers and nonnumeric characters are treated as text.

Entering negative numbers

Start with minus sign (**-**), or enclose the numbers in parentheses ( ).

Aligning numbers
All numbers are right aligned in a cell. To change the alignment, select the cells. On the **Format** menu, click **Cells**, click the **Alignment** tab, and then select the options you want.

How numbers appear The number format that is applied to a cell determines the way Excel displays a number on a worksheet if you type a number into a cell that has the General number format, Excel may apply a different number format. For example, if you type **$14.73**, Excel applies a currency format. To change the number format, select the cells that contain the numbers. On the **Format** menu, click **Cells**, click the **Number** tab, and then select a category and format.

The General number format In cells that have the default General number format, Excel displays numbers as integers (789), decimal fractions (7.89), or scientific notation (7.89E+08). If the number is longer than the width of the cell, the General format displays up to 11 digits, including a decimal point and characters such as "E" and "+." To use numbers with more than 11 digits, you can apply a built-in scientific number format (exponential notation) or a custom number format.

15-digit limit Regardless of the number of digits displayed, Excel stores numbers with up to 15 digits of precision. If a number contains more than 15 significant digits, Excel converts the extra digits to zeros (0).

Entering numbers as text Excel stores a number as numeric data even if you use the **Cells** command to apply the text format to the cells that contain the numbers. To have Excel interpret numbers such as part numbers as text, first apply the Text format to empty cells, and then type the numbers. If you've already entered the numbers, apply the Text format to the cells.

Regional settings The characters recognized as numbers depend on the options you select in the Regional Settings of Control Panel. The options selected also determine the default format for numbers — for example, the period (.) used as the decimal symbol on United States-based systems.

Tips on entering dates and times

Dates and times are numbers Microsoft Excel treats dates and times as numbers. The way that a time or date is displayed on a worksheet depends on the number format applied to the cell. When you type a date or time that Excel recognizes, the cell's format changes from the General number format to a built-in date or time format. By default, dates and times are right aligned in a cell. If Excel cannot recognize the date or time format, the date or time is entered as text, which is left aligned in the cell.

Use a 4-digit year When entering dates such as December 01, Excel matches the day first and then the year. For instance, December 01 is entered as December 1 of the present year, not as December of the year 2001.

Entering dates and times together To type a date and time in the same cell, separate the date and time with a space.

The 12-hour or 24-hour clock To type a time based on the 12-hour clock, type a space followed by **AM** or **PM** (or **A** or **P**) after the time. Otherwise, Excel bases the time on the 24-hour clock. For example, if you type **3:00** instead of **3:00 PM**, the time is stored as **3:00 AM**.

The 1904 date system In Excel for Windows (and Lotus 1-2-3), days are numbered from the beginning of the century; the date serial number 1 corresponds to the date January 1, 1900. Excel for Macintosh uses the 1904 date system; the date serial number 1 corresponds to January 2, 1904. To change the date system for use in calculations, click **Options** on the **Tools** menu, and then click the

Calculation tab. Under **Workbook options**, select the **1904 date system** check box. Use the 1904 date system for a workbook if you use that workbook with other workbooks that use the 1904 date system.

If you open in Excel for Windows a file created in Excel version 2.0 or later for the Macintosh, Excel recognizes the file format and automatically changes dates to the 1900 date system. Similarly, if you open an Excel for Windows file on a Macintosh, Excel changes dates to the 1904 date system.

Edit cell contents

1. Double-click the cell that contains the data you want to edit.
2. Make any changes to the cell contents.
3. Press ENTER.

Enter fractions

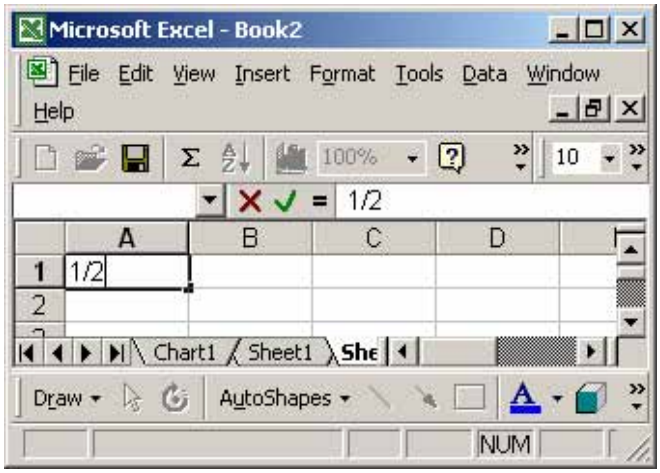
To avoid entering a fraction as a date, precede fractions with a 0 (zero)

Eg. 0 1/2.

Typing numbers like 1/2, 2/3, 5/10
Step 1

Click cell A1

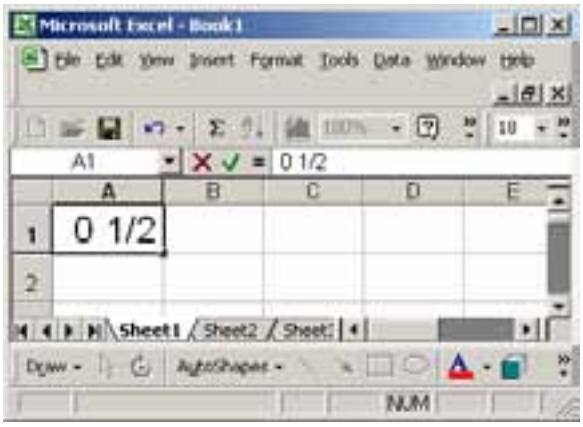
Type 1/2 and press Enter Key – The data is displayed as date

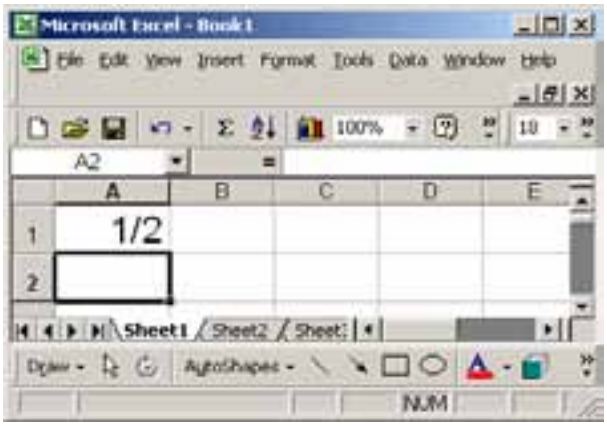


Step 2

Click B1

Type 0 1/2 (Zero, space and 1/2) then press Enter Key





Clear contents, formats, or comments from cells

1. Select the cells, rows, or columns you want to clear.
2. On the **Edit** menu, point to **Clear**, and then click **All**, **Contents**, **Formats**, or **Comments**.

Notes

- When you press DELETE or BACKSPACE, then it removes the cell contents but does not remove any comments or cell formats.

- If you clear a cell, then it removes the contents, formats, comments, or all three from a cell. The value of a cleared cell is 0 (zero), and a formula that refers to that cell will receive a value of 0.

Undo mistakes

- To undo recent actions one at a time, click **Undo** Button Or press **CTRl+Z.**

  To undo several actions at once, click the arrow next to **Undo** and select from the list. Microsoft Excel reverses the selected action and all actions above it.

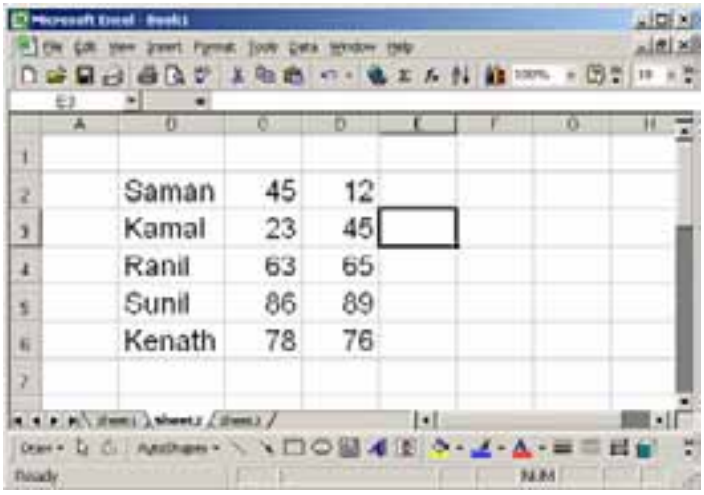
  To cancel an entry in a cell or the formula bar before you press ENTER, press ESC.

Insert cells, rows, or columns

You can insert blank cells, rows, and columns and fill them with data. If you're moving and copying cells, you can insert them between the existing cells to avoid pasting over data.

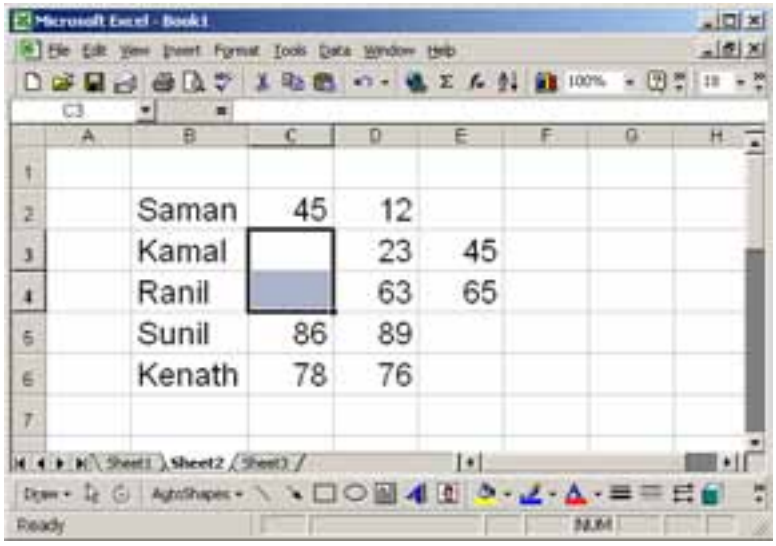
Insert blank cells

1. Type the Following Data on a sheet



2. Select the range c3:c4
3. On the **Insert** menu, click **Cells**.

4. Click **Shift cells right**.



Insert columns

1. To insert a single column, click a cell in the column immediately to the right of where you want to insert the new column. For example, to insert a new column to the left of Column B, click a cell in Column B.

   To insert multiple columns, select columns immediately to the right of where you want to insert the new columns. Select the same number of columns, as you want to insert.

2. On the **Insert** menu, click **Columns**.

Insert rows

1. To insert a single row, click a cell in the row immediately below where you want the new row. For example, to insert a new row above Row 5, click a cell in Row 5.

   To insert multiple rows, select rows immediately below where you want the new rows. Select the number of rows you want to insert.

2. On the **Insert** menu, click **Rows**.

Move or copy whole cells

1. Select the cells you want to move or copy.
2. Point to the border of the selection.

3. To move the cells, drag the selection to the upper-left cell of the paste area. Microsoft Excel replaces any existing data in the paste area.
4. To copy the cells, hold down CTRL as you drag.

To insert the cells between existing cells, hold down SHIFT (if moving) or SHIFT+CTRL (if copying) as you drag.
To drag the selection to a different sheet, hold down ALT and drag over a sheet tab.

Tip To move or copy cells to a different workbook or a long distance, select the cells and click **Cut Button** to move the cells or **Copy Button** to copy the cells. Switch to the other sheet or workbook, select the upper-left cell of the paste area, and then click **Paste Button**

Find text or numbers

1. Select the range of cells you want to search.

   To search the entire sheet, click any cell.

2. On the **Edit** menu, click **Find**.

3. In the **Find what** box, enter the text or numbers you want to search for.

4. In the **Look in** box, click the type of information you want to search for.

5. Click **Find Next**.

3.3.3 Formatting & Printing
Apply borders to cells

1. Select the cells you want to add borders to.

To apply the most recently selected border style, click **Borders Button** on the **Formatting** toolbar To apply a different border style, click the arrow next to **Borders Button**, and then click a border on the palette.
Tips

- **More border settings** To apply additional border styles, click **Cells** on the **Format** menu, and then click the **Border** tab. Click the line style you want, and then click a button to indicate the border placement.

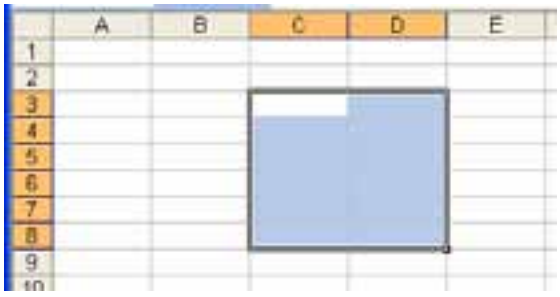
- **Borders and rotated text** To apply borders to selected cells that contain rotated text, use the **Outline** and **Inside buttons** on the **Border** tab. The borders are applied to the edges of the cells, which are rotated to the same degree as the rotated text.

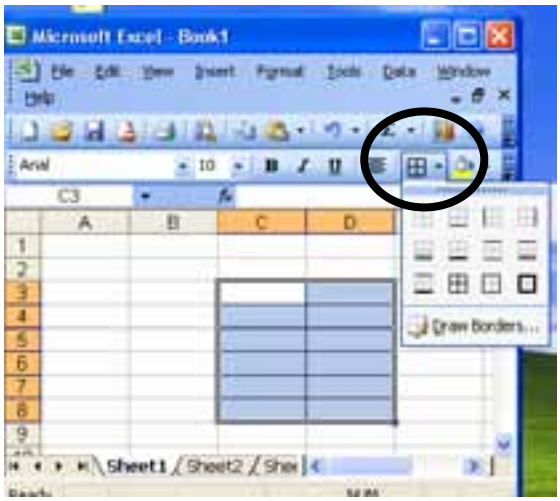
- **Border styles** To change the line style of an existing border, select the cells that the border appears on. On the **Border** tab, click a new style in the **Style** list, and then click the border you want to change in the diagram under **Border**.

Shade cells in solid colors

1. Select the cells you want to apply shading to.
2. To apply the most recently selected color, click **Fill Color** on the **Formatting toolbar**
3. 

   To apply a different color, click the arrow next to **Fill Color**, and then click a color on the palette.





Remove borders

1. Select the cells you want to remove borders from.
2. On the **Formatting toolbar**, click the arrow next to **Borders** and then click on the **palette**.

Remove shading

1. Select the cells you want to remove shading from.

On the Formatting toolbar, click the arrow next to Fill Color, and then click No Fill.

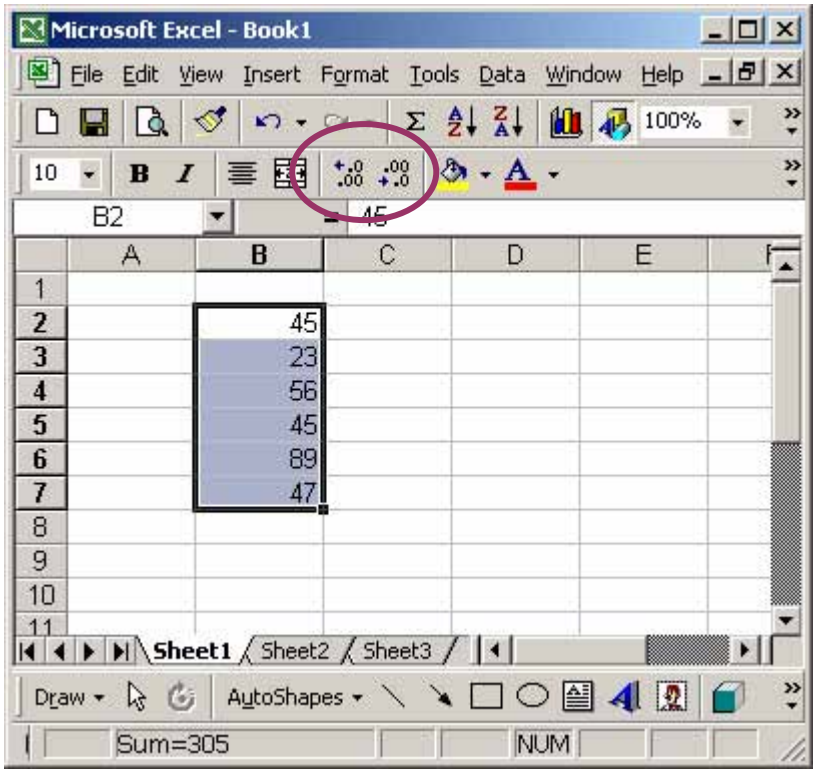
Increase or decrease the number of decimal places shown

Select the cells you want to format.

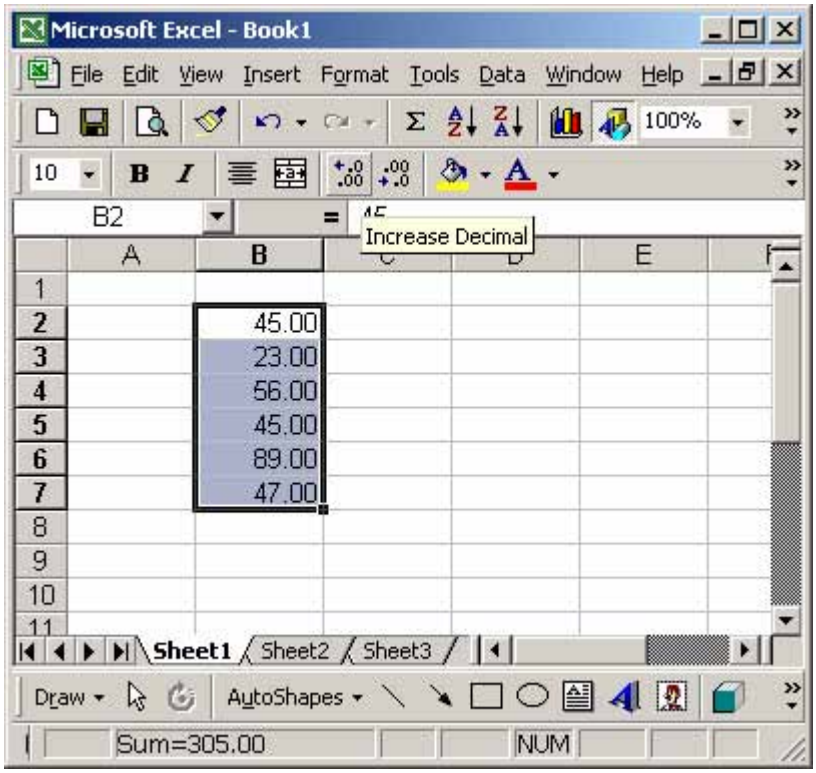
On the Formatting toolbar, do one of the following:

To display fewer digits after the decimal point, click Decrease Decimal To display more digits after the decimal point, Increase Decimal

1. Select data

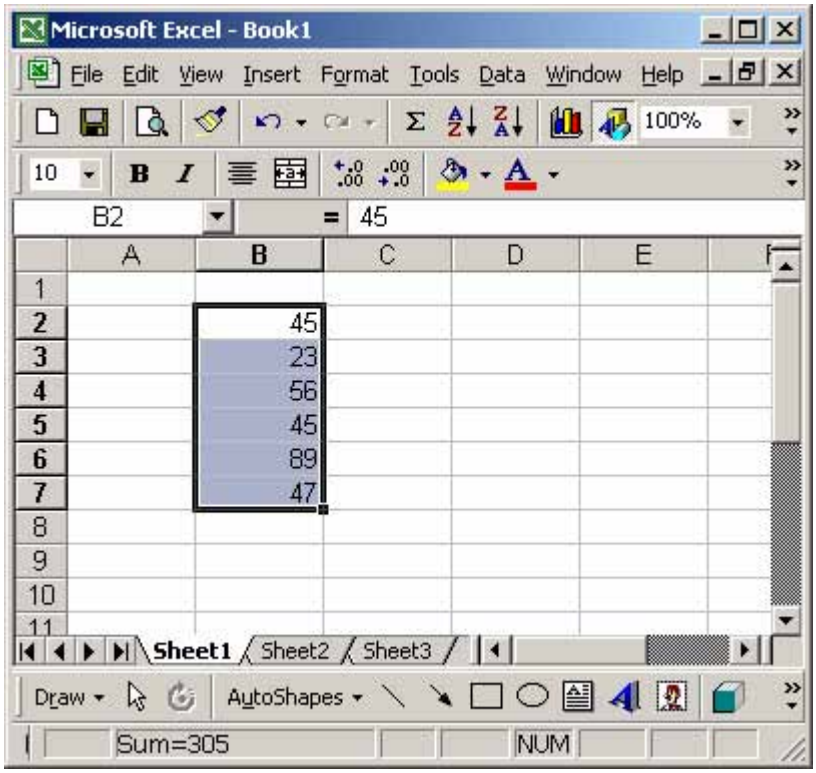


3. Click twice Increase Decimal Button

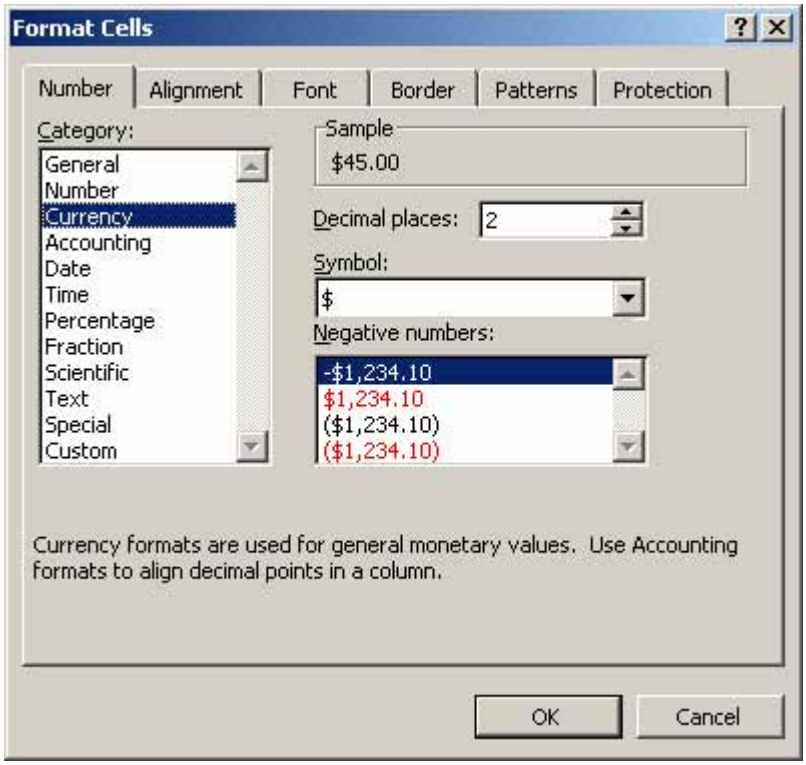


Format Cell as Currency

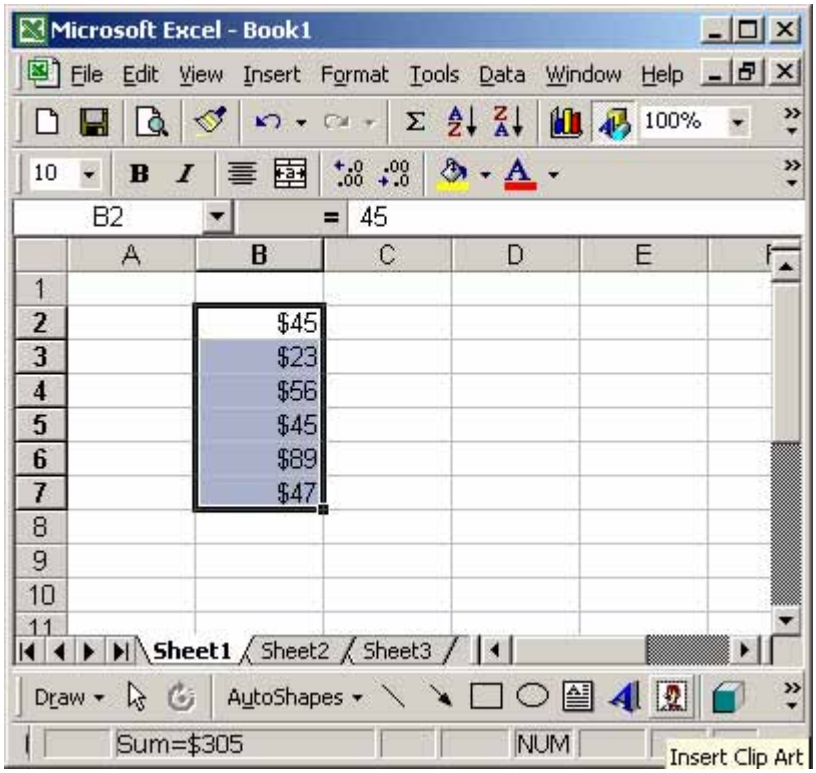
1. Select the cells



2. Click cells in the format menu



3. Select Currency Under the number tab
4. Select Symbol and Click Ok



Show numbers as percentages

1. Select the cells you want to format.

2. On the **Format** menu, click **Cells**, and then click the **Number** tab.
3. In the **Category** list, click **Percentage**.

Notes

- Numbers above 1 are automatically entered as percentages; and numbers below 1 are converted to percentages by multiplying by 100. For example, entering 10 results in 10%, and entering .1 results in 10%. To have all numbers converted by multiplying by 100, on the **Tools** menu, click **Options**, click the **Edit** tab, and then clear the **Enable automatic percent entry** check box.

- To quickly display numbers as percentages of 100, click **Percent Style** on the **Formatting** toolbar

Show or hide the thousands separator in a number

1. Select the cells you want to format.

2. On the **Format** menu, click **Cells**, and then click the **Number** tab.
3. In the **Category** list, click **Number**.

4. Select or clear the **Use 1000 separator (,)** check

Enter a formula

For information about how formulas calculate values, click .

1. Click the cell in which you want to enter the **formula**

   Type **=** (an equal sign).
   If you click **Edit Formula** or **Paste Function Button**, Microsoft Excel inserts an equal sign for you.

2. Enter the formula.

3. Press ENTER.

Tips

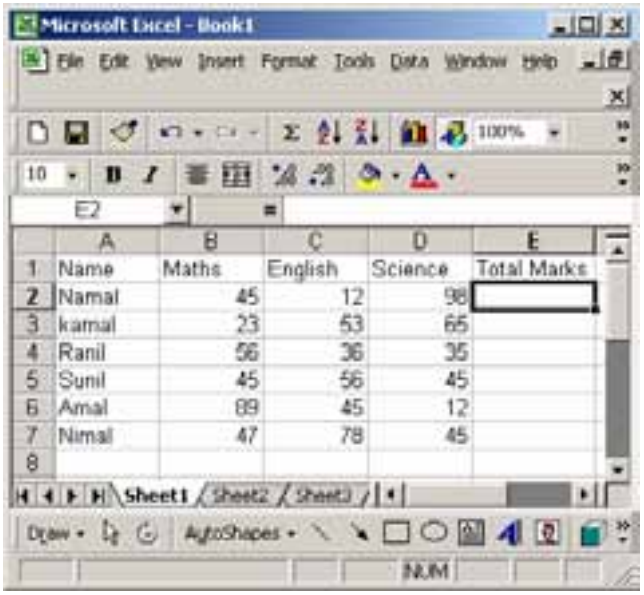
- You can enter the same formula into a range of cells by selecting the range first, typing the formula, and then pressing CTRL+ENTER.

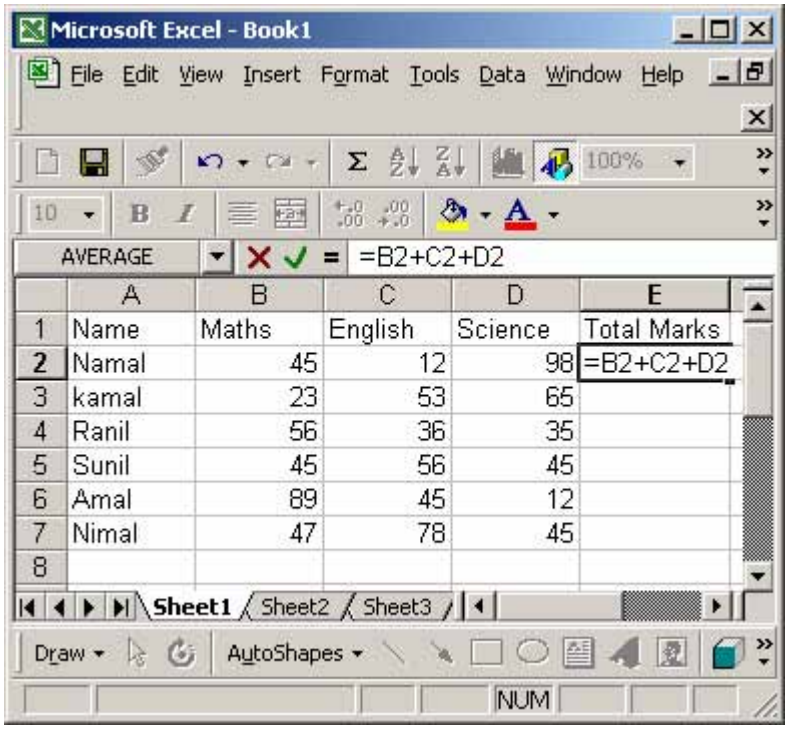
- You can also enter a formula into a range of cells by copying a formula from another cell. For more information about copying a formula, click.

Eg.

1. Type data as follows
2. Click Cell E2

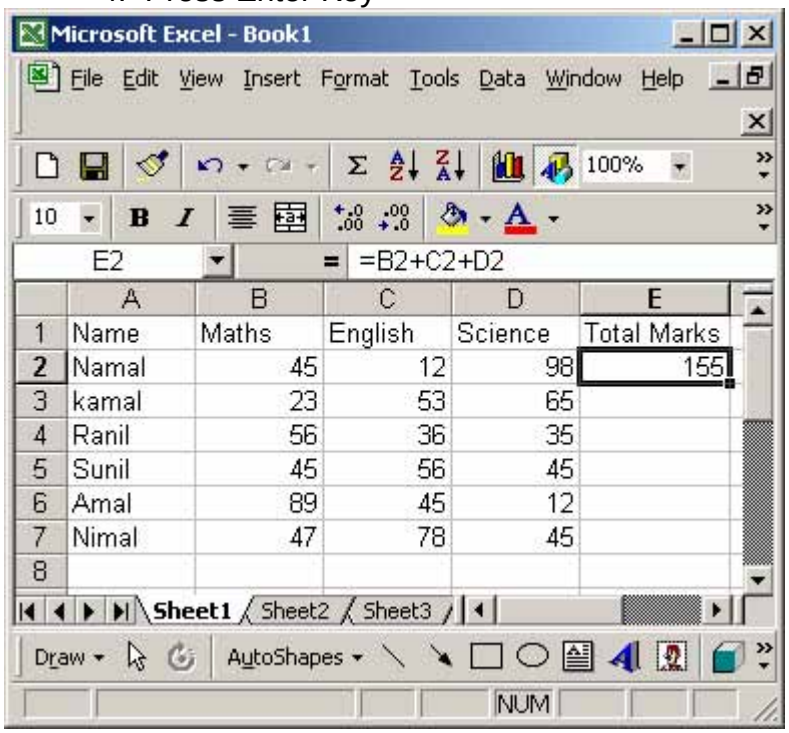
3. Type =B2+C2+D2





	A	B	C	D	E
1	Name	Maths	English	Science	Total Marks
2	Namal	45	12	98	=B2+C2+D2
3	kamal	23	53	65	
4	Ranil	56	36	35	
5	Sunil	45	56	45	
6	Amal	89	45	12	
7	Nimal	47	78	45	
8					

4. Press Enter Key



	A	B	C	D	E
1	Name	Maths	English	Science	Total Marks
2	Namal	45	12	98	155
3	kamal	23	53	65	
4	Ranil	56	36	35	
5	Sunil	45	56	45	
6	Amal	89	45	12	
7	Nimal	47	78	45	
8					

5. Copy formula E3 to E 7

A formula is an equation that performs operations on worksheet data. Formulas can perform mathematical operations, such as addition and multiplication, or they can compare worksheet values or join text. Formulas can refer to other cells on the same worksheet, cells on other sheets in the same workbook, or cells on sheets in other workbooks.

Entering formulas When you create a formula that contains a function, the Formula Palette helps you enter worksheet functions. As you enter a function into the formula, the Formula Palette displays the name of the function, each of its arguments, a description of the function and each argument, the current result of the function, and the current result of the entire formula. To display the Formula Palette, click **Edit Formula Button** in the formula bar

Editing formulas You can use the Formula Palette to edit functions in formulas. Select a cell that contains a formula, and then click **Edit Formula Button**

To display the Formula Palette. The first function in the formula and each of its arguments appear in the palette. You can edit the first function or edit another function in the same formula by clicking in the formula bar anywhere within the function.

Calculation operators in formulas

Operators specify the type of calculation that you want to perform on the elements of a formula. Microsoft Excel includes four different types of calculation operators: arithmetic, comparison, text, and reference.

Arithmetic operators

To perform basic mathematical operations such as addition, subtraction, or multiplication; combine numbers; and produce numeric results, use the Following arithmetic operators.

Arithmetic operator	Meaning	Example
+ (plus sign)	Addition	3+3
– (minus sign)	Subtraction Negation	3–1 –1
* (asterisk)	Multiplication	3*3
/ (forward slash)	Division	3/3
% (percent sign)	Percent	20%
^ (caret)	Exponentiation	3^2 (the same as 3*3)

Comparison operators

You can compare two values with the following operators. When using these operators compares two values, the result is a logical value, either TRUE or FALSE.

Comparison operator	Meaning	Example
= (equal sign)	Equal to	A1=B1
> (greater than sign)	Greater than	A1>B1
< (less than sign)	Less than	A1<B1
>= (greater than or equal to sign)	Greater than or equal to	A1>=B1
<= (less than or equal to sign)	Less than or equal to	A1<=B1
<> (not equal to sign)	Not equal to	A1<>B1

Text concatenation operator

Ampersand (&) operator used to join, or concatenate, one or more text strings to produce a single piece of text.

Text operator	Meaning	Example
& (ampersand)	Connects, or concatenates, two values to produce one continuous text value	"North" & "wind" produce "Northwind"

	A	B	C	D
1	First name	Last Name	Full Name	
2	A.P	Saman		
3	K.A	Kamal		
4	R.Y	Sunil		
5	P.	Ranil		
6	S.T	Nimal		
7				
8				

- Click Cell c2
- Type =A2&" "&B2
- Press Enter

	A	B	C	D
1	First name	Last Name	Full Name	
2	A.P	Saman	A.P Saman	
3	K.A	Kamal		
4	R.Y	Sunil		
5	P.	Ranil		
6	S.T	Nimal		
7				
8				
9				

Reference operators Combine ranges of cells for calculations with the following operators.

Reference operator	Meaning	Example
: (colon)	Range operator, which produces one reference to all the cells between two references, including the two references	B5:B15
, (comma)	Union operator, which combines multiple references into one reference	SUM(B5:B15,D5:D15)

Key The order in which Microsoft Excel performs operations in formulas

If you combine several operators in a single formula, Microsoft Excel performs the operations in the order shown in the following table. If a formula contains operators with the same precedence — for example, if a formula contains both a multiplication and division operator — Excel evaluates the operators from left to right. To change the order of evaluation, enclose the part of the formula to be calculated first in parentheses. For more information about calculation operators,

Operator	Description
: (colon) (single space) , (comma)	Reference operators
–	Negation (as in –1)
%	Percent
^	Exponentiation
* and /	Multiplication and division
+ and –	Addition and subtraction
&	Connects two strings of text (concatenation)
= < > <= >= <>	Comparison

Function

A pre-written formula that takes a value or values, performs an operation, and returns a value or values. Use functions to simplify and shorten formulas on a worksheet, especially those that perform lengthy or complex calculations.

Sum Function

Adds all the numbers in a range of cells.

Syntax

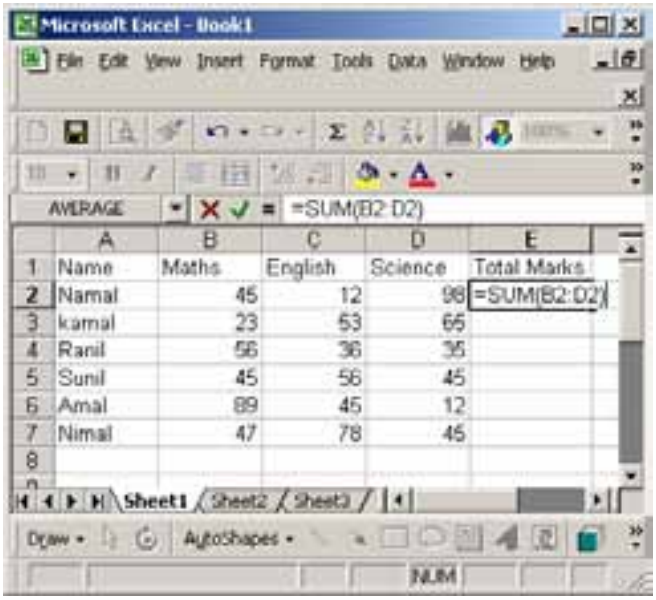
SUM (number1,number2, ...)

Number1, number2, ... are 1 to 30 arguments for which you want the total value or sum.

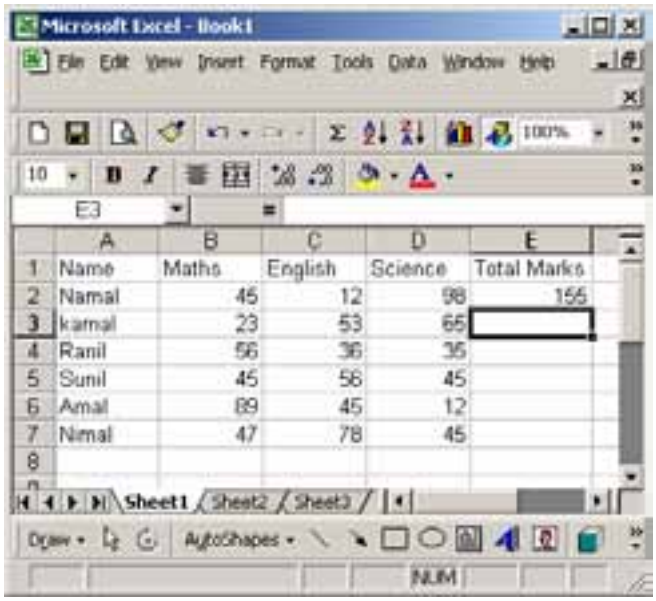
Numbers, logical values, and text representations of numbers that you type directly into the list of arguments are counted. See the following first and second examples.

Eg1

SUM(3, 2) equals 5

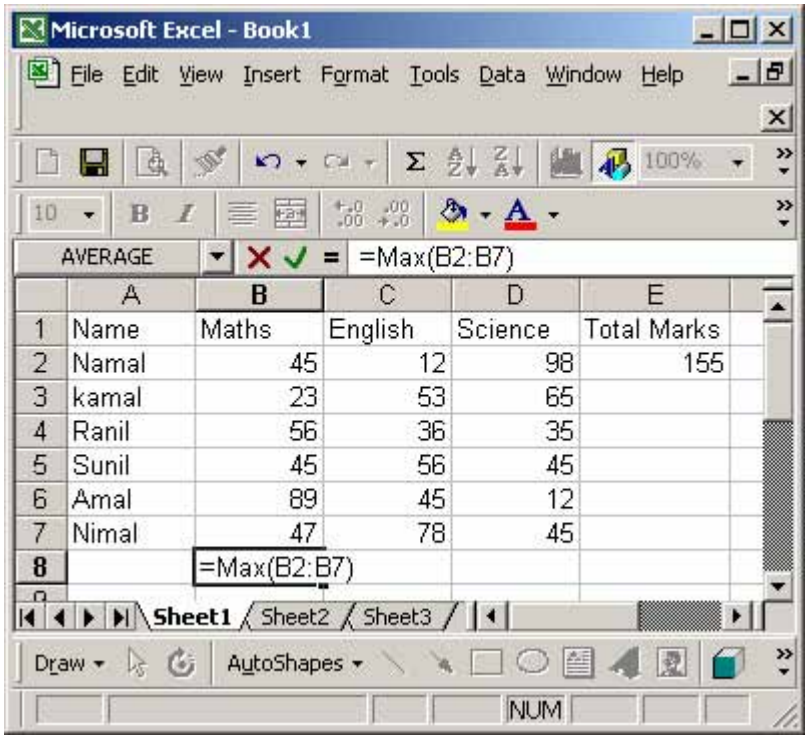


Ex 2

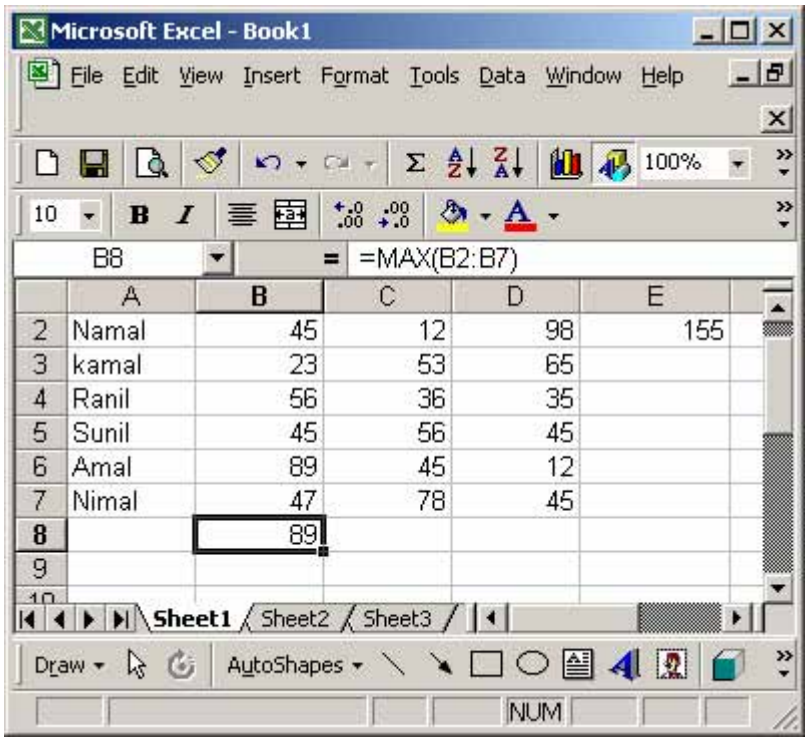


Find maximum value -Max Function

1. Click B8 Cell
2. Type =Max(B2:B7)



3. Press Enter



IF function

Returns one value if a condition you specify evaluates to TRUE and another value if it evaluates to FALSE.

Syntax
IF(**logical_test**,**value_if_true**,value_if_false)

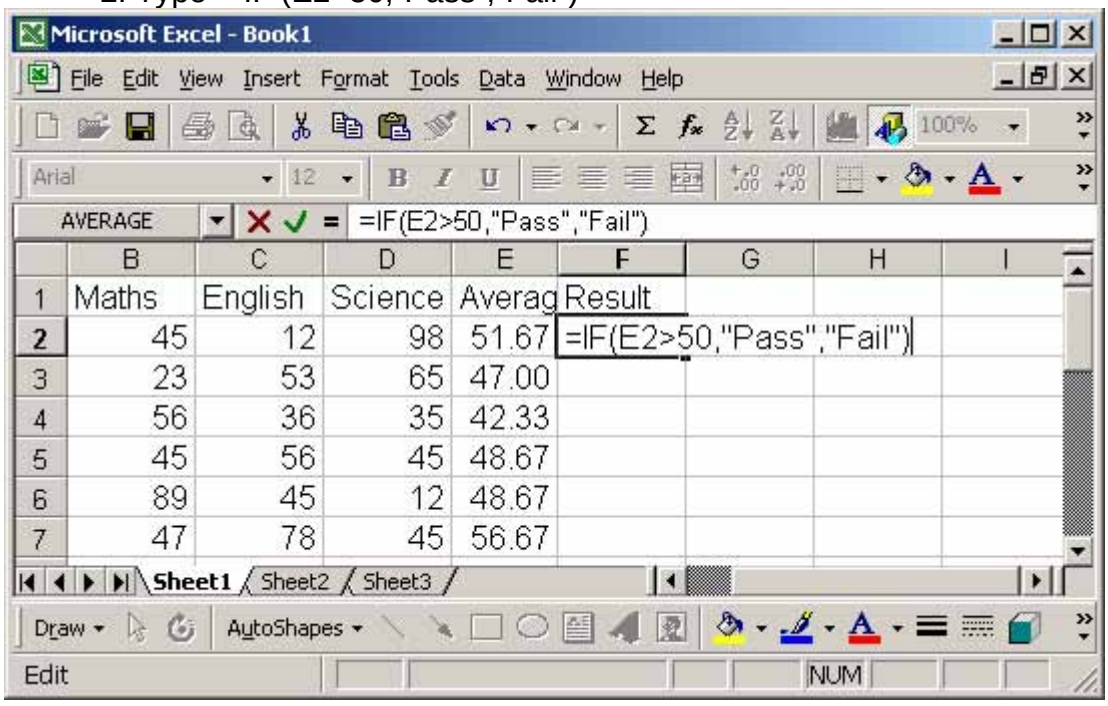
Logical_test is any value or expression that can be evaluated to TRUE or FALSE. For example, A10=100 is a logical expression; if the value in cell A10 is equal to 100, the expression evaluates to TRUE. Otherwise, the expression evaluates to FALSE.

Value_if_true is the value that is returned if logical_test is TRUE.

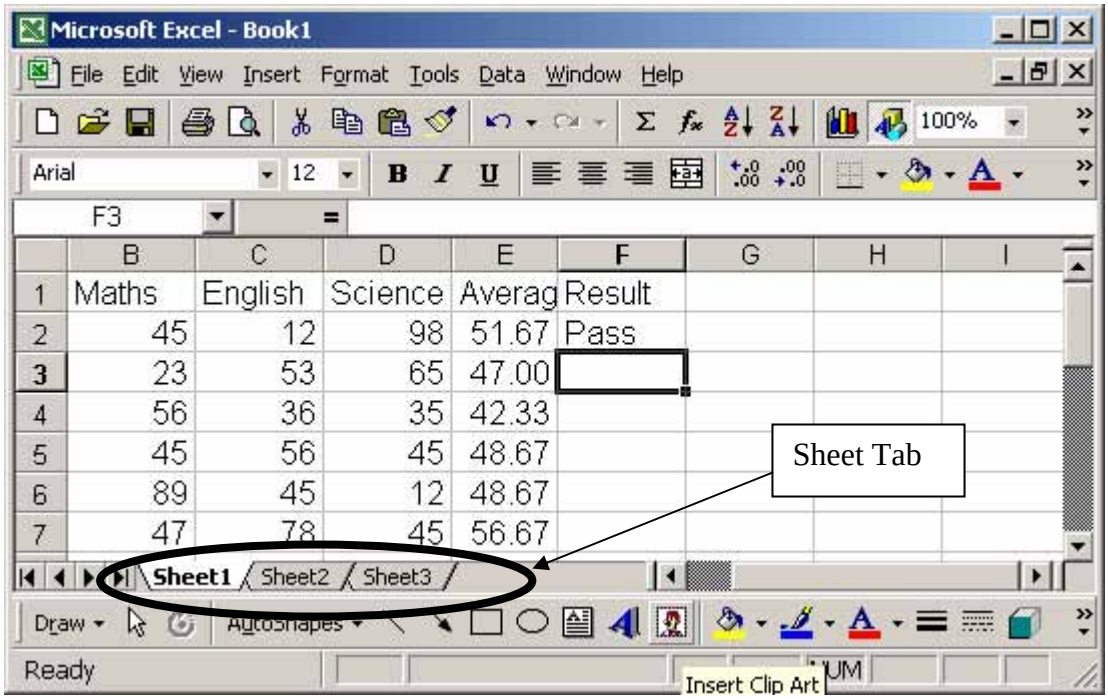
Value_if_false is the value that is returned if logical_test is FALSE.

Ex 1

1 Click Cell F2
2. Type = IF (E2>50,"Pass","Fail")



3. Press Enter Key



Note IF Average >70 display "A"
If Average <70 and >60 display "B"
If average <60 and >50 display "C"
Otherwise display "D"

type and See this Function
=IF(E2>=70,"A",IF(E2>=60,"B",IF(E2>=50,"C","D")))

Ex 2

	A	B	C	D	E	F	G
1		**Income**		Jan	Feb	Mar	Apr
2			Basic Salary	12000	12000	12000	12000
3			Allowances	2000	2000	2000	2000
4			O/T	1500	1500	1500	1500
5			Tax	1200	1200	1300	1250
6			Net Salary				
7							
8							
9							
10		**Expenditure**					
11			Food	6000	7066	7000	756
12			Traveling	2000	1500	1400	2500
13			Water Bill	500	450	523	625
14			Electricity Bill	600	700	652	875
15			Telephone	1000	1200	1500	1200
16			Total expenditure				
17		**Balance**					

1.

- Select D2 to G18
- Click cells in the format menu
- Select currency under number tab

	A	B	C	D	E	F	G
1		**Income**		Jan	Feb	Mar	Apr
2			Basic Salary	$12,000.00	$12,000.00	$12,000.00	$12,000.00
3			Allowances	$2,000.00	$2,000.00	$2,000.00	$2,000.00
4			O/T	$1,500.00	$1,500.00	$1,500.00	$1,500.00
5			Tax	**$15,500.00**	**$15,500.00**	**$15,500.00**	**$15,500.00**
6							
7							
8							
9							
10		**Expenditure**					
11			Food	$6,000.00	$7,066.00	$7,000.00	$756.00
12			Traveling	$2,000.00	$1,500.00	$1,400.00	$2,500.00
13			Water Bill	$500.00	$450.00	$523.00	$625.00
14			Electricity Bill	$600.00	$700.00	$652.00	$875.00
15			Telephone	$1,000.00	$1,200.00	$1,500.00	$1,200.00
16			Total expenditure	**$10,100.00**	**$10,916.00**	**$11,075.00**	**$5,956.00**
17		**Balance**		**$5,400.00**	**$4,584.00**	**$4,425.00**	**$9,544.00**

2. To Find Net salary
   - Select D6 to G6
   - Type =**Sum(D2:D5)**
   - Press **Ctrl+Enter**

3. To Find Total expenditure
   - Select D16:G16
   - Type =Sum(D11:D15)
   - Press **Ctrl+Enter**

1. To find Balance
   - Select D17 to G17
   - Type =D16-D5
   - Press **Ctrl +Enter**

Managing Work sheet

Move or copy sheets

1. To move or copy sheets to another existing workbook, open the workbook that will receive the sheets.

2. Switch to the workbook that contains the sheets you want to move or copy, and then select the sheets.
3. On the **Edit** menu, click **Move or Copy Sheet**.

4. In the **to book** box, click the workbook to receive the sheets.

   To move or copy the selected sheets to a new workbook, click **New book**.

5. In the **before sheet** box, click the sheet before which you want to insert the moved or copied sheets.

6. To copy the sheets instead of moveing them, select the **Create a copy** check box.

Tip To move sheets within the current workbook, you can drag the selected sheets along the row of sheet tabs. To copy the sheets, hold down CTRL, and then drag the sheets; release the mouse button before you release the CTRL key.

Insert a new worksheet

- To add a single worksheet,
- click **Worksheet** on the **Insert** menu.

To add multiple worksheets

- hold down SHIFT, and then click the number of worksheet tabs you want to add in the open workbook.
- Then click **Worksheet** on the **Insert** menu.

Delete sheets from a workbook

- Select the sheets you want to delete.
- On the **Edit** menu, click **Delete Sheet**.

Rename a sheet

- Double-click the sheet tab.
- Type a new name over the current name.

Display formulas or values on a worksheet

- To switch between displaying formulas and their values for all formulas on a worksheet, press CTRL+` (single left quotation mark).

Create a chart
Create a chart from nonadjacent selections

1. Select the first group of cells that contain the data you want to include.
2. While holding down CTRL, select any additional cell groups you want to include.

   The nonadjacent selections must form a rectangle.

3. Click **Chart Wizard** .

Save a new, unnamed workbook

2. On the **File** menu, click **Save As**.

In the **Save in** list, select the drive and folder where you want to save the workbook.
To save the workbook in a new folder, click Crea**te New Folder**

3. In the **File name** box, type a name for the workbook.
4. Click **Save**.

Save an existing workbook

- Click **Save**

About workbooks and worksheets

Workbooks In Microsoft Excel, a workbook is the file in which you work and store your data. Because each workbook can contain many sheets, you can organize various kinds of related information in a single file.

Worksheets Use worksheets to list and analyze data. You can enter and edit data on several worksheets simultaneously and perform calculations based on data from multiple worksheets. When you create a chart, you can place the chart on the worksheet with its related data or on a separate chart sheet

Sheet tabs The names of the sheets appear on tabs at the bottom of the workbook window. To move from sheet to sheet, click the sheet tabs.

Freeze panes

Freezing panes (pane: A portion of the document window bounded by and separated from other portions by vertical or horizontal bars.) allows you to select data that remains visible when scrolling in a sheet. For example, keeping row and column labels visible as you scroll.

1. To freeze a pane, do one of the following:

   The top horizontal pane Select the row below where you want the split to appear.

   The left vertical pane Select the column to the right of where you want the split to appear.

   Both the upper and left panes Click the cell below and to the right of where you want the split to appear.

2. On the **Window** menu, click **Freeze Panes**.

Chart

Type This Mark Sheet

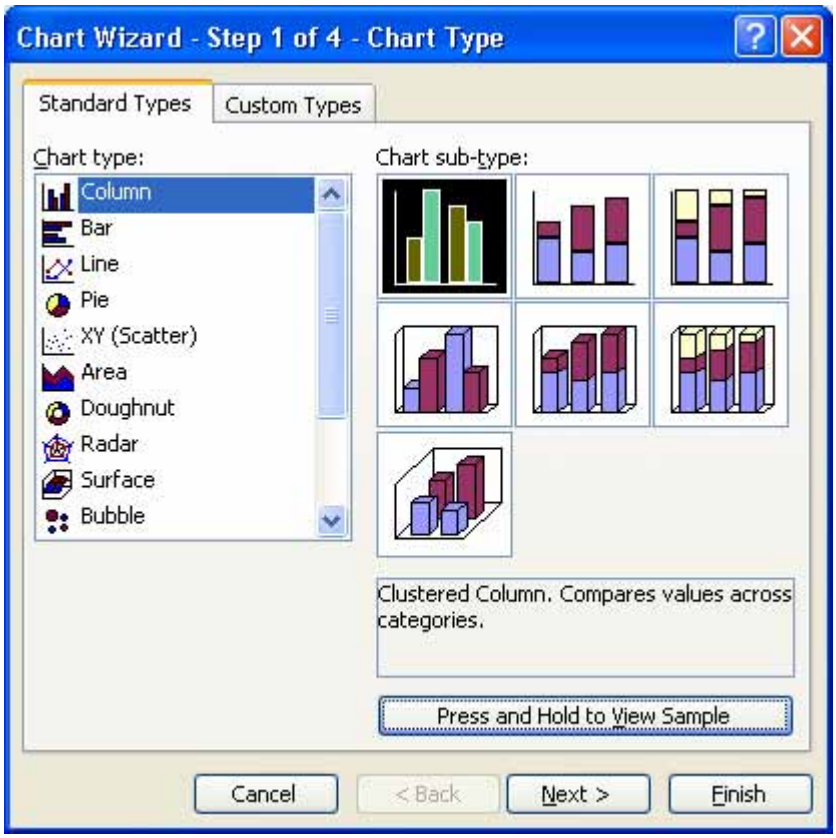
First name	Last Name	Full Name	Maths	English	Science
A.P	Saman	A.P Saman	56	45	63
K.A	Kamal	K.A Kamal	86	98	45
R.Y	Sunil	R.Y Sunil	56	57	58
P.	Ranil	P. Ranil	36	25	74
S.T	Nimal	S.T Nimal	56	36	68

Select names and Marks For the Students

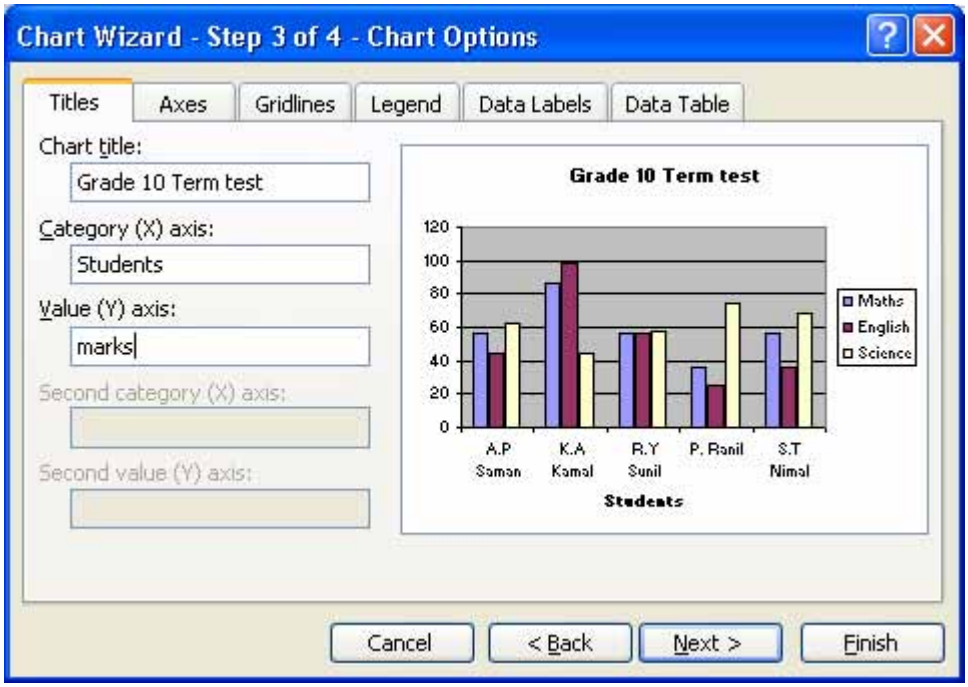
First name	Last Name	Full Name	Maths	English	Science
A.P	Saman	A.P Saman	56	45	63
K.A	Kamal	K.A Kamal	86	98	45
R.Y	Sunil	R.Y Sunil	56	57	58
P.	Ranil	P. Ranil	36	25	74
S.T	Nimal	S.T Nimal	56	36	68

1. Click

Chard Wizard Button Or click chart in the insert menu (you will see following screen)



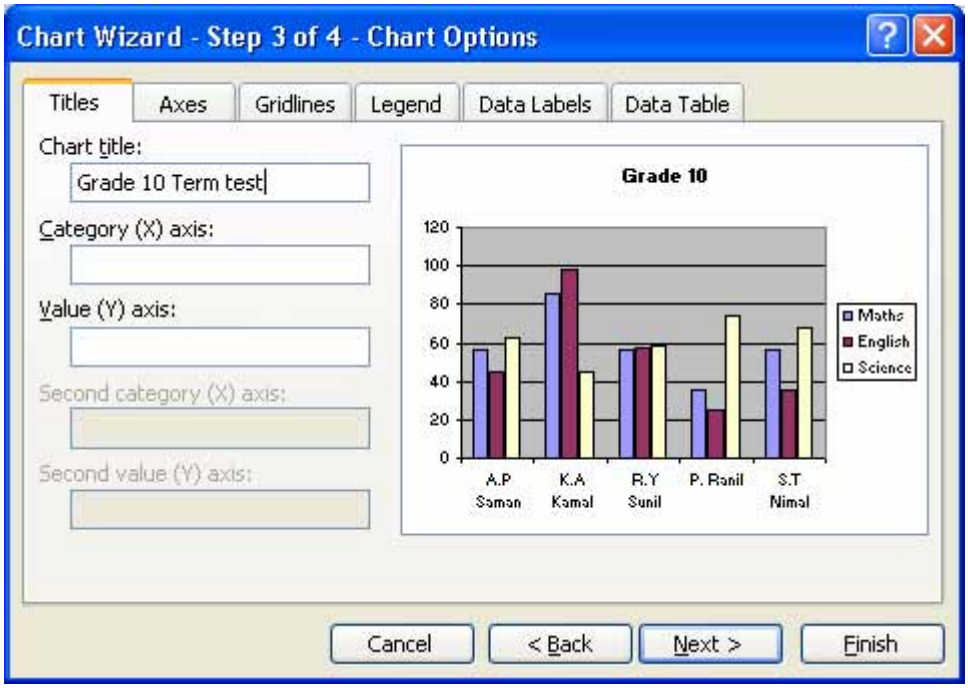
Click Next Button



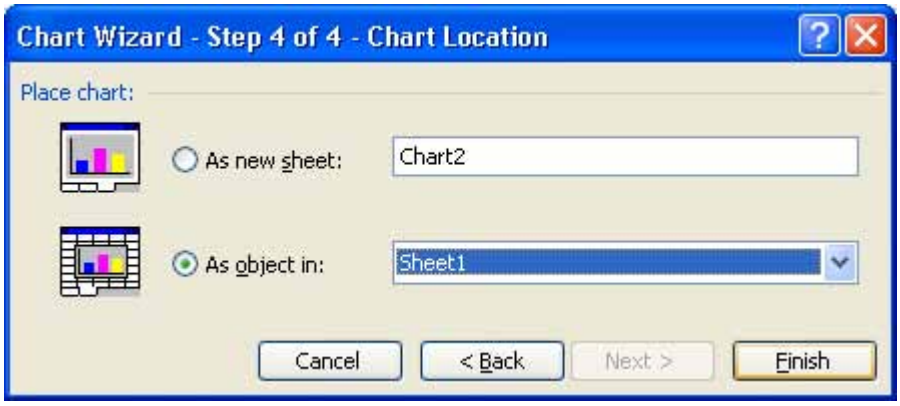
Type

Grade 10 Term Test
Students
marks

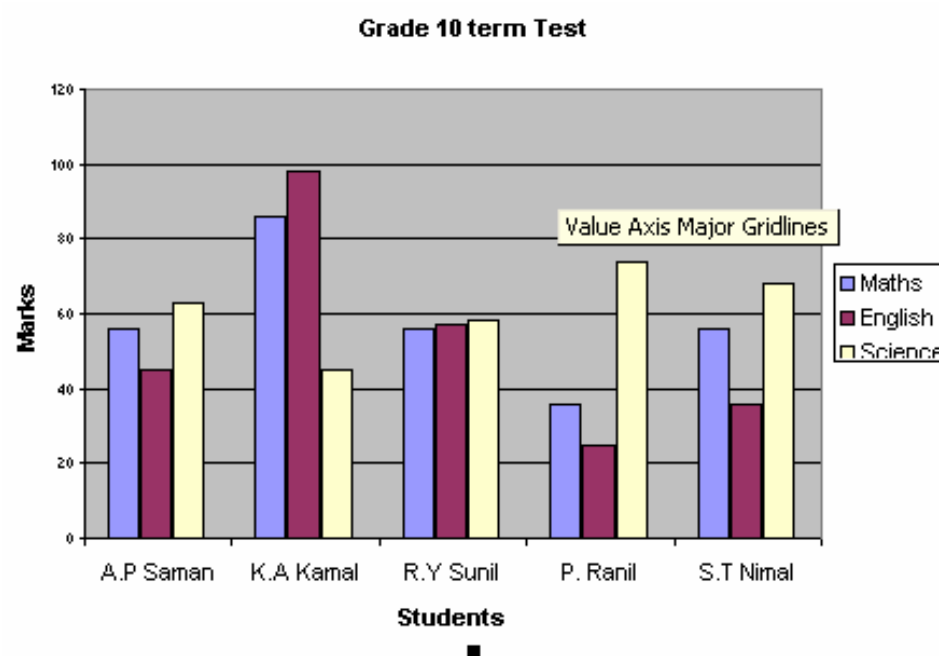
For the Chart Title, Category (X) axis and Value(y) axis respectively



Then click next



Click as new Sheet button and click Finish



Print the active sheets, a selected range, or an entire workbook

If the worksheet has a defined print area, Microsoft Excel will print only the print area. If you select a range of cells to print and then click **Selection**, Microsoft Excel prints the selection and ignores any print area defined for the worksheet.

1. On the **File** menu, click **Print**
2. Under **Print what**, select the option you want.

Tip If you want to print more than one sheet at the same time, select the sheets before you print. For more information about selecting multiple sheets,

3.4 Database Software

3.4.1 Brief introduction to databases

What is a database? Quite simply, it's an organized collection of data related to a particular subject or purpose. A database management system (DBMS) such as Access, FileMaker Pro, Oracle or SQL Server provides you with the software tools you need to organize that data in a flexible manner. It includes facilities to add, modify or delete data from the database, ask questions (or queries) about the data stored in the database and produce reports summarizing selected contents.

Databases are designed to offer an organized mechanism for storing, managing and retrieving information. They do so through the use of **tables**.

Just like Excel tables, database tables consist of columns and rows. Each column contains a different type of attribute and each row corresponds to a single record.

Databases are actually much more powerful than spreadsheets in the way you're able to manipulate data. Here are just a few of the actions that you can perform on a database that would be difficult if not impossible to perform on a spreadsheet:

- Retrieve all records that match certain criteria
- Update records in bulk
- Cross-reference records in different tables
- Perform complex aggregate calculations

Tables comprise the fundamental building blocks of any database. Examine the construction of the table and you'll find that each column of the table corresponds to a specific employee characteristic (or **attribute** in database terms). Each row corresponds to one particular employee and contains his or her information

Tables allow us to create the framework for storing information in a database. Obviously, a database that only stores information would be useless -- we need methods to retrieve information as well.

If you simply want to recall the information stored in a table, Microsoft Access allows you to open the table and scroll through the records contained within it. However, the real power of a database lies in its capabilities to answer more complex requests, or **queries**. Access queries provide the capability to combine data from multiple tables and place specific conditions on the data retrieved.

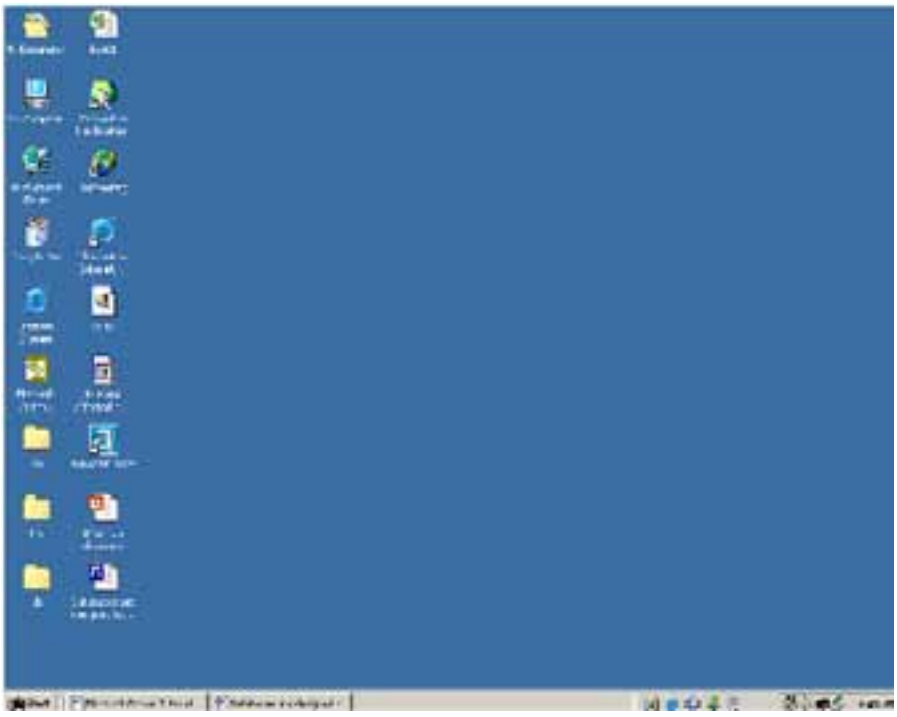
We still need mechanisms to place information into the tables in the first place! Microsoft Access provides two primary mechanisms to achieve this goal. The first method is to simply bring up the table in a window by double-clicking on it and adding information to the bottom of it, just as one would add information to a spreadsheet.

Access also provides a user-friendly **forms** interface that allows users to enter information in a graphical form and have that information transparently passed to the database.

Reports provide the capability to quickly produce attractively formatted summaries of the data contained in one or more tables and/or queries.
We learned that this sort of information could be retrieved from our database through the judicious use of queries. However, recall that this information was presented in a tabular form -- not exactly the most attractive marketing material! Reports allow the inclusion of graphics, attractive formatting and pagination.

Starting Microsoft Access

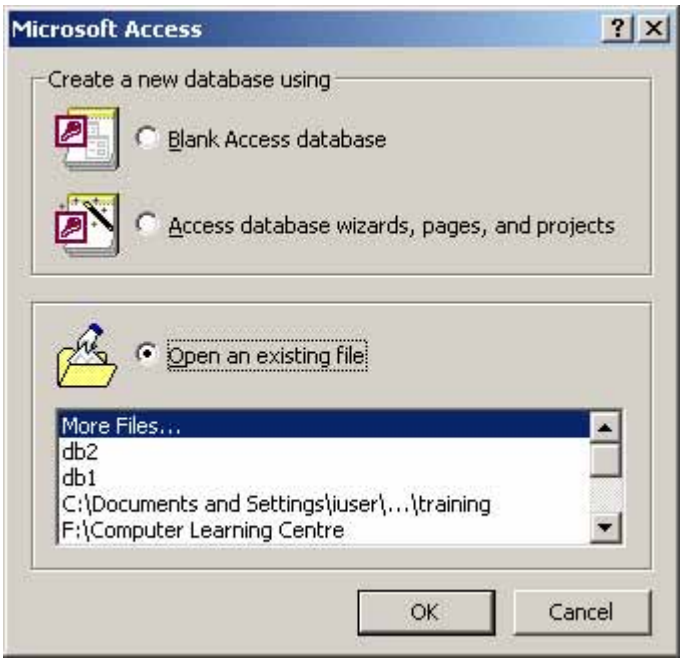
Access can be executed by clicking the Start menu in the lower left-hand corner of the Windows Desktop. A view of a Windows Desktop is given here:



To start Access,

1. Click on the Start button
2. Select the Programs menu
3. Move to the MS Office menu
4. Click on the Microsoft Access menu

Once Access is started, an initial screen will be displayed.



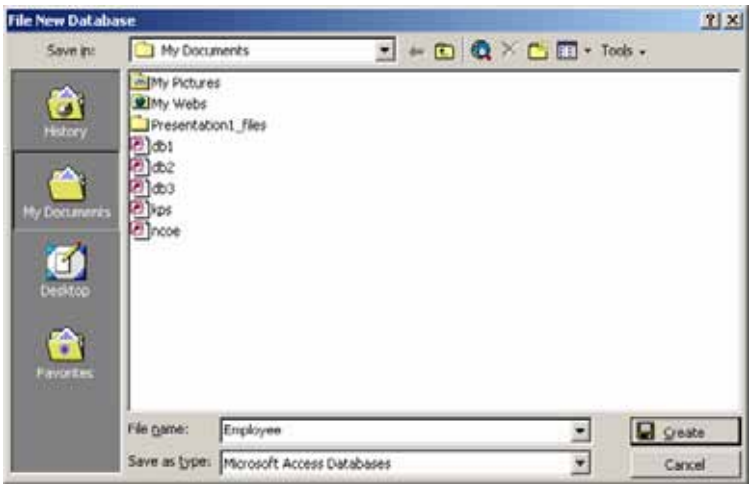
In this screen the user has three options.

1. Create a new blank database
2. Create a new database using wizards
3. Open an existing database

To create a blank database

1. Select the Blank Access database option.
2. Click OK

Then the following screen will be displayed.



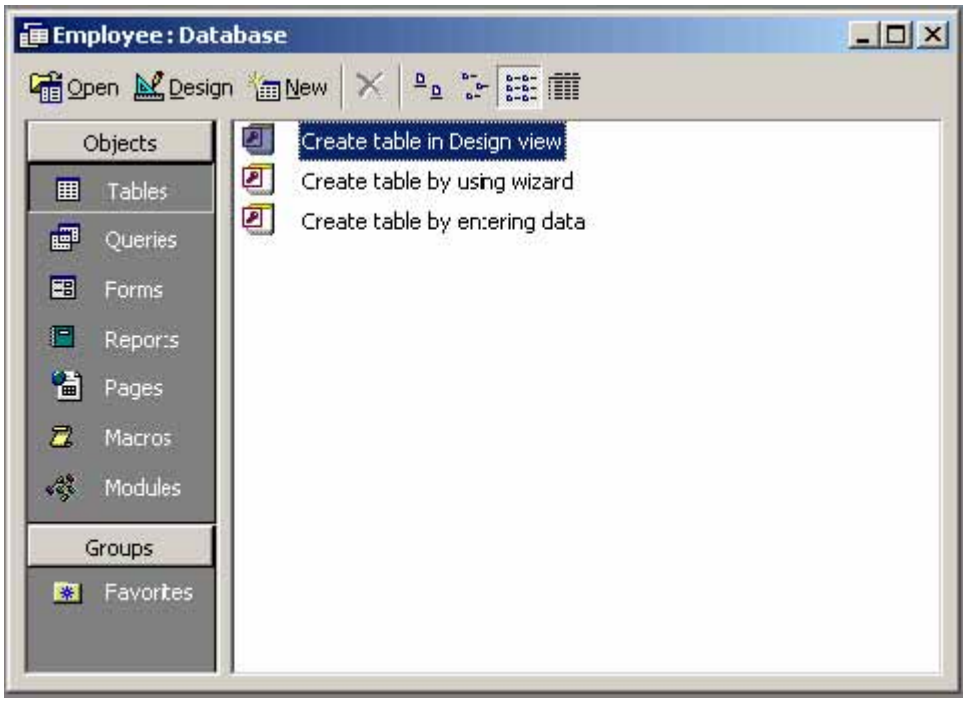
To create the database you have to give it a file name.

1. Fill in a file name in the File name box
2. Click Create button

In this particular database we have given the file name as “Employee”. When giving a name to a database you should keep the following things in mind.

- Keep the name of the database relatively short
- Do not use spaces or other punctuation in the name of the database.
- The name of the database should reflect the database's contents.

Then you will get the following screen. This is the main database window.



The tabs in the main window for the database include:

- Tables - Displays any tables in the database.
- Queries - Displays any queries saved in the database.
- Forms - Displays any forms saved in the database.
- Reports - Displays any reports saved in the database.
- Macros - Displays any macros (short programs) stored in the database.
- Modules - Displays any modules (Visual Basic for Applications procedures) stored in the database.

These tabs appear along the left hand side of the window by default.

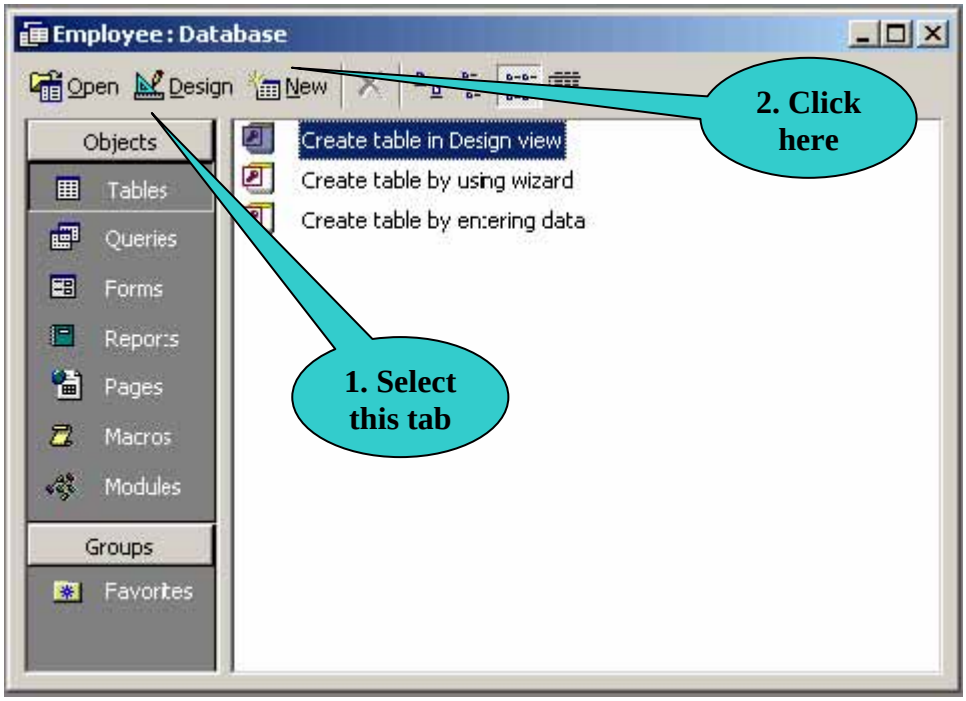
3.4.2 Creating and designing tables

Tables are the main units of data storage in Access. They are made up of one or more columns (or fields).

There are a number of ways to create a table in Access.

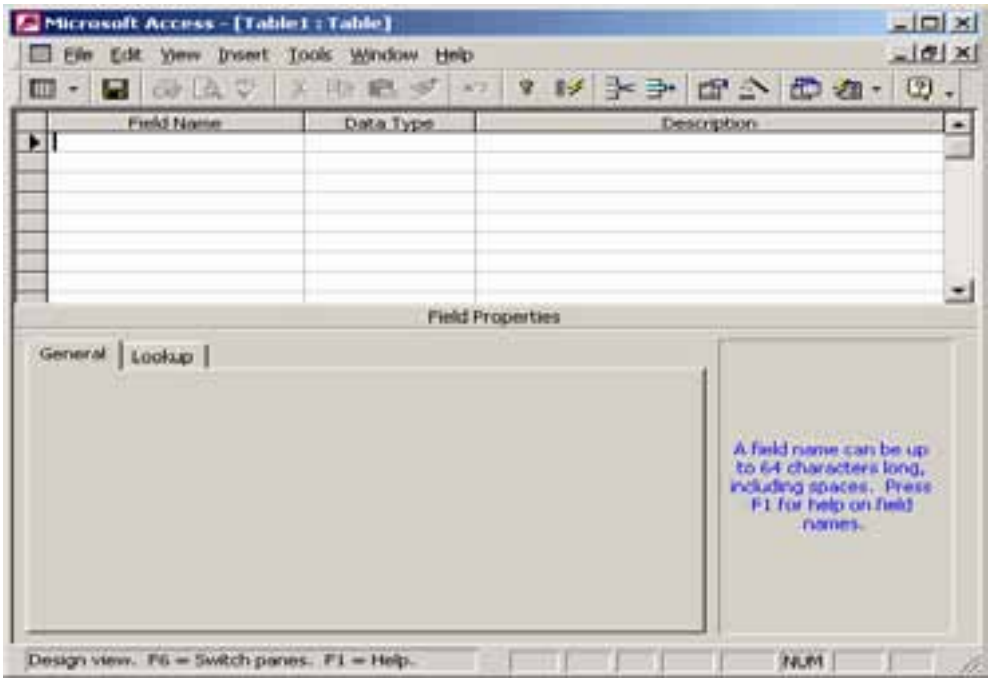
1. Using wizards (guide the user through creating a table)
2. Using the Design View (manually define the columns (fields) and their data types.)

Creating a Table Using the Design View



Highlight Design view in the dialog box you get and click OK button.

The window that appears is called the table design view.



Fill in the **Field Name**, **Data Type** and **Description** for each column/field in the table.

Field Name

When naming a field there are some rules to follow.

- Names can be up to 64 characters long
- Any combination of letters, numbers, spaces, and special characters except a period (.), an exclamation point (!), an accent grave (`), and brackets ([ ]) can be used.
- Do not use leading spaces or control characters (ASCII values 0 to 31).
- Avoid including spaces.
- Avoid using extremely long names because they are difficult to remember and refer to.

It is preferable to use descriptive names for field names.

To define a field name

1. Click in the top row of the Field Name column.
3. Type in the name of the field

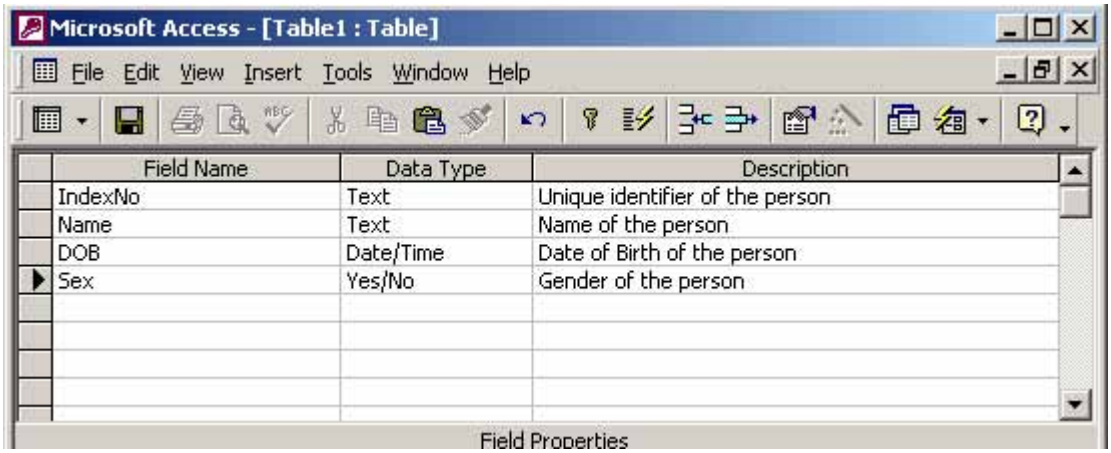
Data Type

Describes what kind of data it can hold. The following data types are available, in a Microsoft Access database.

Data type	Kind of data
Text	Text or numbers
Memo	Long text or numbers
Number	Numbers only
Currency	Currency values
Date/Time	Date and Time values
Auto Number	Serial number
Yes/No	Yes/No, True/False values

After defining the field name, its data type should be defined.

1. Click in the corresponding row of the data type column.
2. If the data type is text, keep the default or click the down arrow to select the data type.



Description

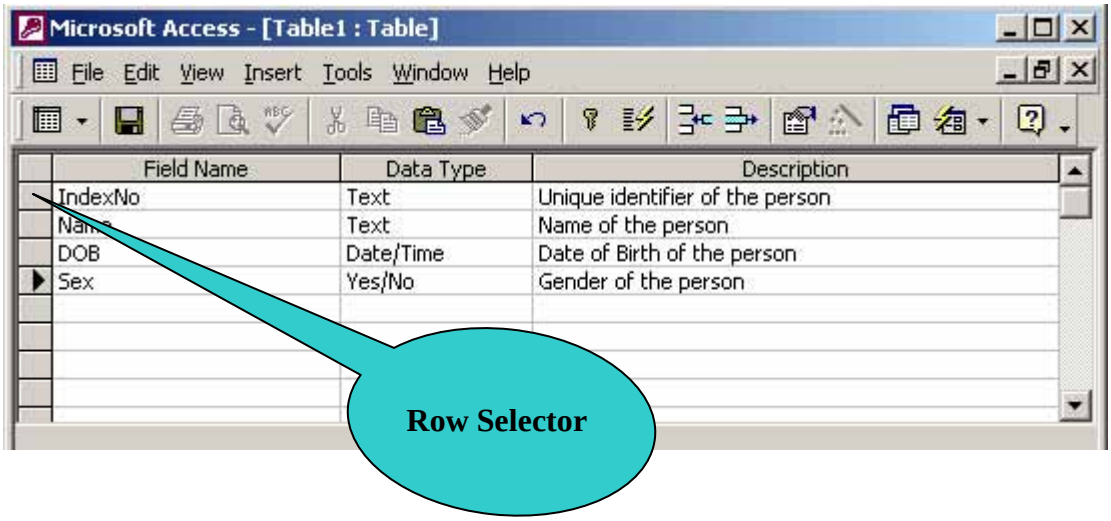
In the description column type what type of information there is in the field.
After filling out the details, it is necessary to define a primary key to the table.

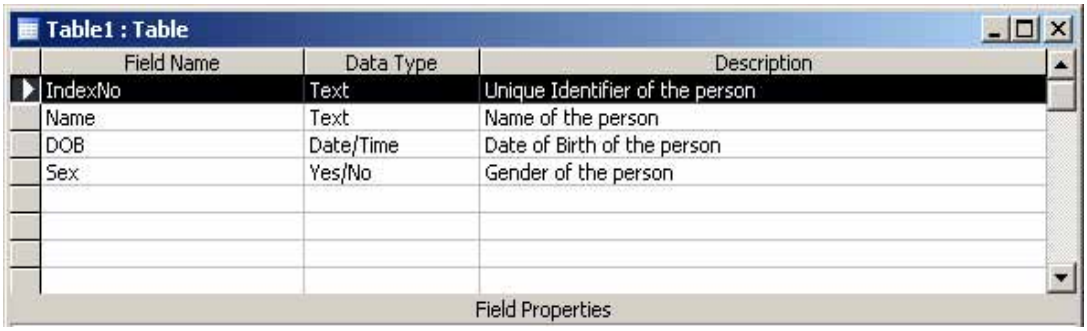
Primary Key

This is a field that can be used to uniquely identify each record in a table. A primary key is used to relate a table to other tables. It doesn't allow Null values.

To define a primary key select the row containing the field which can be used as an unique identifier and click on the primary key tool on the standard tool bar.
Or
Right click on the field and choose primary key on the popup menu.

To select a field click on the row selector (small box left to the field name)
When the primary key is defined a small key appears next to the field name.



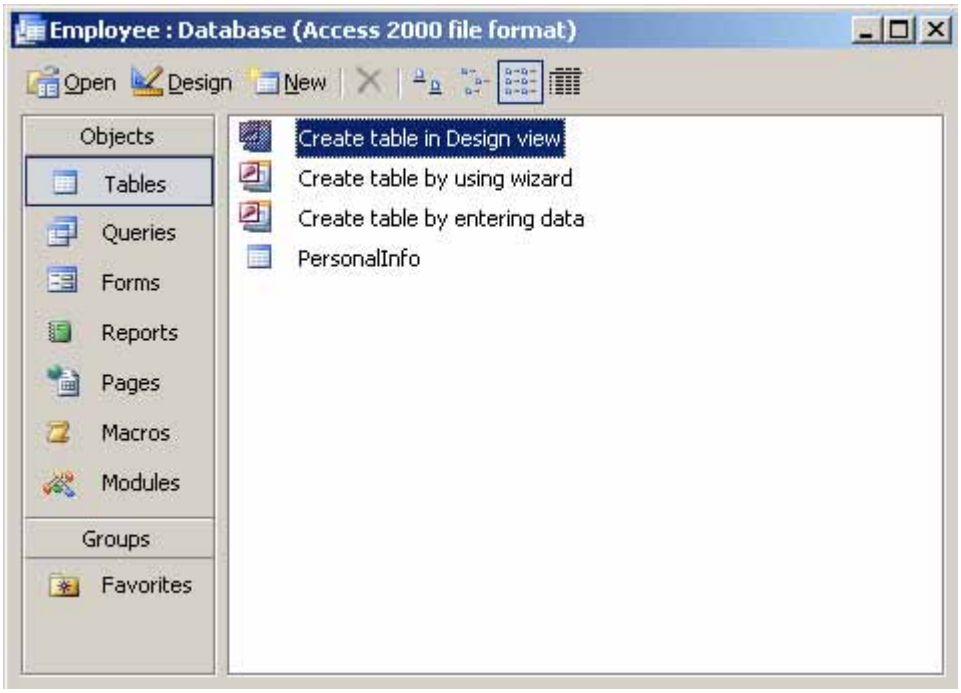


Now Save the table by clicking on the Save icon on the tool bar or

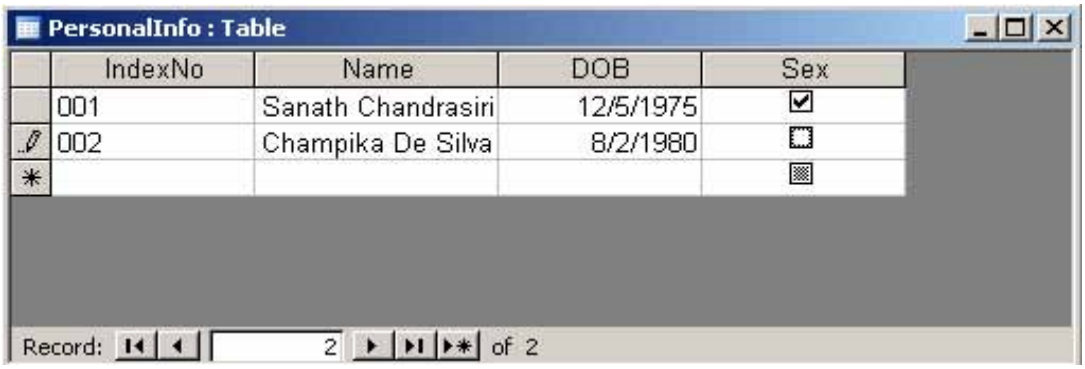
1. Click File menu
2. Select Save

Type a descriptive name for the table and click OK.

Close the design view by clicking on the close button.



Select the "PersonalInfo" table in the database window.
Click Open tab
Enter data in the datasheet view.



Datasheet view

The table must be saved after entering data.

1. Click on the File menu
2. Select Save

To add, delete or change data in an existing table:

1. Click on the **Tables** tab on the Access database window.
2. Highlight the name of the table to be modified and click on the Open button.

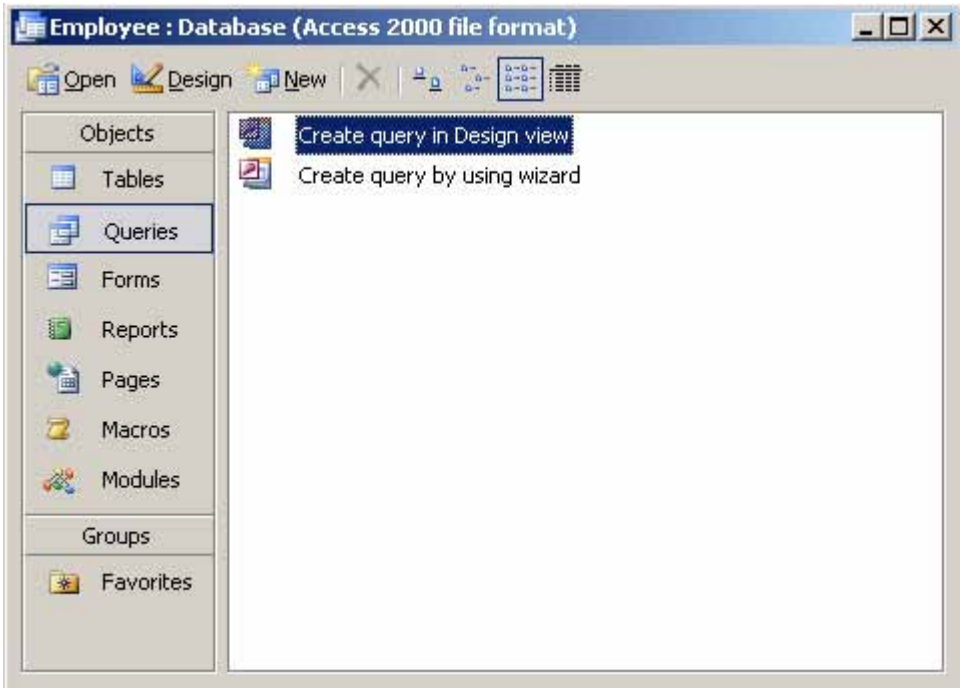
3. Make the necessary changes to the data.
4. Click File menu and choose Save to save the changes.
5. Click File menu and choose Close to close the table

3.4.3 Working with simple queries

Queries are used to view, change, and analyze data in tables.

In the database window

1. select Queries
2. Click New



In the New Query window that appear

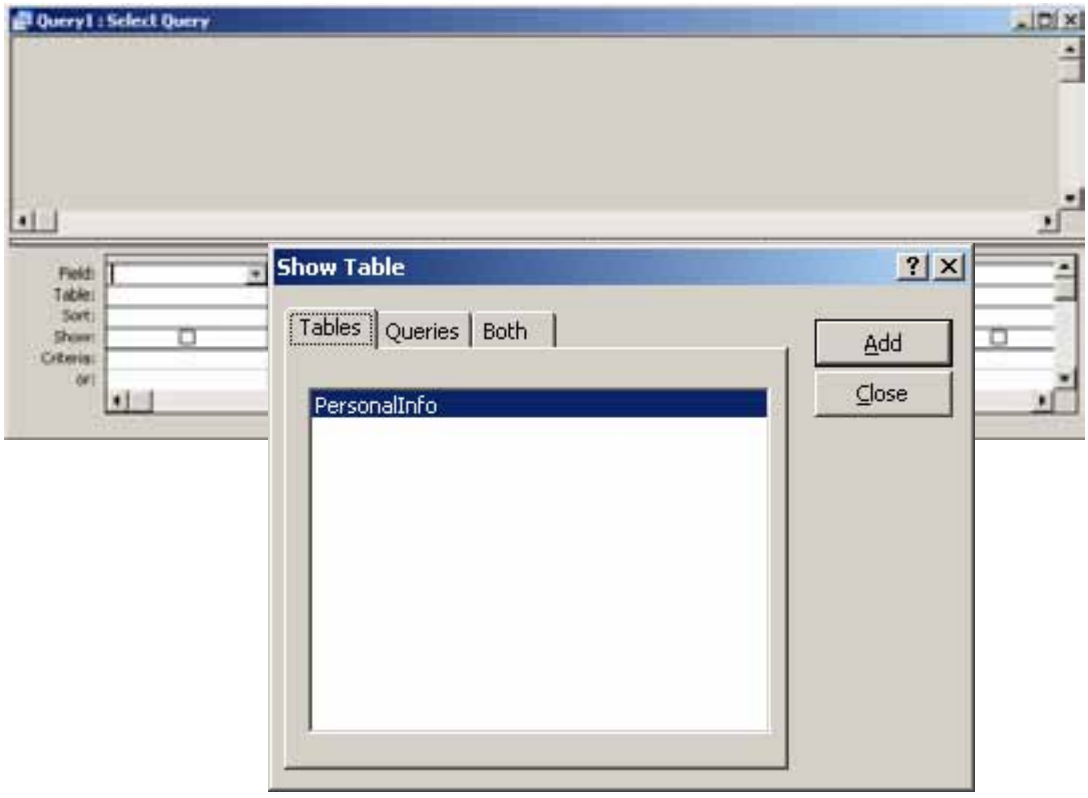
3. Select Design View
4. Click OK

The Query Design view has two major sections. In the top section, the table(s) used for the query are displayed along with the available fields. In the bottom section, those fields that have been selected for use in the query are displayed.

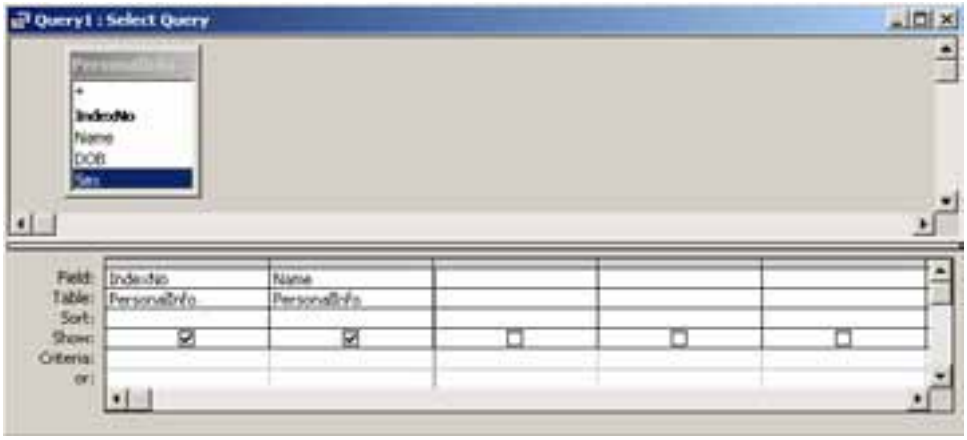
Each field has several options associated with it:

- Field - The name of the field from the table
- Table - The table the field comes from

- Sort - The order in which to sort on this field (Ascending, Descending or Not Sorted)
- Show - Whether or not to display this field in the query output
- Criteria - Indicates how to filter the records in the query output.



5. Click *Add* button on the *Show Table* dialog box to add the table into *Query design view*.
6. Click Close



- The field list is added to the top portion of the design view.
- Add fields to the Field row of the design grid by dragging relevant fields from the field list.

- Specify conditions on which data should be selected in Criteria row.
- To view the results click View button on the tool bar.

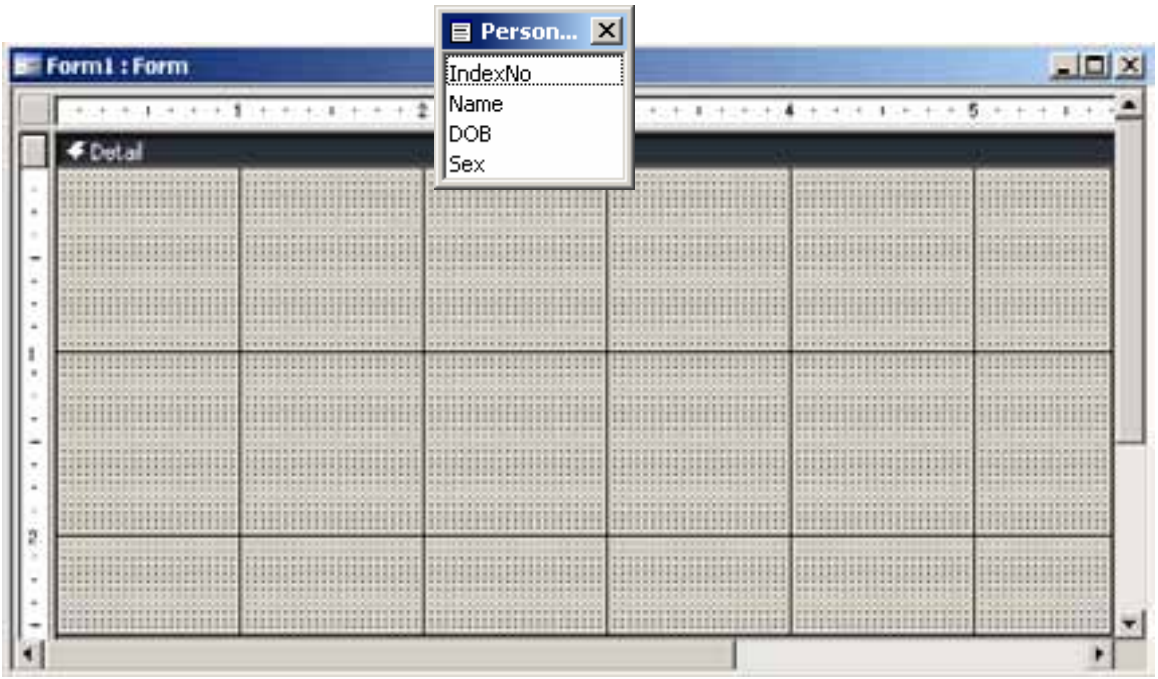
3.4.4 Generating forms

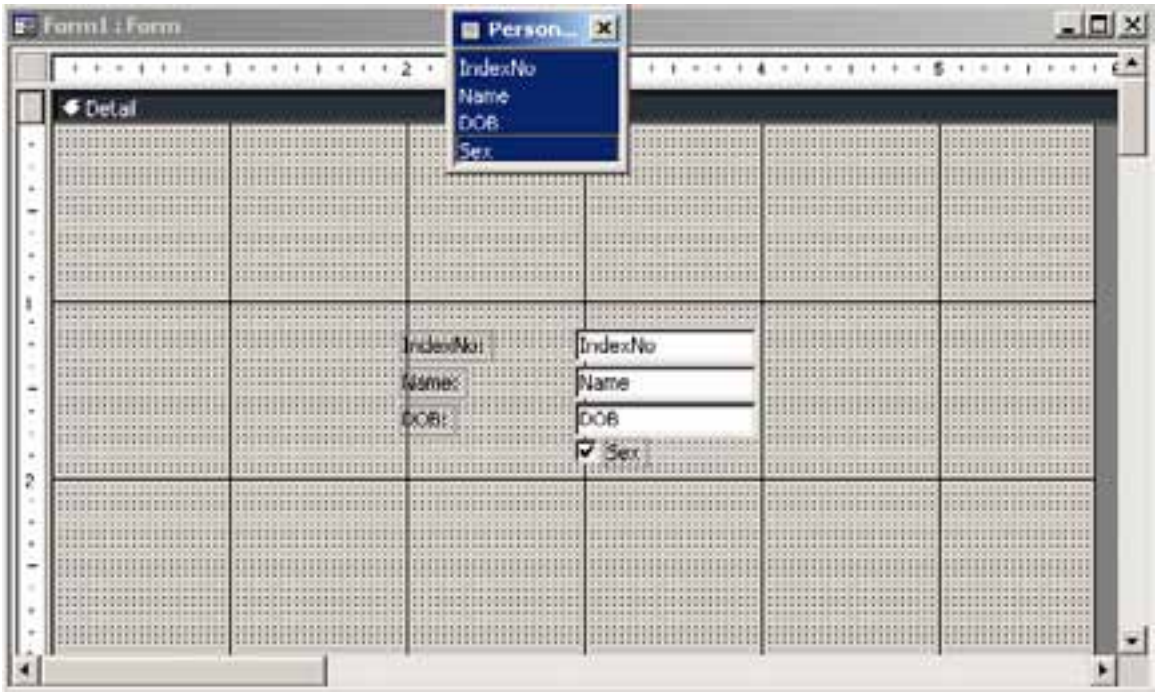
Data entry forms are the primary means of entering or displaying data in a database. They offer a more user-friendly interface by adding labels for each field and other helpful information.
Access provides several different ways of creating data entry forms.

1. Using a Design View
2. Using a wizard

Creation of a Form using Design View

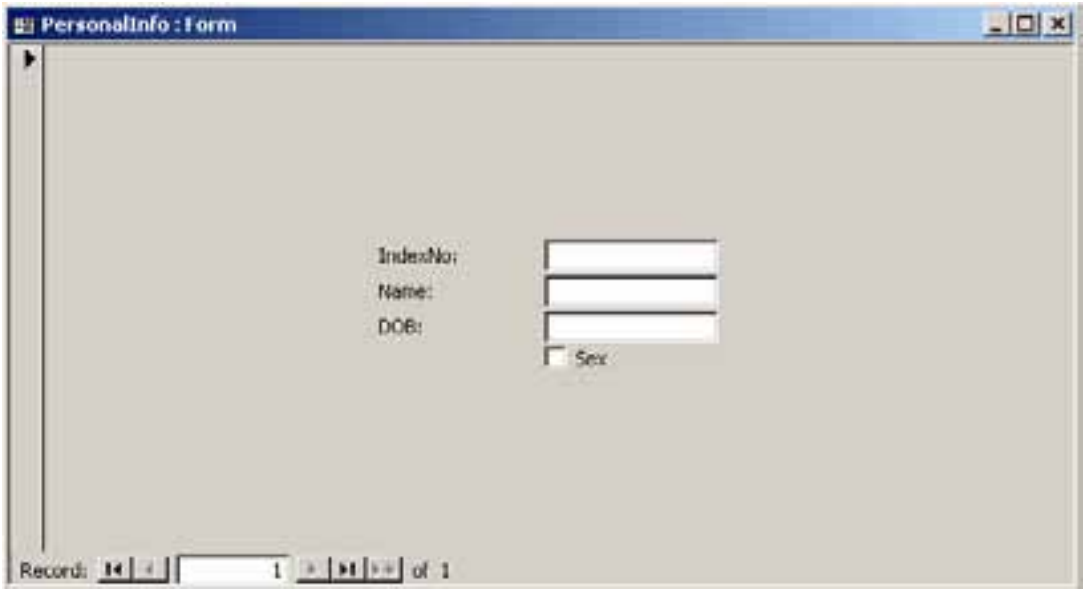
1. Select Forms from the database object tabs in database window.
2. Click New
3. Select Design View in the New Form dialog box.
4. Select the Table or Enter the Name of the table in the combo box below.
5. Click OK
6. Add controls to the Detail area of the design grid of the form from the field list.
7. Save the form by Clicking File menu and selecting Save
8. Enter a name for the Form in Save As dialog box
9. Click OK
10. Close the design view by selecting close from the file menu





Entering Data to the table using the form

1. Select the form from the database window
2. Click Open from the tool bar
3. Enter data to the fields. Use the Tab key to move from one field to another.
4. At the end of the record, press TAB or click New Record on the toolbar to go to the next record.
5. Close the form after entering data.



Viewing data in a table using a form

When opened the form should appear like this. On the lower left corner of the form there is a Record navigation bar. There are five buttons on the Record navigation bar.

Go to the first record.
Go to the previous record.
Go to the next record.
Go to the last record.
Go past the last record to add a new record.

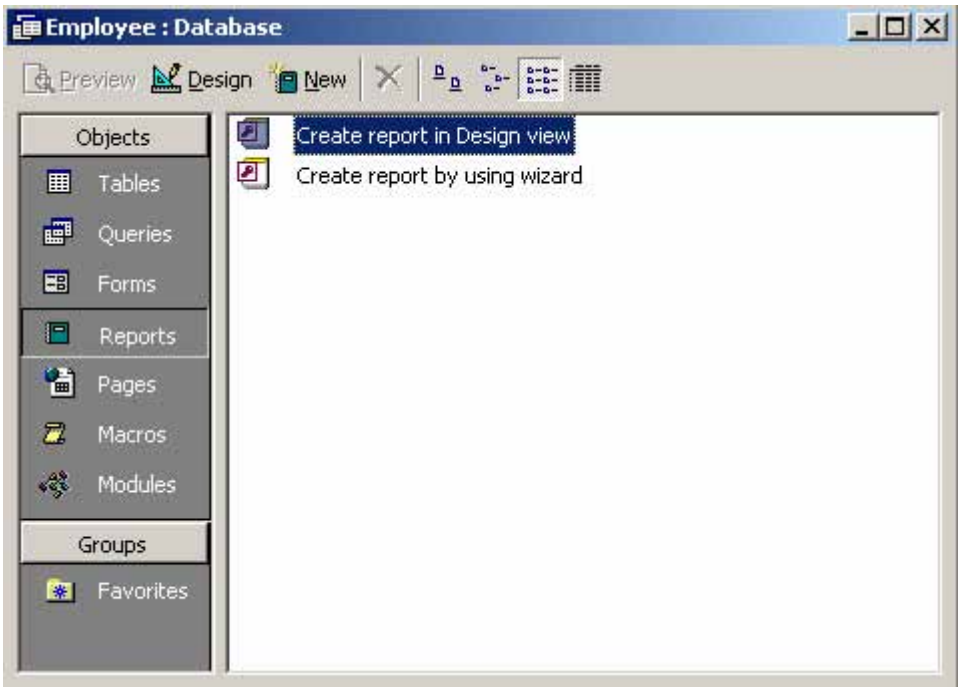
These buttons can be used to move to the next or previous record.

3.4.5 Generating reports

Data can be presented effectively using a report. The size and the appearance of the report can be changed to suit our requirements. Reports are often printed out on paper rather than just viewed on the screen.

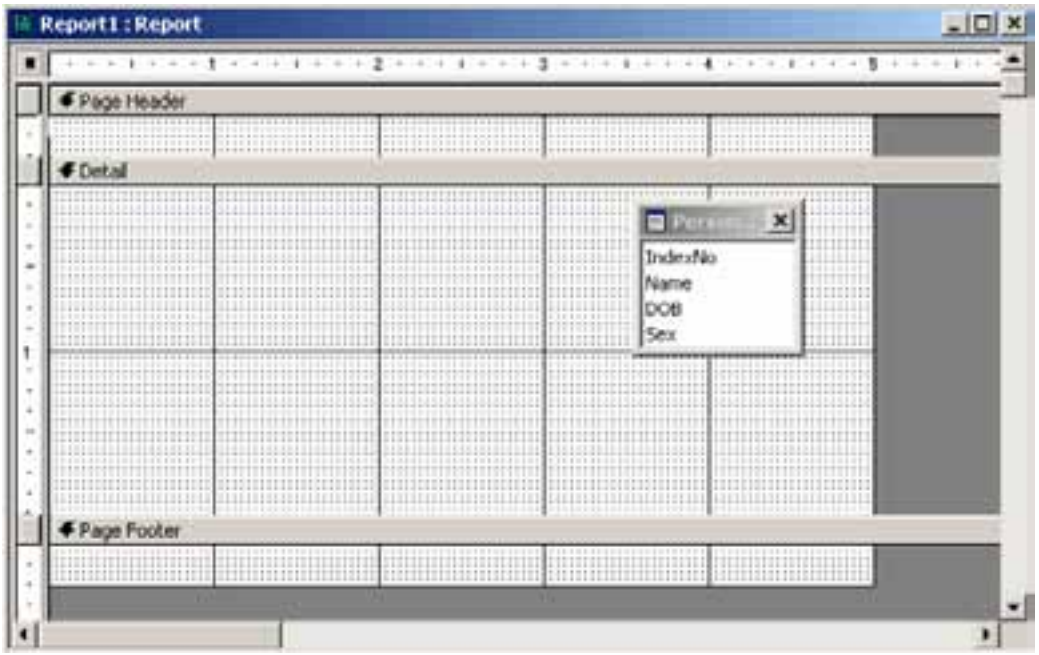
Creating a report in Design view

1. In the database window select Report object
2. Click New

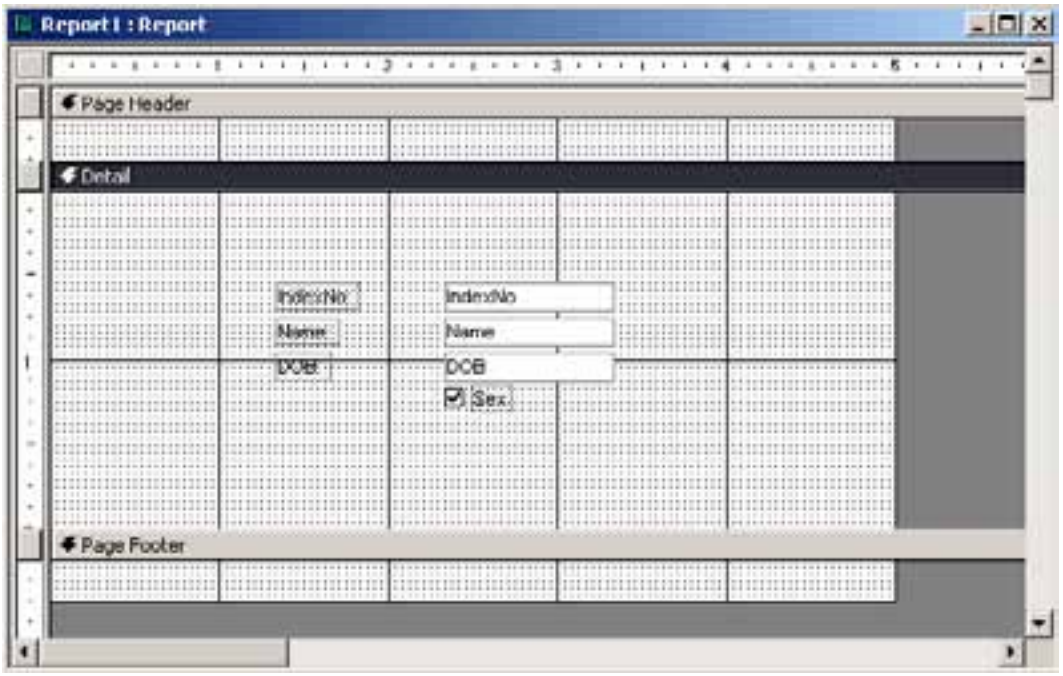


3. Select Design View in New Report dialog box.
4. Select the relevant table from the combo box below in the same dialog box.

5. Click OK



6. Select the Field Names from the Field list and drag and drop into the design grid.
7. Close the field list by clicking close button.



8. Save the report by clicking File menu and selecting Save.
9. Enter a Report Name and Click OK.

10. Click View button on the tool bar to view the Report.
11. Print the report by clicking File menu and selecting Print command.

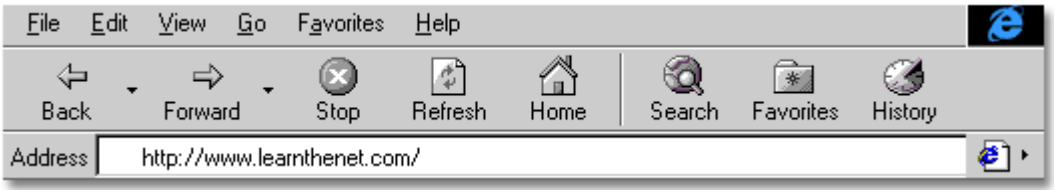
3.5 Communication Software

3.5.1 Internet browsers

Also called Web browsers are the programs used to surf the web, or used to access the World Wide Web, such as Mozilla, Safari, or Internet Explorer. Although many different browsers are available, Microsoft Internet Explorer and Netscape Navigator are the two most popular ones.

When you first launch your web browser, by double-clicking on the icon on your desktop, a predefined web page appears. This page is referred to as your home page or start page. With Navigator for instance, you may be taken to Netscape's portal page or to a page selected by your Internet service provider. If you want however, you can easily change your start page. This article shows you how to do it.

The Toolbar



The row of buttons at the top of your browser, known as the toolbar, helps you travel through the web of possibilities, keeping track of where you've been. Since the toolbars for Navigator and Internet Explorer differ slightly, we'll first describe what the buttons in common do:

- The **Back** button returns you the previous page you've visited.
- Use the **Forward** button to return to the page you just came from.
- **Home** takes you to whichever home page you've chosen. (If you haven't selected one, it will return you to the default home page, usually the Microsoft or Netscape website.)
- **Reload** or **Refresh** does just that, loads the web page again. Why would you want to do this? Sometimes all of the elements of a web page haven't loaded the first time, because the file transfer was interrupted. Also when you download a web page, the data is **cached**, meaning it is stored temporarily in your computer's memory. The next time you want that page, instead of requesting the file from the web server, your web browser accesses it from the cache. But if a web page is updated frequently, as may be the case with news, sports scores or financial data, you won't get the most current information. By reloading the page, this timely data is updated from the web server.
- **Print** lets you make a hard copy of the current page loaded in your browser.
- The **Stop** button stops the browser from loading the current page.
- **Search** connects to directories and search tools on the Microsoft or Netscape websites.
- **Bookmarks** or **Favorites** lets you record the addresses of websites you want to revisit. Once you add a URL to your list, you can return to that web page simply by clicking on the link in your list, instead of retyping the entire address.

The Web consists of:

- Your **personal computer.**
- **Web browser software** to access the Web.
- A connection to an **Internet service provider** (ISP)
- **Servers** to host the data
- **Routers** and **switches** to direct the flow of data
- **Web pages** are stored on **web servers** located around the globe.
- Entering the (Uniform Resource Locator) **URL** of a web page in your web browser or clicking a link sends a request to the server, which hosts the page.
- The server sends the web page to your computer and your **web browser** displays it on your screen.
- A **web page** is an electronic document written in a computer language called **HTML**
- Web pages can contain text, graphics, video, animation, and sound, as well as **interactive features**, such as data entry forms.
- Each page has a unique address known as a **URL**, which identifies its location on the server.
- Web pages contain **hyperlinks** to other web pages. Hyperlinks are text and images that **reference the URLs of other web pages**.
- A **website** is one or more web pages that relate to a common theme, such as a person, business, organization, or a subject, such as sports.

- The first page is called the **home page**, which acts like an index, indicating the content on the site.

3.5.2 Search engines

Programs on the Internet that help users to search for files and information. Examples are Infoseek, Yahoo, Lycos, Excite, and many more. Most search engines find files that contain a key word or words typed in by the user. Some search engines specialize in a subject area or type of file. Others, called meta-search engines

Search engines are an essential part of the World Wide Web. They automatically index all websites they learn about, and maintain a database of keywords. By entering keywords for the subject you are searching for, you can find any number of websites, which may (or may not) be what you are looking for. Strictly speaking, many modern Search Engines are really directories, where sites have actually been reviewed by human beings and placed in an appropriate category.

3.5.3 E-mail (Electronic Mail)

A form of communication where messages can be sent to individuals or groups on networked computers and/or computers equipped for Internet access.

Messages, usually text, sent from one person to another via computer. E-mail can also be sent to a large number of addresses automatically. Any communications service that permits the electronic transmission and storage of messages and attached/enclosed files.

Why Use E-mail?

This is the most frequently used service on the Internet due to the following reasons:

- We can send a message **any time**, **any where** and the recipient can read it at his or her convenience.
- Can send the same message to several people at the same time.
- Can forward information to co-workers without retyping it.
- We can save time. E-mail is fast, usually taking no more than a few minutes to be received.
- Can e-mail electronic documents and the recipients can then edit and **return** revised versions.
- **Send messages around the world** as easily as to co-workers in the next office.

E-mail how it Works on the Internet

Like a postal address, an **e-mail address** specifies the **destination** of an electronic message.

- An **Internet** e-mail address looks like this: **user name@domain name**
- The **user name** is a unique name that identifies the **recipient**.

- The **domain name** is the address. Many people can share the same domain name.
- E-mail is sent and received through electronic "post offices" known as **mail servers**.
- To read your e-mail, you must retrieve it from the **mail server**.
- Once you enter the address of the recipient, compose your message, and click **Send**, your e-mail software handles the delivery.
- If the message isn't delivered, because of an incorrect address, for example, you typically receive an e-mail message explaining why.
- If the message is not delivered, you receive a **message explaining the problem**, along with the full text of the original message. You can correct the problem an incorrect e-mail address--and resend it.

- **To** contains the e-mail addresses of the **recipients**. This is a mandatory entry.
- **CC**, short for **Carbon Copy**, contains the e-mail addresses for people other than the primary recipients. This is optional.
- **BCC:**, short for **Blind Carbon Copy**, contains the e-mail addresses of other recipients who receive copies, but their names and addresses are hidden from the other recipients. This is optional.
- **Subject** contains the **main topic** of the message. Keep this brief. Recipients see this in their summary of incoming e-mails.
- **Attachment** contains the **names of files** that you may be sending, for example, a word-processing document or a spreadsheet
- **Body** contains the **message** itself, which can be of any length.

3.5.4 Chat

An online, real-time interactive communication method using text to send and receive instant messages. Two or more individuals connected to Internet have real-time text-based conversations by typing messages into their computer. Groups gather to chat about various subjects. As you type, everything you type is displayed to the other members of the chat group.

It is a bit like e-mail in real time. Users have conversations via the keyboard in "Chat rooms" with other users. Chat has been criticized for being addictive as well as concerns over unsuitable contact between children and adults. To join a chat room you usually have to give your e-mail address and this can lead to spam.

3.5.5 Video Conferencing

Using a computer, video camera, and network such as the Internet, to conduct a live conference between two or more people. Video conferencing is an extremely useful method of communication because it saves people the time and expense of travel and can often accomplish many of the things a physical meeting can. A two-person videoconference is known as point-to-point, while more than two people involved in a session is a multipoint conference.

Unit 4.
Information Systems

What is a system?

A system is a collection of interrelated components that work together to perform a specific task or achieve a goal. In a system, the different components are connected with each other and they are interdependent.

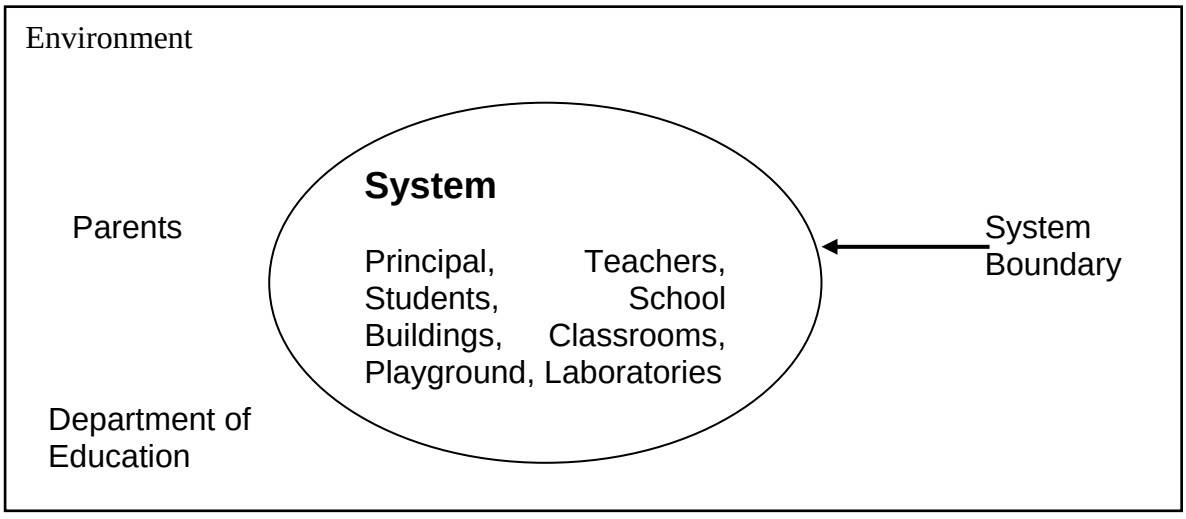
What is a subsystem?

Each component is a subsystem of the original system and carries out a part of the system task.
For example, the human body represents a complete natural system. the human body contains complex muscle, bone, respiratory, digestive and circulatory subsystems, each providing a specific part of the system task.
School, Bank, Library, Supermarket, are some other examples of systems.

What is system boundary?

A system usually interacts with the external world or environment. The system boundary separates the system from its environment. A system's boundary tells us what is inside and what is outside the system.

Let us consider the school for example and identify the system boundary.

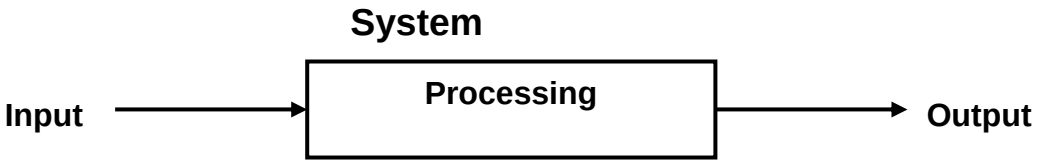


In the above example , the system boundary clearly illustrates the components inside the school and components outside the system.

What are the elements of a system?

Input
Process
Output

To perform a task or accomplish a goal, a system receives inputs (from the environment), process and returns outputs (to the environment).



If we consider a school as a system,

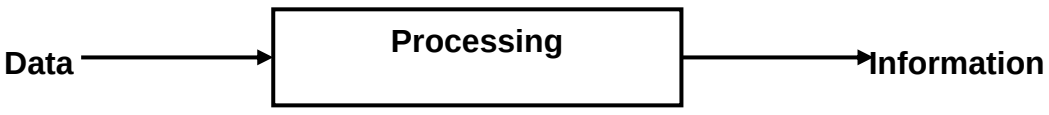
Goal : Education of students
Input : Children, Teachers, Funds
Processing : Teaching and learning
Output : Educated students

Can we consider organization as a System?

If we look in our surroundings, we see many organizations: such as shops, medical centers, communication centers, theatres, universities and others. All of these organizations have **goals**, **components**, **inputs**, **processing** and **outputs.** They can be viewed as systems and analyzed to identify system boundaries, system types, environment in which they operate.

What is Information System?

Data are raw facts. Information is processed data. Information is used to take decisions. We use a process to turn data into information. A process is a set of logically related tasks performed to achieve a specific outcome. Sometimes, data are processed mentally or manually.



What is Manual Information system?

In a manual Information system, all data processing is done manually. Filing cabinets, manual procedures and papers are vital components of a manual information system.
Example

- Book- keeping system
- School registration and attendance keeping system
- Library books index system

What is Computer-based Information system?

A computer-based information system is a single set of hardware, software, databases, telecommunications, people and procedures that are configured to collect, process ,manipulate, store, and communicate data into information.

Example

- Telephone billing system
- Results produced by the department of examinations

What are the types of processing Systems

Batch processing
On line Real time Processing

What is Batch processing?

Data is collected for a period of times and processed batch wise. The term originated in the days when users entered programs on punch cards. These cards are fed into the computer batch wise.

What is On line Real time processing?

A type of computer processing in which the computer responds immediately to user requests. Each request is considered to be a transaction. Automatic teller machines in banks are an example of transaction processing.

The opposite of transaction processing is batch processing, in which a batch of requests is stored and then executed all at one time. Transaction processing requires interaction with a user, whereas batch processing can take place without a user being present.

What are the types of Information Systems?

Office Automation System
Transaction processing system
Management information System
Processing control System

What is Office automation System?

Office Automation systems (OAS) are systems that try to improve the productivity of employees who need to process data and Information.

Example :
Microsoft Office Package

What is Transaction processing system?

Transaction processing systems are information system applications that capture and process data about (or for) business transactions. They are some time called Data Processing Systems (DPS). A TPS is focused at the orational level of a business.

The management information produced by transaction processing systems usually consists of detailed reports of daily transactions or future transactions. The reports generated by a TPS are useful only to lower level managers.

A TPS usually operates only within one functional area of a business. For example, in an organization each department, marketing, accounting and finance, production, and research and development has its own TPS.

The main components of Transaction processing System are hardware (machines), software (instructions or programs), people (programmers, managers, or users), procedures (rules), data and information.

What are the differences between a manual System and automated TPS

Automated system is more Efficient, accurate and more reliable.Automated TPS use different component with compared to components of manual system

What is Management Information System

A management Information System (MIS) is mainly concerned with internal sources of information. MIS usually takes data from the transaction processing systems and summarizes it into a series of management reports.

MIS reports tend to be used by middle management and operational supervisors.

What is Processing control system

Process control systems are used to control machine and equipment. e.g.: cement production factory, vehicle manufacturing and assembling , robots etc.

What is Intelligent information system

A computer application that does the work of human experts. For example, there are expert systems that can diagnose human illnesses, make financial forecasts, and schedule routes for delivery vehicles. Some expert systems are designed to take the place of human experts, while others are designed to aid them.

Expert systems are part of a general category of computer applications known as artificial intelligence . To design an expert system, one needs a knowledge engineer, an individual who studies how human experts make decisions and translates the rules into terms that a computer can understand.

What is system development life Cycle?

System Development Life Cycle (SDLC) is the overall process of developing information systems. It has several steps..

What are the Steps in System Development Life Cycle?

- System Analysis
- System Design
- Software Development
- Testing
- Implementation
- Maintenance

System Analysis
In this phase, the systems analysts study the existing system in detail, and identify new requirements.

System design
In this step Draw a logical diagram for the new system according to the data collected in previous phase

Software Development
The design specifications are converted into source code of a programming language.

Testing
Before actually implementing the new system into operation,a developed system is to be tested in order to remove all errors

Implementation
The New system to be implemented at this stage has mainly two steps.
User training and System conversion