The Tamilnadu
Dr. Ambedkar Law University
CHENNAI - 600 028

BCA. LL.B (HONS)
DEGREE COURSE

COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION

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MESSAGE

Knowledge is power. Legal Knowledge is a potential power. It can be exercised effectively everywhere. Of all the domains of reality, it is Legal Knowledge, which deals with rights and liabilities, commissions and omissions, etc., empower the holder of such knowledge to have prominence over the rest. Law Schools and Law Colleges that offer Legal Education vary in their stature on the basis of their ability in imparting the quality Legal Education to the students. Of all the Law Schools and Colleges, only those that educate their students to understand the nuances of law effectively and to facilitate them to think originally, excel. School of Excellence in Law aims to be in top of such institutions.

The revolution in Information and Communication Technology dump lot of information in the virtual world. Some of the information are mischievous and dangerous. Some others are spoiling the young minds and eating away their time. Students are in puzzle and in dilemma to find out the right information and data. They do not know how to select the right from the wrong, so as to understand, internalise and assimilate into knowledge. Hence in the present scenario, the role of teachers gains much more importance in guiding the students to select the reliable, valid, relevant and suitable information from the most complicated, perplexed and unreliable data.

The teachers of the School of Excellence in Law have made a maiden attempt select, compile and present a comprehensive book to guide the students in various subjects of law. The students can use such materials as guidance and travel further in their pursuit of legal knowledge. Guidance cannot be a complete source of information. It is a source that facilitates the students to search further source of information and enrich their knowledge. Read the materials, refer relevant text books and case laws and widen the knowledge.

Dr.P.Vanangamudi

Vice-Chancellor

PREFACE

As the title suggest, this book is intended for the students who want to learn about computers. It's a useful tool for both beginners in general computer technology and the students in the introductory classes in college and university.

Computer is an advanced electronic device that takes raw data as input from the user and processes it under the control of set of instructions (called program), gives the result (output), and saves it for the future use. This Computer Fundamentals material covers a foundational understanding of computer hardware, software, operating systems, peripherals, Binary Logic, Boolean algebra, Sequential and Logical Circuits, Combinational Circuits etc. along with how to get the most value and impact from computer technology.

It also covers the basics of Office automation. Office automation refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks and goals. Raw data storage, electronic transfer, and the management of electronic business information comprise the basic activities of an office automation system. Office automation helps in optimizing or automating existing office procedures. By keeping all these factors in the mind and elaborated on MS-Office (Ms-Word, MS-Power Point, MS-Excel and MS-Access) techniques and outline tools in this text book.

This text book has been prepared for the beginners as well as advanced learners who want to deal with computers. It is very useful for the undergraduate students of computer science, engineering, business administration, management, science, commerce and arts where an introductory course on computers is a part of curriculum.

COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION

BCA. LL.B (HONS) DEGREE COURSE

Title of the Course/ Paper :	COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION
Objective Course	This course introduces the details about the concepts computer fundamentals of and MS-Office.
Sub.code	HDAB
Course outline	Unit I: Fundamentals of computers - characteristics of computers. Computer language – operating systems - Generation of computers. Number systems - conversion from one number system to another.
	Unit-II: Complements – Binary codes – Binary logic – logic gates – truth tables. Boolean algebra – axioms- Sequential logic-RS,JK,D and T Flip flops-Registers-Counters
	Unit III: Truth table simplification of Boolean function – K-map method (upto 5 variables) – Mc-Clausky tabulation method- Adders-Subtractors-Decoder-Encoder-Multiplexer-Demultiplexer
	Unit-IV: MS-Office, Introduction to MS Word-menus- shortcuts create a word document, opening a file - saving, editing text documents, cut, copy, paste, Formatting a document, alignments, font styles, indents, creating tables –merging, splitting, drawing- shapes, pictures, tools-mail merge, spell check, macros, templates, using wizards.MS-Excel, introduction-working spread sheets, formatting spread sheets, creating charts, formula usage.
Recommended Texts	i. M.M.Mano, Digital Logic and Computer Design, Pearson Education. ii.V.Rajaraman, 2002, Fundamentals of Computers, 3rd Edition, PHI New Delhi. iii. Microsoft Office 2003: The Complete Reference , McGraw-Hill Inc.
Reference Books	i. T.C.Bartee, 1991,Computer Architecture and Logical Design, McGraw Hill. ii. Microsoft Office 2000- Training Guide, Maria Reid-Karl Schwartz, Diana Rain.BPB Publications

MS-OFFICE – LAB EXERCISES

MS WORD

1. Text Manipulations.
2. Usage of Numbering, Bullets, Footer and Headers.
3. Usage of Spell check, and Find & Replace.
4. Text Formatting.
5. Picture insertion and alignment.
6. Creation of documents, using templates.
7. Creation templates.
8. Mail Merge Concepts.
9. Copying Text & Pictures from Excel.

MS - EXCEL

10. Cell Editing.
11. Usage of Formulae and Bulit-in Functions.
12. File Manipulations.
13. Data Sorting (both number and alphabets).
14. Worksheet Preparation.
15. Drawing Graphs.
16. Usage of Auto Formatting.

MS-POWERPOINT

17. Inserting Clip arts and Pictures.
18. Frame movements of the above.
19. Insertion of new slides.
20. Preparation of Organisation Charts.
21. Presentation using Wizards.
22. Usage of design templates.

CHAPTER 1

INTRODUCTION TO FUNDAMENTALS OF COMPUTERS

Computer is an advanced electronic device that takes raw data as input from the user and processes it under the control of set of instructions (called program), gives the result (output), and saves it for the future use.

DEFINITION OF COMPUTER

Computer can be defined as an electronic device that performs rapid computations and generates desired output for users based on input data and programs. Computer can capture, store, retrieve and process data. The data may be numbers, characters, audio, video, images etc. Basically, computer can recognize only two states – whether a signal is present or not. These two states are represented using binary digits 1 and 0. All forms of data are finally converted into binary digits for the computer to recognize and process

CHARACTERISTICS OF COMPUTER

High Speed

- Computer is a very fast device.
- It is capable of performing calculation of very large amount of data.
- The computer has units of speed in microsecond, nanosecond, and even the picosecond.
- It can perform millions of calculations in a few seconds.

Accuracy

- In addition to being very fast, computers are very accurate.
- The calculations are error free.
- Computers perform all jobs with accuracy provided that correct input has been given. Storage Capability
- Memory is a very important characteristic of computers.
- A computer has much more storage capacity.
- It can store large amount of data.
- It can store any type of data such as images, videos, text, audio and many others.
- Diligence
- Unlike human beings, a computer is free from monotony, tiredness and lack of concentration.
- It can work continuously without any error and boredom.
- It can do repeated work with same speed and accuracy.

Versatility

- A computer is a very versatile machine.
- A computer is very flexible in performing the jobs to be done.
- This machine can be used to solve the problems related to various fields.

❑ At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

Reliability

❑ A computer is a reliable machine.

❑ Modern electronic components have long lives.

❑ Computers are designed to make maintenance easy.

Automation

❑ Computer is an automatic machine.

❑ Automation means ability to perform the given task automatically.

❑ Once a program is given to computer i.e. stored in computer memory, the program and instruction can control the program execution without human interaction.

Reduction in Paper Work

❑ The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up a process.

❑ As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.

Reduction in Cost

❑ Though the initial investment for installing a computer is high but it substantially reduces the cost of each of its transaction.

Disadvantages

Ø A computer is a machine that has no intelligence to perform any task.

Ø Each instruction has to be given to computer.

Ø A computer cannot take any decision on its own.

Dependency

Ø It functions as per a user's instruction, so it is fully dependent on human being.

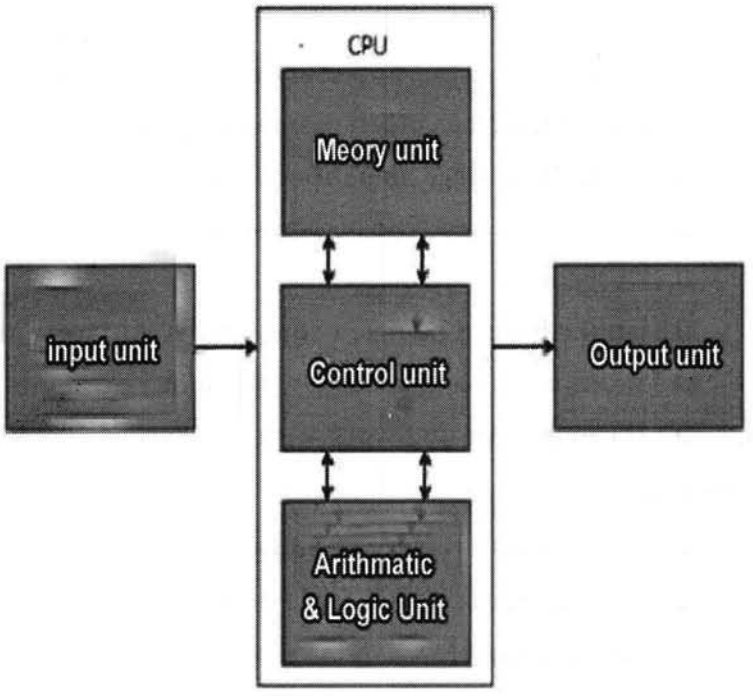
Environment

Ø The operating environment of computer should be dust free and suitable.

No Feeling

Ø Computers have no feelings or emotions.

Ø It cannot make judgment based on feeling, taste, experience, and knowledge unlike a human being.



ELEMENTS OF COMPUTER

Charles Babbage provided the basic structure of computers in the detailed drawings of his Analytical Engine. This engine had a mill to process data, a control to regulate operations and a store to hold data and results of processing temporarily. The anatomy of computers, personal computers to super computers, is basically the same. Let us see how' these components are arranged into a computer system. Computer is designed to carry out instructions for data processing. It has components to receive inputs, process inputs and communicate the outputs with users. The system is organized as follows.

Input Unit

This unit contains devices with the help of which we enter data into computer. This unit makes link between user and computer. The input devices translate the information into the form understandable by computer.

Output Unit

Output unit consists of devices with the help of which we get the information from computer. This unit is a link between computer and users. Output devices translate the computer's output into the form understandable by users.

CENTRAL PROCESSING UNIT (CPU)

CPU is the most important component of a computer. It typically consists of a control unit, arithmetic and logical unit and a primary storage. CPU is the brain of a computer and all processing takes place in the CPU.

The functions of the components of CPU are as follows:

1. Primary Memory

A memory or store is required in a computer to store programs and the data processed by programs. The main memory is made up of a large number of cells with each cell capable of storing one bit. The cells may be organized as a set of addressable words, each word storing a string of bits. The main memory provides random access. The main memory is divided into Random Access Memory (RAM) and Read Only Memory (ROM). RAM is dynamic and volatile. ROM is read only memory and this memory cannot be erased and rewritten. That is, ROM is non-volatile.

2. Arithmetic Logic Unit (ALU)

ALU does all the arithmetic and logical operations. Arithmetical operations involve manipulation of numerical data such as addition, subtraction, division and multiplication. Logical operations compare relative magnitudes of two numeric, alphabetic or alphanumeric data items such as greater than, less than, and equal to.

3. Control Unit (CU)

The control unit controls and co-ordinates all the operations of the CPU and peripheral devices. Its functions are to ensure that the program instructions are carried out in the desired sequence and to control and co-ordinate the flow of data between the CPU and the input-output devices.

Modern computers operate on stored program concept. The control unit is designed to execute the stored program. Its tasks are:

a) Fetch the stored instruction whose address is in a special storage area called the Instruction Address Register (lAR), .

b) Decode the instruction, that is, decide what operation is to be carried out and what data are to be used in the operation

c) Replace the address with that of the next stored instruction in IAR

d) Send signals to the rest of the system to ensure that the indicated operation is carried out. For example, for an input or output operation, the CU would activate the I/O device and memory causing proper transfer of data.

e) The above operations of the CU form a cycle and starts from step1 over again.

COMPUTER SYSTEM

A computer system is made up of three major components: **hardware, software and humanware.** The physical units of a computer system (excluding the third component), constitute its hardware.

- Hardware consists of mechanical, electrical and electronic parts of the system.
- Sets of programmed instructions constitute the software.
- Humanware is the people element in the system.

The Hardware components made up of Input devices, Output devices, Memory, Control unit and ALU.

Input Devices

- Keyboard
- Mouse
- Joy Stick
- Light pen
- Track Ball
- Scanner
- Graphic Tablet
- Microphone
- Magnetic Ink Card Reader(MICR)
- Optical Character Reader(OCR)
- Bar Code Reader
- Optical Mark Reader(OMR)

KEYBOARD

Keyboard is the most common and very popular input device which helps in inputting data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows:

Typing Keys : These keys include the letter keys (A-Z) and digit keys (0-9) which generally give same layout as that of typewriters

Numeric Keypad : It is used to enter numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.

Function Keys The twelve function keys are present on the keyboard which is arranged in a row at the top of the keyboard. Each function key has unique meaning and is used for some specific purpose.

Control keys These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc)

Special Purpose Keys Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

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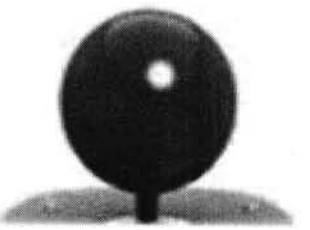
MOUSE

Mouse is most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base which senses the movement of mouse and sends corresponding signals to CPU when the mouse buttons are pressed.

Generally it has two buttons called left and right button and a wheel is present between the buttons. Mouse can be used to control the position of cursor on screen, but it cannot be used to enter text into the computer.

Advantages

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of keyboard.

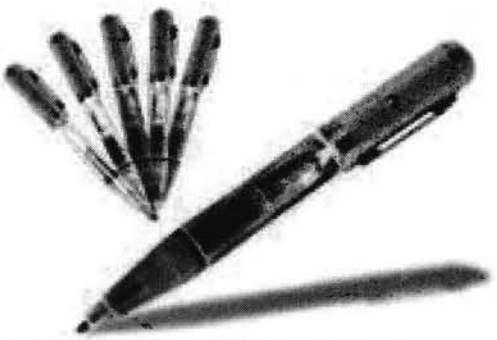


JOYSTICK

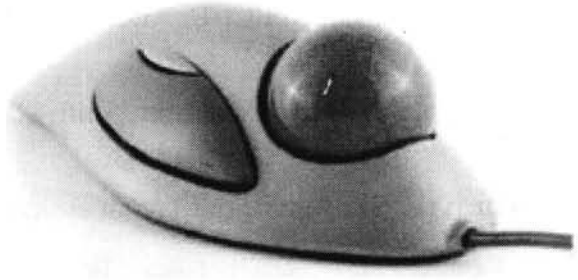
Joystick is also a pointing device which is used to move cursor position on a monitor screen. It is a stick

having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

The function of joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing(CAD) and playing computer games.



LIGHT PEN



Light pen is a pointing device which is similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube. When the tip of a light pen is moved over the monitor screen and pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

TRACK BALL

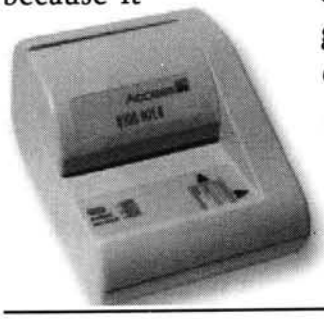
Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on ball, pointer can be moved. Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button and a square.

SCANNER

Scanner is an input device which works more like a photocopy machine. It is used when some information is available on a paper and it is to be transferred to the hard disc of the computer for further manipulation. Scanner captures images from the source which are then converted into the digital form that can be stored on the disc. These images can be edited before they are printed.

DIGITIZER

Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at. Digitizer is also known as Tablet or Graphics Tablet because it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for doing fine works of drawing and image manipulation applications.



MICROPHONE

Microphone is an input device to input sound that is then stored in digital form. The microphone is used for various applications like adding sound to a multimedia presentation or for mixing music.

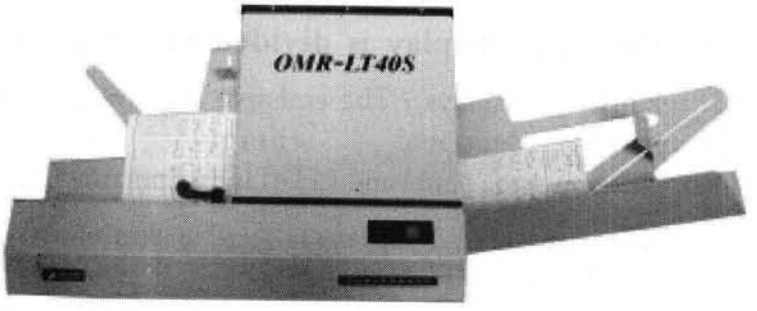
MAGNETIC INK CARD READER(MICR)

MICR input device is generally used in banks because of a large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable. This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.

OPTICAL CHARACTER READER(OCR)

OCR is an input device used to read a printed text. OCR scans text optically character by character, converts them into a machine readable code and stores the text on the system memory.

BAR CODE READERS



Bar Code Reader is a device used for readi bar coded data (data in form of light and dark line Bar coded data is generally used in labelling goo numbering the books etc. It may be a hand he scanner or may be embedded in a stationary sca ner. Bar Code Reader scans a bar code image, co verts it into an alphanumeric value which is then fed to the computer to which bar code reader is connected.

OPTICAL MARK READER(OMR)

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked. It is specially used for checking the answer sheets of examinations having multiple choice questions.

OUTPUT DEVICES

- Monitors
- Graphic Plotter
- Printer

MONITORS

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat- Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity, or resolution. It takes more than one illuminated pixel to form whole character.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically. There are some disadvantages of CRT

- Large in Size
- High power consumption

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, videogames, monitors, laptop computer, graphics display.

The flat-panel display is divided into two categories

Emissive Displays - The emissive displays are devices that convert electrical energy into light. Example are plasma panel and LED(Light-Emitting Diodes).

Non-Emissive Displays - The Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. Example is LCD(Liquid-Crystal Device)

PRINTERS

Printer is an output device, which is used to print information on paper. There are two types of printers

- Impact Printers
- Non-Impact Printers

Impact Printers

The impact printers print the characters by striking them on the ribbon which is then pressed on the paper. Characteristics of Impact Printers are the following

- Very low consumable costs
- Very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

These printers are of two types

- Character printers
- Line printers

Character Printers

Character printers are the printers which print one character at a time.

These are further divided into two types

- Dot Matrix Printer(DMP)
- Daisy Wheel

Dot Matrix Printer

In the market one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character that is why it is called Dot Matrix Printer.

Advantages

- Inexpensive
- Widely Used
- Other language characters can be printed

Disadvantages

- Slow Speed
- Poor Quality

DAISY WHEEL

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower name) that is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices which require a few letters to be sent here and there with very nice quality.

Advantages

- More reliable than DMP
- Better quality
- The fonts of character can be easily changed

Disadvantages

- Slower than DMP
- Noisy
- More expensive than DMP

Line Printers

Line printers are the printers which print one line at a time.

These are of further two types

1. Drum Printer
2. Chain Printer

Drum Printer

This printer is like a drum in shape so it is called drum printer. The surface of drum is divided into number of tracks. Total tracks are equal to size of paper i.e. for a paper width of 132 characters, drum will have 132 tracks. A character set is embossed on track. The different character sets available in the market are 48 character set, 64 and 96 characters set. One rotation of drum prints one line. Drum printers are fast in speed and can print 300 to 2000 lines per minute.

Advantages

- Very high speed
- Disadvantages
- Very expensive
- Characters' fonts cannot be changed

Chain Printer

In this printer, chain of character sets are used so it is called Chain Printer. A standard character set may have 48. 64, or 96 characters.

Advantages

- Character fonts can easily be changed.
- Different languages can be used with the same printer.

Disadvantages

- Noisy
- Non-impact Printers

Non-impact printers print the characters without using ribbon. These printers print a complete page at a time so they are also called as Page Printers.

These printers are of two types

- Laser Printers
- Inkjet Printers

Characteristics of Non-impact Printers

- Faster than impact printers.
- They are not noisy.
- High quality.
- Support many fonts and different character size.

Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

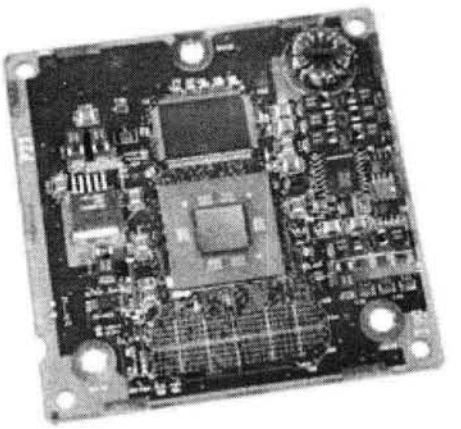
Advantages

- Very high speed
- Very high quality output
- Give good graphics quality
- Support many fonts and different character size

Disadvantages

- Expensive.
- Cannot be used to produce multiple copies of a document in a single printing.

Inkjet Printers



Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

They make less noise because no hammering is done and these have many styles of printing modes available. Colour printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

Advantages

- High quality printing
- More reliable

Disadvantages

- Expensive as cost per page is high
- Slow as compared to laser printer

MEMORY

Storage space in computer where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address which varies from zero to memory size minus one. For example if computer has 64k words, then this memory unit has 64 * 1024=65536 memory locations. The address of these locations varies from 0 to 65535.

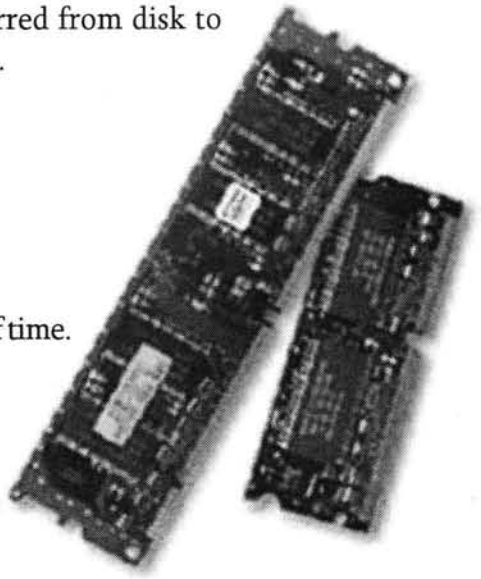
Memory is primarily of three types

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory

Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most

frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.



Advantages

The advantages of cache memory are as follows

Cache memory is faster than main memory.

- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows

- Cache memory has limited capacity.
- It is very expensive.

PRIMARY MEMORY (MAIN MEMORY)

Primary memory holds only those data and instructions on which computer is currently working. It has limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed reside in main memory. It is divided into two subcategories RAM and ROM.

Characteristics of Main Memory

- These are semiconductor memories.
- It is known as main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without primary memory.

Secondary Memory

This type of memory is also known as external memory or non-volatile. It is slower than main memory. These are used for storing data/Information permanently. CPU directly does not access these memories instead they are accessed via input-output routines. Contents of secondary memories are first transferred to main memory, and then CPU can access it. For example: disk, CD-ROM, DVD etc.

Characteristic of Secondary Memory

- These are magnetic and optical memories.
- It is known as backup memory.
- It is non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without secondary memory.
- Slower than primary memories.

Few higher storage units are following

Sr. No.	Unit	Description
1	Kilobyte (KB)	1 KB = 1024 Bytes
2	Megabyte (MB)	1 MB = 1024 KB
3	GigaByte (GB)	1 GB = 1024 MB
4	TeraByte (TB)	1 TB = 1024 GB
5	PetaByte (PB)	1 PB = 1024 TB

TYPES OF COMPUTERS

Computers can be broadly classified by their speed and computing power.

Sr. No. Type Specifications

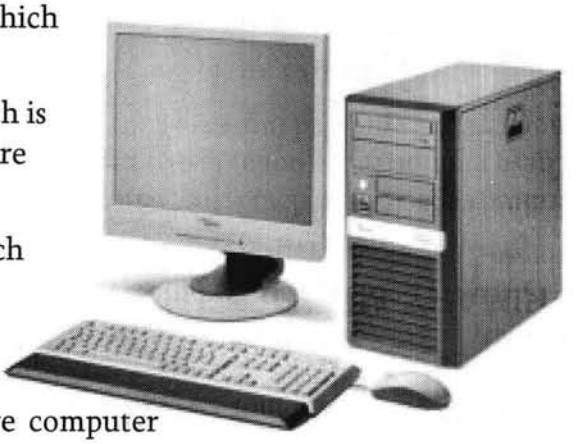
1 PC (Personal Computer) It is a single user computer system having moderately powerful microprocessor

2 WorkStation It is also a single user computer system which is similar to personal computer but have more powerful microprocessor.

3 Mini Computer It is a multi-user computer system which is capable of supporting hundreds of users simultaneously.

4 Main Frame It is a multi-user computer system which is capable of supporting hundreds of users simultaneously. Software technology is different from minicomputer.

5 Supercomputer It is an extremely fast computer which can execute hundreds of millions of instructions per second.



PC (PERSONAL COMPUTER)

A PC can be defined as a small, relatively inexpensive computer designed for an individual user. PCs are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers isplaying games and surfing Internet.

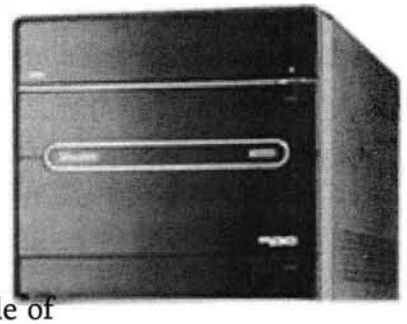
Although personal computers are designed as single-user systems, these systems are normally linked together to form a network. In terms of power, now-a-days High-end models of the Macintosh and PC offer the same computing power and graphics capability as low-end workstations by Sun Microsystems, Hewlett-Packard, and Dell.

WORKSTATION

Workstation is a computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other such types of applications which require a moderate amount of computing power and relatively high quality graphics capabilities.

Workstations generally come with a large, high-resolution graphics screen, large amount of RAM, inbuilt network support, and a graphical user interface. Most workstations also have a mass storage device such as a disk drive, but a special type of workstation, called a diskless workstation, comes without a disk drive.

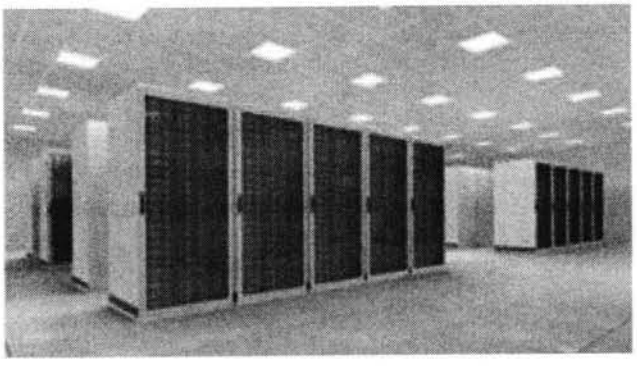
Common operating systems for workstations are UNIX and Windows NT. Like PC, Workstations are also single- user computers like PC but are typically linked together to form a local-area network, although they can also be used as stand-alone systems.Mini computer



It is a midsize multi-processing system capable of supporting up to 250 users simultaneously

MAINFRAME

Mainframe is very large in size and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously. Mainframe executes many programs concurrently and supports many simultaneous execution of programs.



SUPERCOMPUTER

Supercomputers are one of the fastest computers currently available. Supercomputers are very expensive and are employed for specialized applications that require immense amount of mathematical calculations (number crunching). For example, weather forecasting, scientific simulations, (animated) graphics, fluid dynamic calculations, nuclear energy research, electronic design, and analysis of geological data (e.g. in petrochemical prospecting).

GENERATIONS OF COMPUTERS

Generation in computer terminology is a change in technology a computer is/was being used. Initially, the generation term was used to distinguish between varying hardware technologies. But nowadays, generation includes both hardware and software, which together make up an entire computer system.

There are totally five computer generations known till date. Each generation has been discussed in detail along with their time period and characteristics.

Following are the main five ***generations*** of computers

First Generation

The period of first generation: 1946-1959. Vacuum tube based.

Second Generation

The period of second generation: 1959-1965. Transistor based.

Third Generation

The period of third generation: 1965-1971. Integrated Circuit based.

Fourth Generation

The period of fourth generation: 1971-1980. VLSI microprocessor based.

Fifth Generation

The period of fifth generation: 1980-onwards.ULSI microprocessor based

First Generation

he period of first generation was 1946-1959. The computers of first generation used vacuum tubes as the basic components for memory and circuitry for CPU (Central Processing Unit). These tubes, like electric bulbs, produced a lot of heat and were prone to frequent fusing of the installations, therefore, were very expensive and could be afforded only by very large organizations. In this generation mainly batch processing operating system were used. Punched cards, paper tape, and magnetic tape were used as input and output devices. The computers in this generation used machine code as programming language.

The main features of first generation are:

- Vacuum tube technology
- Unreliable
- Supported machine language only
- Very costly
- Generated lot of heat
- Slow input and output devices
- Huge size
- Need of A.C.
- Non-portable
- Consumed lot of electricity

Some computers of this generation were:

- ENIAC
- EDVAC
- UNIVAC
- IBM-701
- IBM-650

Second Generation

The period of second generation was 1959-1965. In this generation transistors were used that were cheaper, consumed less power, more compact in size, more reliable and faster than the first generation machines made of vacuum tubes. In this generation, magnetic cores were used as primary memory and magnetic tape and magnetic disks as secondary storage devices. In this generation assembly language and high-level programming languages like FORTRAN, COBOL was used. The computers used batch processing and multiprogramming operating system.

The main features of second generation are:

- Use of transistors

- Reliable in comparison to first generation computers
- Smaller size as compared to first generation computers
- Generated less heat as compared to first generation computers
- Consumed less electricity as compared to first generation computers
- Faster than first generation computers
- Still very costly
- A.C. needed
- Supported machine and assembly languages

Some computers of this generation were:

- IBM 1620
- IBM 7094
- CDC 1604
- CDC 3600
- UNIVAC 1108

Third Generation

The period of third generation was 1965-1971. The computers of third generation used integrated circuits (IC's) in place of transistors. A single IC has many transistors, resistors and capacitors along with the associated circuitry. The IC was invented by Jack Kilby. This development made computers smaller in size, reliable and efficient. In this generation remote processing, time-sharing, multi-programming operating system were used. High-level languages (FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC, ALGOL-68 etc.) were used during this generation.

The main features of third generation are:

- IC used
- More reliable in comparison to previous two generations
- Smaller size
- Generated less heat
- Faster
- Lesser maintenance
- Still costly
- A.C needed
- Consumed lesser electricity
- Supported high-level language

Some computers of this generation were:

- IBM-360 series
- Honeywell-6000 series
- PDP(Personal Data Processor)

- IBM-370/168
- TDC-316

Fourth Generation

The period of fourth generation was 1971-1980. The computers of fourth generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors and other circuit elements and their associated circuits on a single chip made it possible to have microcomputers of fourth generation. Fourth generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to personal computer (PC) revolution. In this generation time sharing, real time, networks, distributed operating system were used. All the high-level languages like C, C++, DBASE etc. were used in this generation.

The main features of fourth generation are:

- VLSI technology used
- Very cheap
- Portable and reliable
- Use of PC's
- Very small size
- Pipeline processing
- No A.C. needed
- Concept of internet was introduced
- Great developments in the fields of networks
- Computers became easily available

Some computers of this generation were:

- DEC 10
- STAR 1000
- PDP 11
- CRAY-1(Super Computer)
- CRAY-X-MP(Super Computer)

FIFTH GENERATION

The period of fifth generation is 1980-till date. In the fifth generation, the VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components. This generation is based on parallel processing hardware and AI (Artificial Intelligence) software. AI is an emerging branch in computer science, which interprets means and method of making computers think like human beings. All the high-level languages like C and C++, Java, .Net etc. are used in this generation.

AI includes:

- Robotics
- Neural networks
- Game Playing
- Development of expert systems to make decisions in real life situations.
- Natural language understanding and generation.

The main features of fifth generation are:

- ULSI technology
- Development of true artificial intelligence
- Development of Natural language processing
- Advancement in Parallel Processing
- Advancement in Superconductor technology
- More user friendly interfaces with multimedia features
- Availability of very powerful and compact computers at cheaper rates

Some computer types of this generation are:

- Desktop
- Laptop
- NoteBook
- UltraBook
- ChromeBook

OPERATING SYSTEMS.

It is a program with following features:

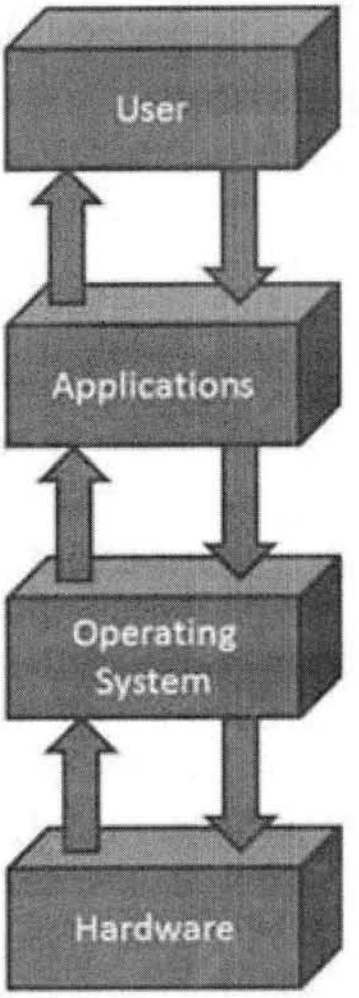
- An operating system is a program that acts as an interface between the software and the computer hardware.
- It is an integrated set of specialized programs that are used to manage overall resources and operations of the computer.
- It is specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

Objectives of Operating System

- To make a computer system convenient to use in an efficient manner
- To hide the details of the hardware resources from the users
- To provide users a convenient interface to use the computer system
- To act as an intermediary between the hardware and its users and making it easier for the users to access and use other resources
- To manage the resources of a computer system

❖ To keep track of who is using which resource, granting resource requests, according for resource using and mediating conflicting requests from different programs and users

❖ To provide efficient and fair sharing of resources among users and programs



CHARACTERISTICS OF OPERATING SYSTEM

❖ **Memory Management** — keeps tracks of primary memory i.e. what part of it is in use by whom, what part is not in use etc. and allocates the memory when a process or program requests it.

❖ **Processor Management** — allocates the processo r(CPU) to a process and deallocates processor when it is no longer required.

❖ **Device Management** — keeps track of all devices. This is also called I/O controller that decides which process gets the device, when, and for how much time.

❖ **File Management** — allocates and de-allocates the resources and decides who gets the resources.

❖ **Security** — prevents unauthorized access to programs and data by means of passwords and similar other techniques.

❖ **Job accounting** — keeps track of time and resources used by various jobs and/or users.

❖ **Control over system performance** — records delays between request for a service and from the system.

❖ **Interaction with the operators** — The interaction may take place via the console of the computer in the form of instructions. Operating System acknowledges the same, does the corresponding action and informs the operation by a display screen.

❖ **Error-detecting aids** — Production of dumps, traces, error messages and other debugging and error-detecting methods.

❖ **Coordination between other software and users** — Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

Example Operating Systems: DOS, WINDOWS 3.1, WINDOWS 95, 98, 2000, WINDOWS XP, NT, Me, UNIX , LINUX etc.

There are primarily three choices: **Windows, Linux, Apple** OS X.

❖ **Linux** is free but people generally do not use it for home purpose.

❖ **Apple** OS X works only on Apple Desktops.

❖ **Windows 7** is very popular among desktop users. Most of the computers come pre-equipped with Windows 7 Starter edition.

❖ **Windows 8** is recently introduced and is available in market. Windows 7 and Windows 8 come in multiple versions from starter, home basic, home premium, professional, ultimate and enterprise editions.

❖ As edition version increases, their features list and price increases.

❖ **Recommended** - Windows 7 Home Premium.

QUESTIONS

1. Define computer and describe its features.
2. What are the characteristics of computer?
3. What are the limitations of computer?
4. CPU is the brain of the computer'. Explain the components and functions of CPU.
5. What are the elements of a computer system?
6. What is computer peripheral?
7. Explain the functions of I/O devices.
8. Describe the working of any five input devices.
9. Describe the working of any three output devices.
10. Describe any two secondary storage devices.
11. What is MICR? What is it used for?
12. What are the types of printers?
13. What is secondary storage?
14. Explain the various generations of computers
15. Elaborate on Types of Computers.
16. What are Super Computers?
17. Define Operating Systems.
18. What are the functions of Operating Systems?
19. List the Services offered by the Operating Systems.
20. List the names of commonly used operating systems.

CHAPTER 2

NUMBER SYSTEMS

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

A value of each digit in a number can be determined using

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

Decimal Number System

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

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

(1x1000)+ (2x100)+ (3x10)+ (4xl)

$(1x10^3)+ (2x10^2)+ (3x10^1)+ (4xl0^0)$

1000 + 200 + 30 + 4

1234

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

S.N.	Number System and Description	
1	Binary Number System	Base 2. Digits used : 0, 1
2	Octal Number System	Base 8. Digits used : 0 to 7
3	Hexa Decimal Number System	Base 16. Digits used : 0 to 9, Letters used : A- F

Binary Number System

Characteristics of binary number system are as follows:

- Uses two digits, 0 and 1.
- Also called base 2 number system
- Each position in a binary number represents a 0 power of the base (2). Example 2^0
- Last position in a binary number represents a x power of the base (2). Example $2^x$where x represents the last position - 1.

Example

Binary Number : 10101_2

Calculating Decimal Equivalent:

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

Note : 10101_2 is normally written as 10101.

Octal Number System

Characteristics of octal number system are as follows:

- Uses eight digits, 0,1,2,3,4,5,6,7.
- Also called base 8 number system
- Each position in an octal number represents a 0 power of the base (8). Example 8^0
- Last position in an octal number represents a x power of the base (8). Example $8^x$where x represents the last position - 1.

Example

Octal Number : 12570_8

Calculating Decimal Equivalent:

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

Note : 12570_8 is normally written as 12570.

Hexadecimal Number System

Characteristics of hexadecimal number system are as follows:

- Uses 10 digits and 6 letters, 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F.
- Letters represents numbers starting from 10. A = 10. B = 11, C = 12, D = 13, E = 14, F = 15.
- Also called base 16 number system
- Each position in a hexadecimal number represents a 0 power of the base (16). Example 16^0
- Last position in a hexadecimal number represents a x power of the base (16). Example 16^x where x represents the last position - 1.

Example

Hexadecimal Number : $19FDE_{16}$

Calculating Decimal Equivalent:

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

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

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

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

Decimal to Other Base System

Steps

- Step 1 - Divide the decimal number to be converted by the value of the new base.
- Step 2 - Get the remainder from Step 1 as the rightmost digit (least significant digit) of new base number.
- Step 3 - Divide the quotient of the previous divide by the new base.
- Step 4 - Record the remainder from Step 3 as the next digit (to the left) of the new base number.

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

The last remainder thus obtained will be the most significant digit (MSD) of the new base number.

Example

Decimal Number : 29_{10}

Calculating Binary Equivalent:

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

As mentioned in Steps 2 and 4, the remainders have to be arranged in the reverse order so that the first remainder becomes the least significant digit (LSD) and the last remainder becomes the most significant digit (MSD).

Decimal Number : 29_{10} = Binary Number : $11101_{2.}$

Other base system to Decimal System

Steps

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

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

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

Example

Binary Number : 11101_2

Calculating Decimal Equivalent:

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

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

Other Base System to Non-Decimal System

Steps

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

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

Example

Octal Number : 25_8

Calculating Binary Equivalent:

Step 1 : Convert to Decimal

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

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

Step 2 : Convert Decimal to Binary

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

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

Octal Number : 25_8 = Binary Number : 10101_2

Shortcut method - Binary to Octal

Steps

Step 1 - Divide the binary digits into groups of three (starting from the right).

Step 2 - Convert each group of three binary digits to one octal digit.

Example

Binary Number : 10101_2

Calculating Octal Equivalent:

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

Binary Number : 10101_2 = Octal Number : 25_8

Shortcut method - Octal to Binary

Steps

Step 1 - Convert each octal digit to a 3 digit binary number (the octal digits may be treated as decimal for this conversion).

Step 2 - Combine all the resulting binary groups (of 3 digits each) into a single binary number.

Example

Octal Number : 25_8

Calculating Binary Equivalent:

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

Octal Number : 25_8 = Binary Number : 10101_2

Shortcut method - Binary to Hexadecimal

Steps

Step 1 - Divide the binary digits into groups of four (starting from the right).

Step 2 - Convert each group of four binary digits to one hexadecimal symbol.

Example

Binary Number : 10101_2

Calculating hexadecimal Equivalent:

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

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

Shortcut method - Hexadecimal to Binary

Steps

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

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

Example

Hexadecimal Number : 15_{16}

Calculating Binary Equivalent:

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

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

QUESTIONS

1. What is meant by number system?
2. List the number systems are used in computers.
3. Convert the following decimal numbers into binary, octal and hexa decimal

a) 66 b) 1021 c) 48 d) 765

4. Convert the following binary numbers into decimal, octal and hexa decimal

a) 11101 b) 101010 c) 11110011 b) 10000101

5. Convert the following octal numbers into decimal, binary and hexa decimal

a) 46 b) 1025 c) 186 b) 7645

6. Convert the following hexa decimal numbers into decimal, binary and octal

a) 99 b) 7EF c) C8 b) FFA1

CHAPTER 3

BINARY CODES

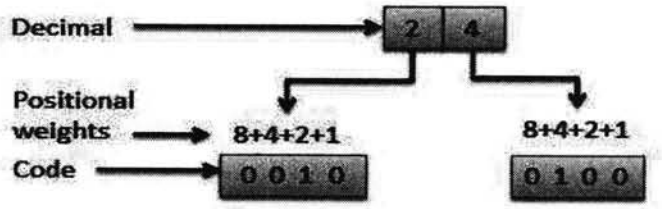
All digital circuits operate with only two states namely HIGH and LOW or ON and OFF or 1 or 0. All the operations are of binary nature. The digital data is represented, stored and transmitted as group of binary bits. This group is also called as **binary code**. Special binary codes are required to represent alphabets and special characters. Digital data prefer 4-bit code to represent decimal numbers 0 to 9. Based on these points, different types of binary codes have been developed.

Advantages of Binary Code

Following is the list of advantages that binary code offers.

- Binary codes are suitable for the computer applications.
- Binary codes are suitable for the digital communications.
- Binary codes make the analysis and designing of digital circuits if we use the binary codes.
- Since only 0 & 1 are being used, implementation becomes easy.

Classification of binary codes



The codes are broadly categorized into following four categories.

- Weighted Codes
- Non-Weighted Codes
- Binary Coded Decimal Code
- Alphanumeric Codes

Weighted Codes

Weighted binary codes are those binary codes which obey the positional weight principle. Each position of the number represents a specific weight. Several systems of the codes are used to express the decimal digits 0 through 9. In these codes each decimal digit is represented by a group of four bits.

Non-Weighted Codes

In this type of binary codes, the positional weights are not assigned. The examples of non-weighted codes are Excess-3 code and Gray code.

EXCESS-3 CODE

The Excess-3 code is also called as XS-3 code. It is non-weighted code used to express decimal numbers. The Excess-3 code words are derived from the 8421 BCD code words adding (0011)2 or (3)10 to each code word in 8421. The excess-3 codes are obtained as follows

Example

Decimal	BCD 8 4 2	Excess – 3BCD + 0011
0	0 0 0 0	0 0 1 1
1	0 0 0 1	0 1 0 0
2	0 0 1 0	0 1 0 1
3	0 0 1 1	0 1 1 0
4	0 1 0 0	0 1 1 1
5	0 1 0 1	1 0 0 0
6	0 1 1 0	1 0 0 1
7	0 1 1 1	1 0 1 0
8	1 0 0 0	1 0 1 1

GRAY CODE

It is the non-weighted code and it is not arithmetic codes. That means there are no specific weights assigned to the bit position. It has a very special feature that has only one bit will change, each time the decimal number is incremented as shown in fig. As only one bit changes at a time, the gray code is called as a unit distance code. The gray code is a cyclic code. Gray code cannot be used for arithmetic operation.

Decimal	BCD	Gray
0	0 0 0 0	0 0 0 0
1	0 0 0 1	0 0 0 1
2	0 0 1 0	0 0 1 1
3	0 0 1 1	0 0 1 0
4	0 1 0 0	0 1 1 0
5	0 1 0 1	0 1 1 1
6	0 1 1 0	0 1 0 1
7	0 1 1 1	0 1 0 0
8	1 0 0 0	1 1 0 0
9	1 0 0 1	1 1 0 1

APPLICATION OF GRAY CODE

- Gray code is popularly used in the shaft position encoders.
- A shaft position encoder produces a code word which represents the angular position of the shaft.

Binary Coded Decimal (BCD) code

In this code each decimal digit is represented by a 4-bit binary number. BCD is a way to express each of the decimal digits with a binary code. In the BCD, with four bits we can represent sixteen numbers (0000 to 1111). But in BCD code only first ten of these are used (0000 to 1001). The remaining six code combinations i.e. 1010 to 1111 are invalid in BCD.

ANTAGES OF BCD CODES

Decimal	0	1	2	3	4	5	6	7	8	9
BCD	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001

- It is very similar to decimal system.
- We need to remember binary equivalent of decimal numbers 0 to 9 only.

DISADVANTAGES OF BCD CODES

- The addition and subtraction of BCD have different rules.
- The BCD arithmetic is little more complicated.
- BCD needs more number of bits than binary to represent the decimal number. So BCD is less efficient than binary.

Alphanumeric codes

A binary digit or bit can represent only two symbols as it has only two states '0' or '1'. But this is not enough for communication between two computers because there we need many more symbols for communication. These symbols are required to represent 26 alphabets with capital and small letters, numbers from 0 to 9 , punctuation marks and other symbols.

The alphanumeric codes are the codes that represent numbers and alphabetic characters. Mostly such codes also represent other characters such as symbol and various instructions necessary for conveying information. An alphanumeric code should at least represent 10 digits and 26 letters of alphabet i.e. total 36 items. The following three alphanumeric codes are very commonly used for the data representation.

- American Standard Code for Information Interchange (ASCII).
- Extended Binary Coded Decimal Interchange Code (EBCDIC).
- Five bit Baudot Code.

ASCII code is a 7-bit code whereas EBCDIC is an 8-bit code. ASCII code is more commonly used worldwide while EBCDIC is used primarily in large IBM computers.

COMPLEMENTS

There are two types of complements for each base-r system: the radix complement and diminished radix complement.

- **Diminished Radix Complement - (r-1)'s Complement**
  - Given a number N in base r having n digits, the $(r-1)$'s complement *of* N is defined as:
    $(r^n - 1) - N$
- **Example for 6-digit decimal numbers:**
  - 9's complement is $(r^n - 1) - N = (10^6 - 1) - N = 999999 - N$
  - 9's complement of 546700 is 999999–546700 = 453299

- Example for 7-digit binary numbers:
  - 1's complement is $(r^n - 1) - N = (2^7 - 1) - N = 1111111 - N$
  - 1's complement of 1011000 is 1111111–1011000 = 0100111
- Observation:
  - Subtraction from $(r^n - 1)$ will never require a borrow
  - Diminished radix complement can be computed digit-by-digit
  - For binary: 1 – 0 = 1 and 1 – 1 = 0
- 1's Complement (*Diminished Radix* Complement)
  - All '0's become '1's
  - All '1's become '0's

Example $(10110000)_2$

$\Rightarrow (01001111)_2$

If you add a number and its 1's complement ...

```
  10110000
+ 01001111
----------
  11111111
----------
```

- Radix Complement

The r's complement of an n-digit number N in base r is defined as $r^n - N$ for N "" 0 and as 0 for $N = 0$. Comparing with the $(r - 1)$'s complement, we note that the r's complement is obtained by adding 1 to the $(r - 1)$'s complement, since $r^n - N = [(r^n - 1) - N] + 1$.

- Example: Base-10
  - The 10's complement of 012398 is 987602
  - The 10's complement of 246700 is 753300
- Example: Base-2
  - The 2's complement of 1101100 is 0010100
  - The 2's complement of 0110111 is 1001001
- 2's Complement (*Radix* Complement)
  - Take 1's complement then add 1
  - Toggle all bits to the left of the first '1' from the right

Example:

```
Number:    10110000
1's Comp.: 01001111
       +          1
-----------------
           01010000
-----------------
```

- Subtraction with Complements
  - The subtraction of two n-digit unsigned numbers $M - N$ in base r can be done as follows:

1. Add the minuend M to the r's complement of the subtrahend N. Mathematically, $M + (r^n - N) = M - N + r^n$.
2. If $M \geq N$, the sum will produce and end carry r^n, which can be discarded; what is left is the result $M - N$.
3. If $M < N$, the sum does not produce an end carry and is equal to $r^n - (N - M)$, which is the r's complement of $(N - M)$. To obtain the answer in a familiar form, take the r's complement of the sum and place a negative sign in front.

- Example
  - Using 10's complement, subtract 72532 – 3250.

	M =	03250
10's complement of	N =	+27468
	Sum =	30718

- Example
  - Using 10's complement, subtract 3250 – 72532.

There is no end carry

Therefore, the answer is – (10's complement of 30718) = - 69282

	M =	03250
10's complement of	N =	+27468
	Sum =	30718

- Example
  - Given the two binary numbers $X = 1010100$ and $Y = 1000011$, perform the subtraction (a) $X - Y$; and (b) $Y - X$, by using 2's complement.

(a)		
	X =	1010100
	2's complement of Y =	+0111101
	Sum =	10010001
	Discard end carry 2^7 =	-10000000
	Answer. X – Y =	0010001

(b)		
	Y =	1000011
	2's complement of X =	+ 0101100
	Sum =	1101111

There is no end carry. Therefore, the answer is Y – X = - (2's complement of 1101111) = - 0010001

BINARY ARITHMETIC

Binary arithmetic is essential part of all the digital computers and many other digital system.

Binary Addition

It is a key for binary subtraction, multiplication, division. There four rules of the binary addition.

Case	A + B	Sum	Carry
1	0 + 0	0	0
2	0 + 1	1	0
3	1 + 0	1	0
4	1 + 1	0	1

In fourth case, a binary addition is creating a sum of (1+1=10) i.e. 0 is write in the given column and a carry of 1 over to the next column.

EXAMPLE - ADDITION

0011010 - 001100 = 00001110

11 Carry

$0011010=26_{10}$

$0001100=12_{10}$

$0100110=38_{10}$

Subtraction and Borrow, these two words will be used very frequently for the binary subtraction.There four rules of the binary substration.There four rules of the binary Subtraction.

Case	A - B	Subtract	Borrow
1	0 - 0	0	0
2	1 - 0	1	0
3	1 - 1	0	0
4	0 - 1	0	1

EXAMPLE - SUBTRACTION

0011010 - 001100 = 00001110

1 1 borrow

0 0 ~~1 1~~ 0 1 0 = 26_{10}

- 0 0 0 1 1 0 0 = 12_{10}

0 0 0 1 1 1 0 = 14_{10}

Binary Multiplication

Binary multiplication is similar to decimal multiplication. It is simpler than decimal multiplication because only 0s and 1s are involved. There four rules of the binary multiplication.

Case	A x B	Multiplication
1	0 x 0	0
2	0 x 1	0
3	1 x 0	0
4	1 x 1	1

EXAMPLE - MULTIPLICATION

Example:

0011010 x 001100 = 100111000

```
    0011010  = 26₁₀
  x0001100   = 12₁₀
  ---------
    0000000
   0000000
  0011010
 0011010
 ---------
 0100111000  = 312₁₀
```

Binary Division

Binary division is similar to decimal division. It is called as the long division procedure.

EXAMPLE - DIVISION

101010 / 000110 = 000111

```
          111     = 7₁₀
      ----------
000110 ) 101010   = 42₁₀
        -110      = 6₁₀
        ----
         100
         -110
         ----
          110
          -110
          ----
            0
```

Questions

1. Define Binary codes.
2. What is meant by alphanumeric codes?
3. Elaborate on weighted and non weighted codes.
4. Write short note on binary arithmetic.
5. Explain 1's and 2's complement with an example.
6. Define Gray code.
7. What is meant by Excess-3 Code?
8. Brief on BCD codes.
9. Write the number $(123)_{10}$ in binary, BCD and Excess-3 code.
10. Write the number $(25)_{10}$ in binary, BCD and Gray
11. What do you understand by self-complementing code?
12. Why the gray code is called as reflected binary code?

CHAPTER 4

LOGIC GATE TRUTH TABLES

Basic logic circuits with one or more inputs and one output are known as gates. Gates are used as the building blocks in the design of more complex digital logic circuit.

The input and output information of any Logic Gate or circuit can be plotted into a standard table to give a visual representation of the switching function of the system. The table used to represent the Boolean expression of a logic gate function is commonly called a Truth Table. A logic gate truth table shows each possible input combination to the gate or circuit with the resultant output depending upon the combination of these input(s).

For example, consider a single 2-input logic circuit with input variables labelled as A and B. There are "four" possible input combinations or 2^2 of "OFF" and "ON" for the two inputs. However, when dealing with Boolean expressions and especially logic gate truth tables, we do not general use "ON" or "OFF" but instead give them bit values which represent a logic level "1" or a logic level "0" respectively.

Then the four possible combinations of A and B for a 2-input logic gate is given as:

- Input Combination 1. – "OFF" – "OFF" or (0, 0)
- Input Combination 2. – "OFF" – "ON" or (0, 1)
- Input Combination 3. – "ON" – "OFF" or (1, 0)
- Input Combination 4. – "ON" – "ON" or (1, 1)

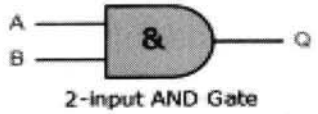
Therefore, a 3-input logic circuit would have 8 possible input combinations or 2^3 and a 4-input logic circuit would have 16 or 2^4, and so on as the number of inputs increases. Then a logic circuit with "n" number of inputs would have 2^n possible input combinations of both "OFF" and "ON".

So in order to keep things simple to understand we will only deal with standard 2-input type logic gates, but the principles are still the same for gates with more than two inputs.

Then the Truth tables for a 2-input AND Gate, a 2-input OR Gate and a single input NOT Gate are given as:

2-input AND Gate

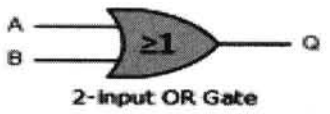
For a 2-input AND gate, the output Q is true if BOTH input A "AND" input B are both true, giving the Boolean Expression of: (Q = A and B).

Symbol	Truth Table		
 2-input AND Gate	A	B	Q
	0	0	0
	0	1	0
	1	0	0
	1	1	1
Boolean Expression Q = A.B	Read as A AND B gives Q		

Note that the Boolean Expression for a two input AND gate can be written as: A.B or just simply AB without the decimal point.

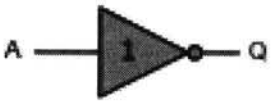
-input OR (Inclusive OR) Gate

For a 2-input OR gate, the output Q is true if EITHER input A "OR" input B is true, giving the Boolean Expression of: (Q = A or B).

Symbol	Truth Table		
 2-input OR Gate	A	B	Q
	0	0	0
	0	1	1
	1	0	1
	1	1	1

NOT Gate

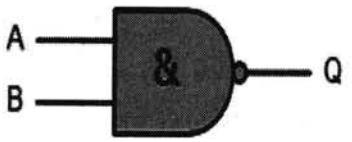
For a single input NOT gate, the output Q is ONLY true when the input is "NOT" true, the output is the inverse or complement of the input giving the Boolean Expression of: (Q = NOT A).

Symbol	Truth Table	
 Inverter or NOT Gate	A	Q
	0	1
	1	0
Boolean Expression Q = NOT A or A	Read as inversion of A gives Q	

The NAND and the NOR Gates are a combination of the AND and OR Gates with that of a NOT Gate or inverter.

2-input NAND (Not AND) Gate

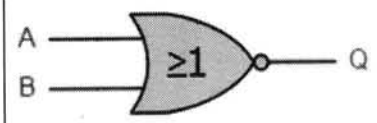
For a 2-input NAND gate, the output Q is true if input A or input B are NOT true, giving the Boolean Expression of: (Q = not(A and B)).

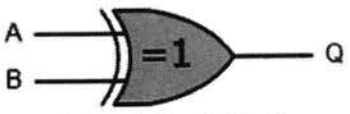
Symbol	Truth Table		
 2-input NAND Gate	A	B	Q
	0	0	1
	0	1	1
	1	0	1
	1	1	0
Boolean Expression Q = Not(A .B)	Read as A AND B gives NOT-Q		

2-input NOR (Not OR) Gate

For a 2-input NOR gate, the output Q is true if BOTH input A and input B are NOT true, giving the Boolean Expression of: (Q= not(A or B)).

As well as the standard logic gates there are also two special types of logic gate function called an Exclusive-OR Gate and an Exclusive-NOR Gate. The actions of both of these types of gates can be made using the above standard gates however, as they are widely used functions, they are now available in standard IC form and have been included here as reference.

Symbol	Truth Table		
 2-input NOR Gate	A	B	Q
	0	0	0
	0	1	1
	1	0	1
	1	1	0
Boolean Expression Q = Not(A+B)	Read as A OR B gives NOT-Q		

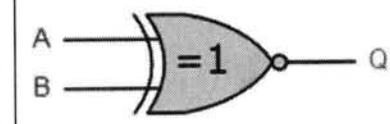
Symbol	Truth Table		
 2-input Ex-OR Gate	A	B	Q
	0	0	0
	0	1	1
	1	0	1
	1	1	0
Boolean Expression Q = Not(A+B)	Read as A OR B gives NOT-Q		

2-input EX-OR (Exclusive OR) Gate

For a 2-input Ex-OR gate, the output Q is true if EITHER input A or if input B is true, but NOT both giving the Boolean Expression of: (Q = (A and NOT B) or (NOT A and B)).

2-input EX-NOR (Exclusive NOR) Gate

For a 2-input Ex-NOR gate, the output Q is true if BOTH input A and input B are the same, either true or false, giving the Boolean Expression of: (Q = (A and B) or (NOT A and NOT B)).

Symbol	Truth Table		
 2-input Ex-NOR Gate	A	B	Q
	0	0	1
	0	1	0
	1	0	0
	1	1	1
Boolean Expression Q = Not(A+B)	Read as A OR B gives NOT-Q		

Inputs		Truth Table Outputs For Each Gate					
A	B	AND	NAND	OR	NOR	EX-OR	EX-NOR
0	0	0	1	0	1	0	1
0	1	0	1	1	0	1	0
1	0	0	1	1	0	1	0
1	1	1	0	1	0	0	1

Summary of 2-input Logic Gates

The following Truth Table compares the logical functions of the 2-input logic gates above.

The following table gives a list of the common logic functions and their equivalent Boolean notation.

ILogic Function	Boolean Notation
AND	A.B
OR	A+B
NOT	A
NAND	A .B
NOR	A+B
EX-OR	(A.B) + (A.B) or A B
EX-NOR	(A.B) + or A B

2-input logic gate truth tables are given here as examples of the operation of each logic function, but there are many more logic gates with 3, 4 even 8 individual inputs. The multiple input gates are no different to the simple 2-input gates above, So a 4-input AND gate would still require ALL 4-inputs to be present to produce the required output at Q and its larger truth table would reflect that.

UNIVERSAL GATES.

AND, NOT and OR gates are the basic gates; we can create any logic gate or any Boolean expression by combining them. Now NOR and NAND gates have the particular property that any one of them can create any logical Boolean expression if designed in a proper way. Therefore NAND and NOR Gates are called Universal Gates.

De- Morgan's laws

There are actually two theorems that were put forward by De-Morgan. On the basis of DE Morgan's laws much Boolean algebra are solved. Solving these types of algebra with De-Morgan's theorem has a major application in the field of digital electronics. De Morgan's theorem can be stated as follows:-

Theorem 1:

The compliment of the product of two variables is equal to the sum of the compliment of each variable.

Thus according to De-Morgan's laws or De-Morgan's theorem if A and B are the two variables or Boolean numbers. Then accordingly

$(A.B)' = A' + B'$

Theorem 2: The compliment of the sum of two variables is equal to the product of the compliment of each variable.

Thus according to De Morgan's theorem if A and B are the two variables then.

$(A + B)' = A'.B'$

THE LAWS OF BOOLEAN ALGEBRA

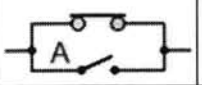
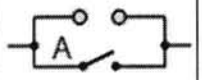
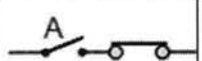
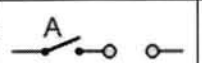
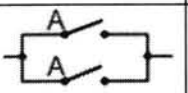
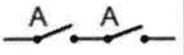
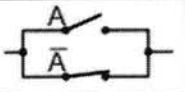
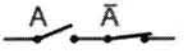
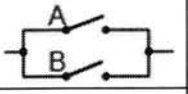
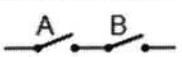
As well as the logic symbols "0" and "1" being used to represent a digital input or output, we can also use them as constants for a permanently "Open" or "Closed" circuit or contact respectively. A set of rules or Laws of Boolean Algebra expressions have been invented to help reduce the number of logic gates needed to perform a particular logic operation resulting in a list of functions or theorems known commonly as the Laws of Boolean Algebra.

Boolean Algebra is the mathematics we use to analyze digital gates and circuits. We can use these "Laws of Boolean" to both reduce and simplify a complex Boolean expression in an attempt to reduce the number of logic gates required. ***Boolean Algebra*** is therefore a system of mathematics based on logic that has its own set of rules or laws which are used to define and reduce Boolean expressions.

The variables used in Boolean Algebra only have one of two possible values, a logic "0" and a logic"1" but an expression can have an infinite number of variables all labelled individually to represent inputs to the expression, For example, variables A, B, C etc, giving us a logical expression of A + B = C, but each variable can ONLY be a 0 or a 1.

Examples of these individual laws of Boolean, rules and theorems for Boolean Algebra are given in the following table.

Truth Tables for the Laws of Boolean

Boolean Expression	Description	Equivalent Switching Circuit	Boolean Algebra Law or Rule
A + 1 = 1	A in parallel with closed = "CLOSED"		Annulment
A + 0 = A	A in parallel with open= "A"		Identity
A . 1 = A	A in series with closed= "A"		Identity
A . 0 = 0	A in series with open= "OPEN"		Annulment
A + A = A	A in parallel with A = "A"		Indempotent
A . A = A	A in series with A = "A"		Indempotent
NOT A = A	NOT NOT A(double negative) = "A"		Double Negation
A + A = 1	A in parallel with not " A= "CLOSED		Complement
A . A = 0	A in series with not A= "OPEN"		Complement
A+B = B+A	A in parallel with B =B i n parallel with A		Commutative
A.B = B.A	A in series with B =B in series with A		Commutative

The basic **Laws of Boolean Algebra** that relate to the **Commutative Law** allowing a change in position for addition and multiplication, the **Associative Law** allowing the removal of brackets for addition and multiplication, as well as the **Distributive Law** allowing the factoring of an expression, are the same as in ordinary algebra.

Each of the Boolean Laws above are given with just a single or two variables, but the number of variables defined by a single law is not limited to this as there can be an infinite number of variables as inputs too the expression. These Boolean laws detailed above can be used to prove any given Boolean expression as well as for simplifying complicated digital circuits.

A brief description of the various Laws of Boolean **are given below with A representing a variable input.**

Description of the Laws of Boolean Algebra

- Annulment Law – A term AND'ed with a "0" equals 0 or OR'ed with a "1" will equal 1.
  - A . 0 = 0 A variable AND'ed with 0 is always equal to 0.
  - A + 1 = 1 A variable OR'ed with 1 is always equal to 1.
- Identity Law – A term OR'ed with a "0" or AND'ed with a "1" will always equal that term.
  - A + 0 = A A variable OR'ed with 0 is always equal to the variable.
  - A . 1 = A A variable AND'ed with 1 is always equal to the variable.
- Indempotent Law – An input AND'ed with itself or OR'ed with itself is equal to that input.
  - A + A = A A variable OR'ed with itself is always equal to the variable.
  - A . A = A A variable AND'ed with itself is always equal to the variable.
- Complement Law – A term AND'ed with its complement equals "0" and a term OR'ed with its complement equals "1".
  - A . A = 0 A variable AND'ed with its complement is always equal to 0.
  - A + A = 1 A variable OR'ed with its complement is always equal to 1.
- Commutative Law – The order of application of two separate terms is not important.
  - A . B = B . A The order in which two variables are AND'ed makes no difference.
  - A + B = B + A The order in which two variables are OR'ed makes no difference.
- Double Negation Law – A term that is INVERTED twice is equal to the original term.
  - ((A)')' = A A double complement of a variable is always equal to the variable.
- De Morgan's Theorem – There are two "de Morgan's" rules or theorems,
- (1) Two separate terms NOR'ed together is the same as the two terms INVERTED (Complement) and AND'ed for example, (A+B)' = A'. B'.
- (2) Two separate terms NAND'ed together is the same as the two terms inverted (Complement) and OR'ed for example, (A.B)' = A' +B'.

Other algebraic Laws of Boolean not detailed above include:

- Distributive Law – This law permits the multiplying or factoring out of an expression.
  - A(B + C) = A.B + A.C (OR Distributive Law)
  - A + (B.C) = (A + B).(A + B) (AND Distributive Law)
- Absorptive Law – This law enables a reduction in a complicated expression to a simpler one by absorbing like terms.

- ❖ A + (A.B) = A (OR Absorption Law)
- ❖ A(A + B) = A (AND Absorption Law)

❑ Associative Law – This law allows the removal of brackets from an expression and regrouping of the variables.

- ❖ A + (B + C) = (A + B) + C = A + B + C (OR Associate Law)
- ❖ A(B.C) = (A.B)C = A . B . C (AND Associate Law)

Boolean Algebra Functions

Using the information above, simple 2-input AND, OR and NOT Gates can be represented by 16 possible functions as shown in the following table.

	Function Description	Expression
1.	NULL	0
2.	IDENTITY	1
3.	Input A	A
4.	Input B	B
5.	NOT A	A
6.	NOT B	B
7.	A AND B (AND)	A . B
8.	A AND NOT B	A . B'
9.	NOT A AND B	A' . B
10.	NOT A AND NOT B (NAND)	(A. B)'
11.	A OR B (OR)	A + B
12.	A OR NOT B	A + B'
13.	NOT A OR B	A' + B
14.	NOT OR (NOR)	(A + B)'
15.	Exclusive-OR	A.B' + A'.B
16.	Exclusive-NOR	A.B + A'.B'

Laws of Boolean Algebra

Example

Using the above laws, simplify the following expression: (A + B)(A + C)

Q =(A + B).(A + C)

A.A + A.C + A.B + B.C	– Distributive law
A + A.C + A.B + B.C	– Identity AND law (A.A = A)
A(1 + C) + A.B + B.C	– Distributive law
A.1 + A.B + B.C	– Identity OR law (1 + C = 1)
A(1 + B) + B.C	– Distributive law
A.1 + B.C	– Identity OR law (1 + B = 1)
Q = A + (B.C)	– Identity AND law (A.1 = A)

QUESTIONS

1. What are Logic gates?
2. What is meant by universal gate?
3. What is Boolean algebra?
4. Explain the basic laws of Boolean algebra with the truth tables.
5. State and prove De-Morgan's Law
6. By means of truth tables, prove the validity of the following laws

a) Distributive Law b) Absorption Law

7. Define Duality principle.
8. Explain various basic logic gates with the TT.
9. What is an XOR gate?
10. Draw the logic circuit for F(A,B,C) = (A + B+ C).(Â + B)

CHAPTER 5

SEQUENTIAL LOGIC

Sequential logic is a form of binary circuit design that employs one or more inputs and one or more outputs, whose states are related by defined rules that depend, in part, on previous states. Each of the inputs and output(s) can attain either of two states: logic 0 (low) or logic 1 (high).

A common example of a circuit employing sequential logic is the flip-flop, also called a bistable gate. A simple flip-flop has two stable states. The flip-flop maintains its states indefinitely until an input pulse called a trigger is received. If a trigger is received, the flip-flop outputs change their states according to defined rules, and remain in those states until another trigger is received.

There are several different kinds of flip-flop circuits, with designators such as D, T, J-K, and R-S. Flip-flop circuits are interconnected to form the logic gates that comprise digital integrated circuits (IC s) such as memory chips and microprocessors.

Sequential logic differs from combinatorial logic (also called combinational logic). In the later scheme, the output states depend only on the input states at a specific moment in time, and not on previous states.

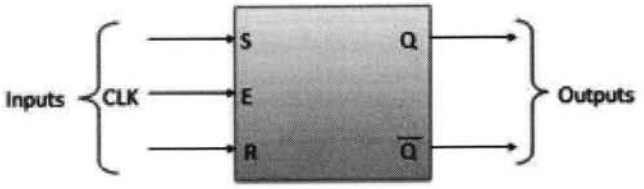
FLIP FLOP

Flip flop is a sequential circuit which generally samples its inputs and changes its outputs only at particular instants of time and not continuously. Flip flop is said to be edge sensitive or edge triggered rather than being level triggered like latches. Flip-flop is a 1 bit memory cell which can be used for storing the digital data. To increase the storage capacity in terms of number of bits, we have to use a group of flip-flop.

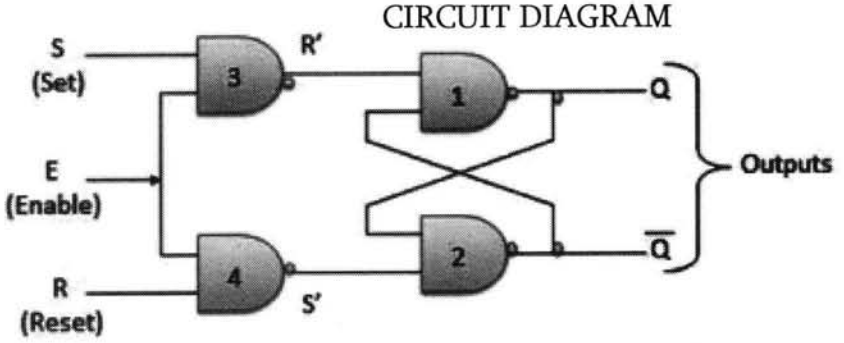
S-R Flip Flop

It is basically S-R latch using NAND gates with an additional **enable** input. It is also called as level triggered SR-FF. For this circuit in output will take place if and only if the enable input (E) is made active. In short this circuit will operate as an S-R latch if E= 1 but there is no change in the output if E = 0.

BLOCK DIAGRAM



CIRCUIT DIAGRAM



TRUTH TABLE

Inputs			Outputs		Comments
E	S	R	Q_{n+1}	$\overline{Q_{n+1}}$	
1	0	0	Q_n	$\overline{Q_n}$	No change
1	0	1	0	1	Rset
1	1	0	1	0	Set
1	1	1	x	x	Indeterminate

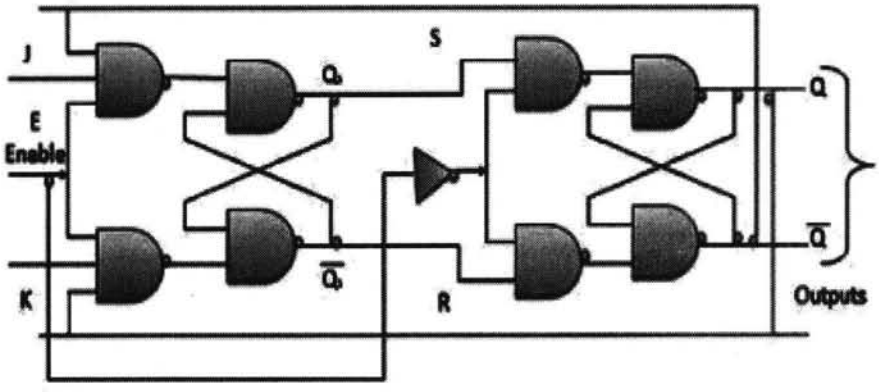
OPERATION

S.N.	Condition	Operation
1	S = R = 0 : No change	If S = R = 0 then output of NAND gates 3 and 4 are forced to become 1.· Hence R'and S' both will be equal to 1. Since S' and R' are the input of the basic S-R latch using NAND gates, there will be no change in the state of outputs.
2	S = 0, R=1,E=1	Since S = 0, output of NAND-3 i.e. R' = 1· and E = 1 the output of NAND-4 i.e. S'=0.· Hence Q_{n+1} = 0 and Q_{n+1} bar = 1. This is Reset condition.
3	S = 1, R=0,E=1	Output of NAND-3 i.e. R' = 0 and output of NAND-4 i.e. S' = 1.· Hence output of S-R NAND latch is Q_{n+1} = 1 and Q_{n+1} bar = 0. This is the Set condition.
4	S = 1, R=1,E=1	As S = 1, R = 1 and E = 1, the output of NAND gates 3 and 4 both are 0 i.e. S'=R'=0.· Hence the Race condition will occur in the basic NAND latch.

Master Slave JK Flip Flop

Master slave JK FF is a cascade of two S-R FF with feedback from the output of second to input of first. Master is a positive level triggered. But due to the presence of the inverter in the clock line, the slave will respond to the negative level. Hence when the clock = 1 (positive level) the master is active and the slave is inactive. Whereas when clock = 0 (low level) the slave is active and master is inactive.

CIRCUIT DIAGRAM



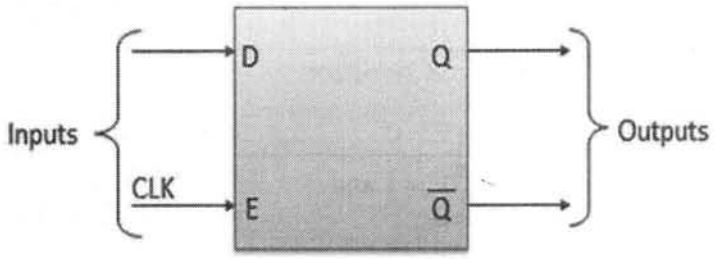
TRUTH TABLE

Inputs			Outputs		Comments
E	J	K	Q_{n+1}	$\overline{Q}_{n+1}$	
1	0	0	Q_n	$\overline{Q}_n$	No change
1	0	1	0	1	Rset
1	1	0	1	0	Set
1	1	1	$\overline{Q}_n$	Q_n	Toggle

OPERATION

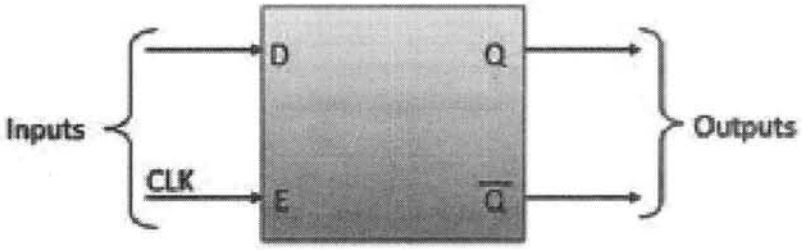
S.N.	Condition	Operation
1	J = K = 0	When clock = 0, the slave becomes active and master is inactive. But since the S and R inputs have not changed, the slave outputs will also remain unchanged. Therefore outputs will not change if J = K =0.
2	J = 0 and = 1 (Reset)·	Clock = 1: Master active, slave inactive. Therefore K outputs of the master become Q_1 = 0 and Q_1 bar = 1. That means S = 0 and R =1.·
		Clock = 0: Slave active, master inactive Therefore out puts of the slave become Q = 0 and Q bar = 1.·
		Again clock = 1: Master active, slave inactive. Therefore even with the changed outputs Q = 0 and Q bar = 1 fed back to master, its outputs will Q1 = 0 and Q1 bar = 1. That means S = 0 and R = 1.·
		Hence with clock = 0 and slave becoming active the outputs of slave will remain Q = 0 and Q bar = 1. Thus we get a stable output from the Master slave.
3	J = 1 and K = 0 (Set)·	Clock = 1: Master active, slave inactive. Therefore outputs of the master become Q_1 = 1 and Q_1 bar = 0. That means S = 1 and R =0.·
		Clock = 0: Slave active, master inactive Therefore outputs of the slave become Q = 1 and Q bar = 0.·
		Again clock = 1: then it can be shown that the outputs of the slave are stabilized to Q = 1 and Q bar = 0.
4	J = K = 1 (Toggle)·	Clock = 1: Master active, slave inactive. Outputs of master will toggle. So S and R also will be inverted.·
		Clock = 0: Slave active, master inactive. Outputs of slave will toggle.·
leads slave flip		These changed output are returned back to the master inputs. But since clock = 0, the master is still inactive. So it does not respond to these changed outputs. This avoids the multiple toggling which to the race around condition. The master flop will avoid the race around condition.

Delay Flip Flop / D Flip Flop

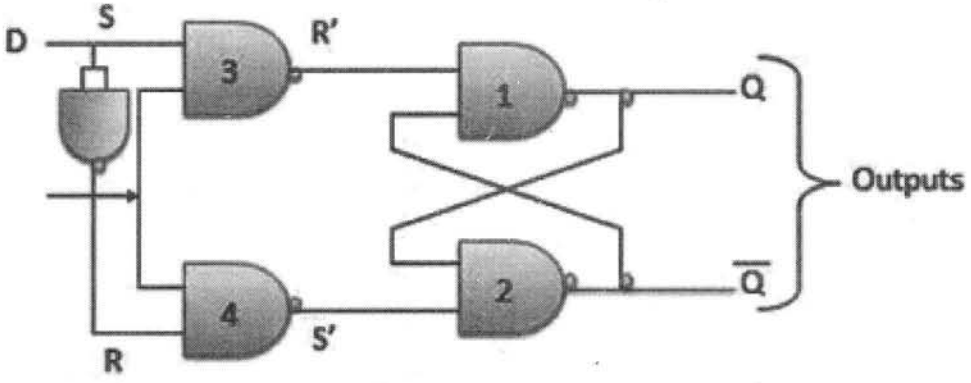


Delay Flip Flop or D Flip Flop is the simple gated S-R latch with a NAND inverter connected between S and R inputs. It has only one input. The input data is appearing at the output after some time. Due to this data delay between i/p and o/p, it is called delay flip flop. S and R will be the complements of each other due to NAND inverter. Hence S = R = 0 or S = R = 1,these input condition will never appear. This problem is avoid by SR = 00 and SR = 1 conditions.

BLOCK DIAGRAM



CIRCUIT DIAGRAM



TRUTH TABLE

Inputs		Outputs		Comments
E	D	Q_{n+1}	$\overline{Q}_{n+1}$	
1	0	0	1	Rset
1	1	1	0	Set

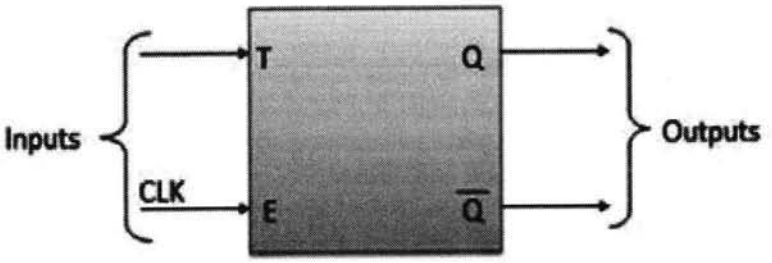
OPERATION

S.N.	Condition	Operation
	E = 0 ·	Latch is disabled. Hence is no change in output.
	E = 1 and 0·	If E = 1 and D = 0 then S = 0 and R = 1. Hence D = irrespective of the present state, the next state is Q_{n+1} = 0 and Q_{n+1} bar = 1. This is the reset condition.
	E = 1 and D = 1·	if E = 1 and D = 1, then S = 1 and R = 0. This will set the latch and Q_{n+1} = 1 and Q_{n+1} bar = 0 irrespective of the present state.

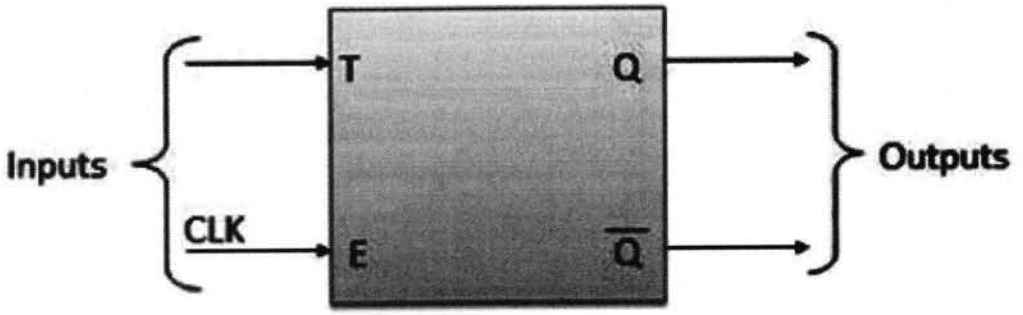
Toggle Flip Flop / T Flip Flop

Toggle flip flop is basically a JK flip flop with J and K terminals permanently connected together. It has only input denoted by T is shown in the Symbol Diagram. The symbol for positive edge triggered T flip flop is shown in the Block Diagram.

SYMBOL DIAGRAM



BLOCK DIAGRAM



TRUTH TABLE

Inputs		Outputs		Comments
E	T	Q_{n+1}	$\overline{Q}_{n+1}$	
1	0	Q_n	$\overline{Q}_n$	No change
1	1	$\overline{Q}_n$	Q_n	Toggle

OPERATION

S.N.	Condition	Operation
	T = 0, J = K = 0.	The output Q and Q bar won't change
	T = 1, J = K = 1.	output will toggle corresponding to every leading edge of clock signal.

REGISTERS

Flip-flop is a 1 bit memory cell which can be used for storing the digital data. To increase the storage capacity in terms of number of bits, we have to use a group of flip-flop. Such a group of flip-flop is known as a **Register**. The **n-bit register** will consist of **n** number of flip-flop and it is capable of storing an **n**-bit word.

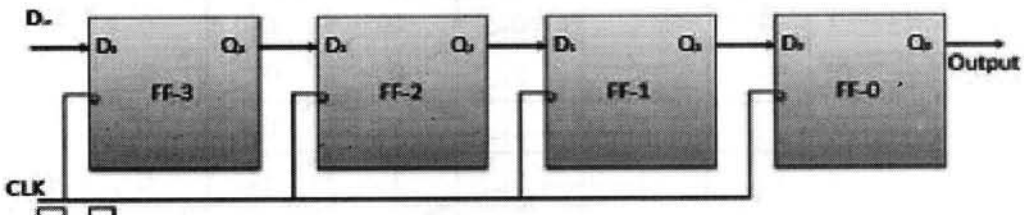
The binary data in a register can be moved within the register from one flip-flop to another. The registers that allow such data transfers are called as **shift registers**. There are four mode of opearation of a shift register.

- Serial Input Serial Output
- Serial Input Parallel Output
- Parallel Input Serial Output
- Parallel Input Parallel Output

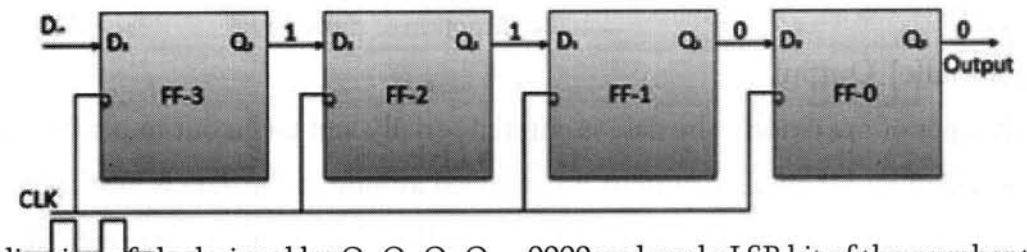
Serial Input Serial Output

Let all the flip-flop be initially in the reset condition i.e. $Q_3 = Q_2 = Q_1 = Q_0 = 0$. If we entry of a four bit binary number 1 1 1 1 into the register. When this is to be done, this number should be applied to D_{in} bit by with the LSB bit applied first. The D input of FF-3 i.e. D_3 is connected to serial data input D_{in}. Output of FF-3 i.e. Q_3 is connected to the input of the next flip-flop i.e. D_2 and so on.

BLOCK DIAGRAM

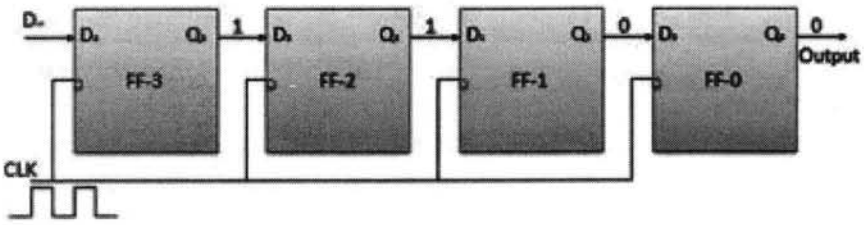


OPERATION

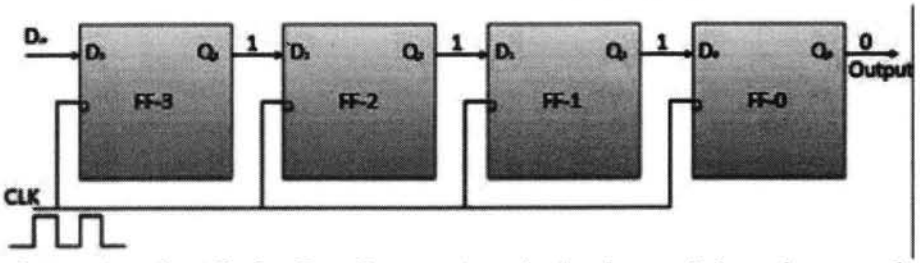


Before application of clock signal let $Q_3\ Q_2\ Q_1\ Q_0 = 0000$ and apply LSB bit of the number to be entered to D_{in}. So $D_{in}=D_3=1$. Apply the clock. On the first falling edge of clock, the FF-3 is set, and stored word in the register is $Q_3\ Q_2\ Q_1\ Q_0 = 1000$.

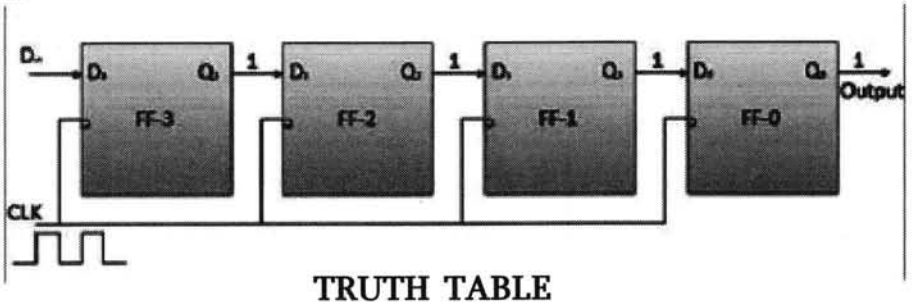
Apply the next bit to D_{in}. So D_{in}=1. As soon as the next negative edge of the clock hits, FF-2 will set and the stored word change to $Q_3\ Q_2\ Q_1\ Q_0$ = 1100.



Apply the next bit to be stored i.e. 1 to D_{in}. Apply the clock pulse. As soon as the third negative clock edge hits, FF-1 will be set and output will be modified to $Q_3\ Q_2\ Q_1\ Q_0$ = 1110.



Similarly with D_{in}=1 and with the fourth negative clock edge arriving, the stored word in the register is $Q_3\ Q_2\ Q_1\ Q_0$ = 1111.



TRUTH TABLE

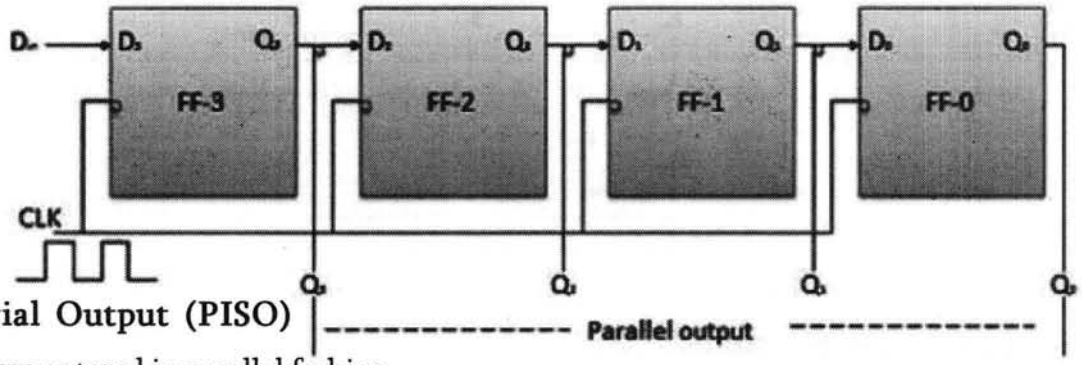
	CLK	$D_{in}=Q_3$	$Q_3=D_2$	$Q_2=D_1$	$Q_1=D_0$	Q_0
Initially			0	0	0	0
(i)	↓	1	1	0	0	0
(ii)	↓	1	1	1	0	0
(iii)	↓	1	1	1	1	0
(iv)	↓	1	1	1	1	1

→ Direction of data travel

Serial Input Parallel Output

- In such types of operations, the data is entered serially and taken out in parallel fashion.
- Data is loaded bit by bit. The outputs are disabled as long as the data is loading.
- As soon as the data loading gets completed, all the flip-flops contain their required data, the outputs are enabled so that all the loaded data is made available over all the output lines at the same time.
- 4 clock cycles are required to load a four bit word. Hence the speed of operation of SIPO mode is same as that of SISO mode.

BLOCK DIAGRAM



Parallel Input Serial Output (PISO)

- Data bits are entered in parallel fashion.
- The circuit shown below is a four bit parallel input serial output register.
- Output of previous Flip Flop is connected to the input of the next one via a combinational circuit.
- The binary input word B_0,B_1,B_2,B_3 is applied though the same combinational circuit.
- There are two modes in which this circuit can work namely shift mode or load mode.

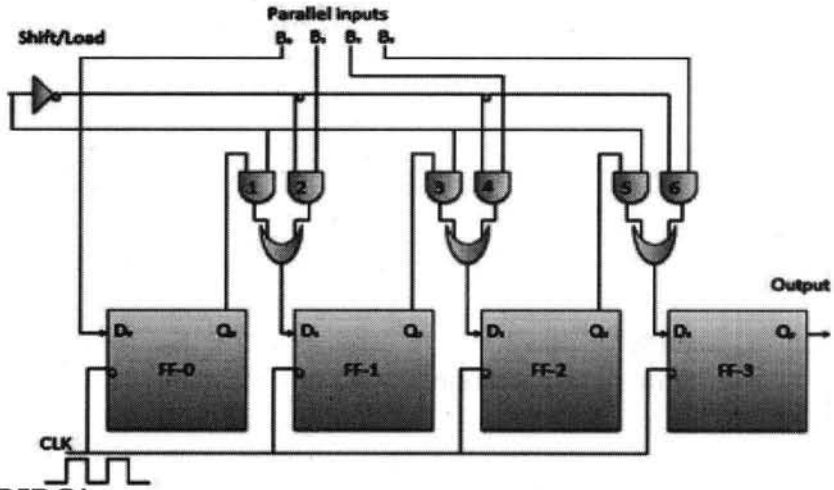
LOAD MODE

When the shift/load bar line is low (0), the AND gate 2,4 and 6 become active. They will pass B_1,B_2,B_3 bits to the corresponding flip-flops. On the low going edge of clock, the binary input B_0,B_1,B_2,B_3 will get loaded into the corresponding flip-flops. Thus parallel loading takes place.

SHIFT MODE

When the shift/load bar line is low (1), the AND gate 2,4 and 6 become inactive. Hence the parallel loading of the data becomes impossible. But the AND gate 1,3 and 5 become active. Therefore the shifting of data from left to right bit by bit on application of clock pulses. Thus the parallel in serial out operation take place.

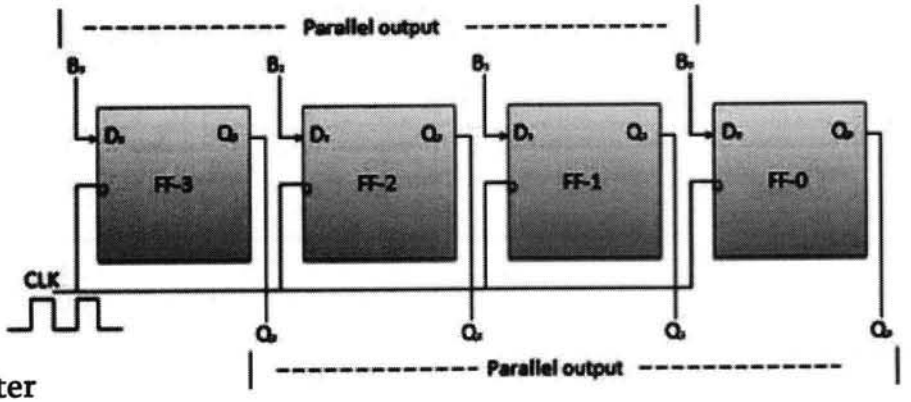
BLOCK DIAGRAM



Parallel Input Parallel Output (PIPO)

In this mode, the 4 bit binary input B_0,B_1,B_2,B_3 is applied to the data inputs D_0,D_1,D_2,D_3 respectively of the four flip-flops. As soon as a negative clock edge is applied, the input binary bits will be loaded into the flip-flops simultaneously. The loaded bits will appear simultaneously to the output side. Only clock pulse is essential to load all the bits.

BLOCK DIAGRAM



Bidirectional Shift Register

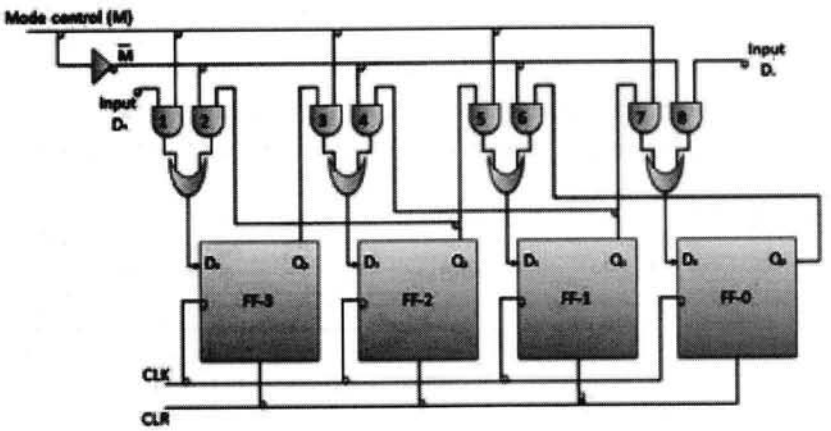
❖ If a binary number is shifted left by one position then it is equivalent to multiplying the original number by 2. Similarly if a binary number is shifted right by one position then it is equivalent to dividing the original number by 2.

❖ Hence if we want to use the shift register to multiply and divide the given binary number, then we should be able to move the data in either left or right direction.

❖ Such a register is called as a bi-directional register. A four bit bi-directional shift register is shown in fig.

❖ There are two serial inputs namely the serial right shift data input DR and the serial left shift data input DL along with a mode select input (M).

BLOCK DIAGRAM



S.N.	Condition	Operation
1	**With M = 1 : Shift right operation·**	If M = 1, then the AND gates 1,3,5 and 7 are enable whereas the remaining AND gates 2,4,6 and 8 will be disabled.· The data at D_R is shifted to right bit by bit from FF-3 to FF-0 on the application of clock pulses. Thus with M = 1 we get the serial right shift operation.
2	**With M = 0 : Shift left operation·** the application of clock pulses. Thus with M = 0 we get the serial right shift operation.	When the mode control M is connected to 0 then the AND gates 2,4,6 and 8 are enabled while 1,3,5 and 7 are disabled.· The data at D_L is shifted left bit by bit from FF-0 to FF-3 on

OPERATION

COUNTERS

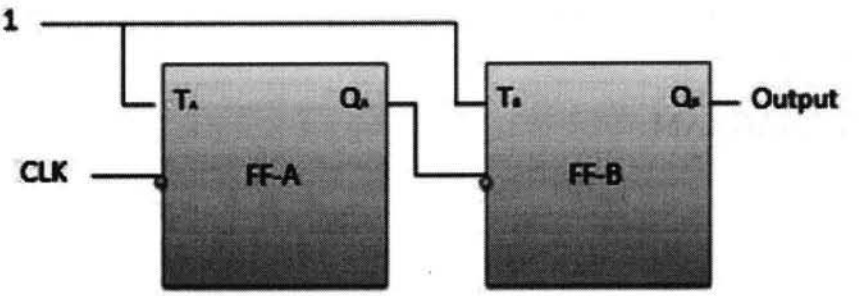
Counter is a sequential circuit. A digital circuit which is used for a counting pulses is known counter. Counter is the widest application of flip-flops. It is a group of flip-flops with a clock signal applied. Counters are of two types.

- Asynchronous or ripple counters
- Synchronous counters.

Asynchronous or ripple counters

The logic diagram of a 2-bit ripple up counter is shown in figure. The toggle(T) flip-flop are being used. But we can use the JK flip-flop also with J and K connected permanently to logic 1. External clock is applied to the clock input of flip-flop A and Q_A output is applied to the clock input of the next flip-flop i.e. FF-B.

LOGICAL DIAGRAM



S.N.	Condition	Operation
	Initially let both the FFs be in the reset state	Q_BQ_A =00.....initially
	After 1st negative clock edge	As soon as the first negative clock edge is applied, FF-A will toggle and Q_A will be equal to 1. Q_A is connected to clock input of FF-B. Since Q_A has changed from 0 to 1, it is treated as the positive clock edge by FF-B. There is no change in Q_B because FF-B is a negative edge triggered FF.Q_BQ_A =01.....After the first clock pulse
	After 2nd negative clock edge	On the arrival of second negative clock edge, FF-A toggles again and Q_A =0. The change in Q_A acts as a negative clock edge for FF-B. So it will also toggle, and Q_B will be 1.Q_BQ_A = 10.....After the second clock pulse
	After 3rd negative clock edge	On the arrival of 3rd negative clock edge, FF-A toggles again and Q_A become 1 from 0. Since this is a positive going change,FF-B does not respond to it and remains inactive. So Q_B does not change and continues to be equal to 1. Q_BQ_A = 11.....After the third clock pulse
	After 4th negative clock edge	On the arrival of 4th negative clock edge, FF-A toggles again and Q_A become 1 from 0. This negative change in Q_A acts as clock pulse for FF-B. Hence it toggles to change Q_B from 1 to 0.Q_BQ_A =00.....After the fourth clock pulse

Truth Table

Clock	Counter output		State number	Decimal Counter output
	Q_B	Q_A		
Initially	0	0	—	0
1st	0	1	1	1
2nd	1	0	2	2
3rd	1	1	3	3
4th	0	0	4	0

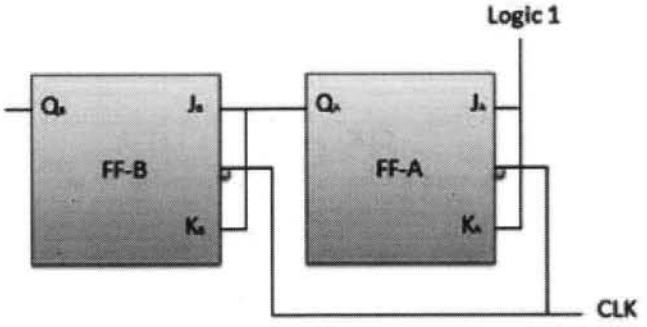
Synchronous counters

If the "clock" pulses are applied to all the flip-flops in a counter simultaneously, then such a counter is called as synchronous counter.

2-BIT SYNCHRONOUS UP COUNTER

The J_A and K_A inputs of FF-A are tied to logic 1. So FF-A will work as a toggle flip-flop. The J_B and $K_B$inputs are connected to Q_A.

LOGICAL DIAGRAM



OPERATION

S.N.	Condition	Operation
	Initially let both the FFs be in the reset state	Q_BQ_A = 00.....initially
	After 1st negative clock edge	As soon as the first negative clock edge is applied, FF-A will toggle and Q_A will change from 0 to 1. But at the instant of application of negative clock edge, Q_A , $J_B = K_B$ =0 Hence FF-B will not change its state. So Q_B will remain 0. Q_BQ_A = 01.....After the first clock pulse
	After 2nd negative clock edge	On the arrival of second negative clock edge, FF-A toggles again and Q_A change from 1 to 0. But at this instant Q_A was 1. So $J_B = K_B$=1 and FF-B will toggle. Hence Q_B changes from 0 to 1. Q_BQ_A = 10.....After the second clock pulse
	After 3rd negative clock edge	On application of the third falling clock edge, FF-A will toggle from 0 to 1 but there is no change of state for FF-B. Q_BQ_A = 11.....After the third clock pulse
	After 4th negative clock edge	On application of the next clock pulse, Q_A will change from 1 to 0 as Q_B will also change from 1 to 0 Q_BQ_A = 00.....After the fourth clock pulse

Application of the counters

- Frequency counters
- Digital clock
- Time measurement
- A to D converter
- Frequency divider circuits
- Digital triangular wave generator

Questions

1. Define flip-flop.
2. Explain the working of SR flip-flop.
3. Explain the working of JK Master Slave flip-flop.
4. Brief on D flip-flop
5. Elaborate on T flip-flop.
6. What is meant by sequential logic?
7. Discuss on Registers
8. Elaborate on Counters

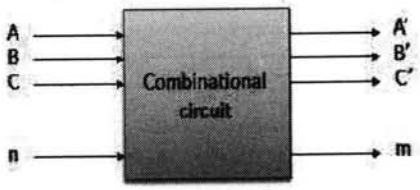
CHAPTER 6

COMBINATIONAL CIRCUITS

Combinational circuit is circuit in which we combine the different gates in the circuit for example encoder, decoder, multiplexer and demultiplexer. Some of the characteristics of combinational circuits are following.

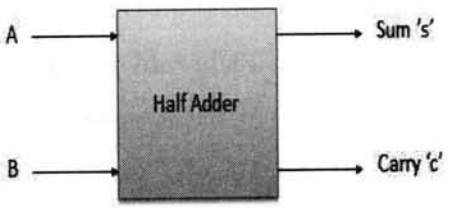
- The output of combinational circuit at any instant of time, depends only on the levels present at input terminals.
- The combinational circuit do not use any memory. The previous state of input does not have any effect on the present state of the circuit.
- A combinational circuit can have **n** number of inputs and **m** number of outputs.

BLOCK DIAGRAM

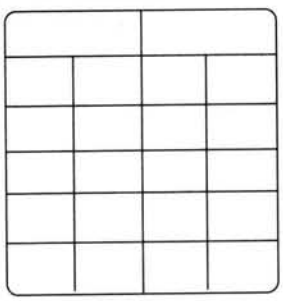


HALF ADDER

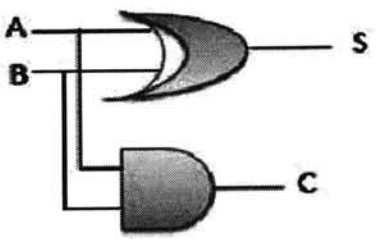
Half adder is a combinational logic circuit with two input and two output. The half adder circuit is designed to add two single bit binary numbers A and B. It is the basic building block for addition of two **single** bit numbers. This circuit has two outputs **carry** and **sum**.



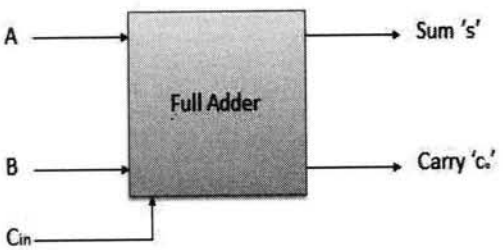
TRUTH TABLE



CIRCUIT DIAGRAM



FULL ADDER

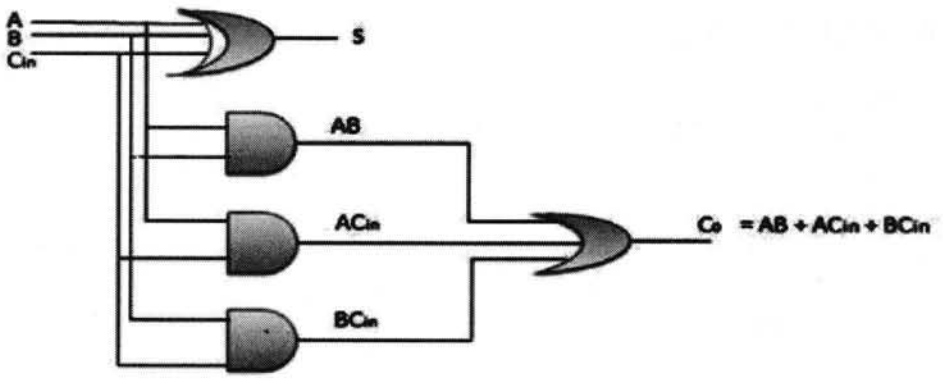


Full adder is developed to overcome the drawback of Half Adder circuit. It can add two one-bit numbers A and B, and carry c. The full adder is a three input and two output combinational circuit.

TRUTH TABLE

INPUT			OUTPUT	
A	B	C_{in}	S	C_o
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

CIRCUIT DIAGRAM



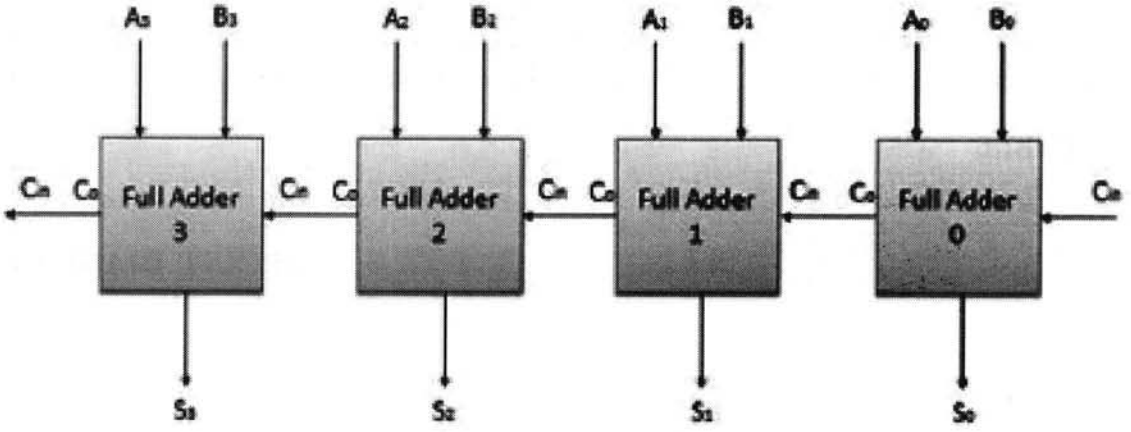
N-Bit Parallel Adder

The Full Adder is capable of adding only two single digit binary number along with a carry input. But in practical we need to add binary numbers which are much longer than just one bit. To add two n-bit binary numbers we need to use the n-bit parallel adder. It uses a number of full adders in cascade. The carry output of the previous full adder is connected to carry input of the next full adder.

4 BIT PARALLEL ADDER

In the block diagram, A_0 and B_0 represent the LSB of the four bit words A and B. Hence Full Adder-0 is the lowest stage. Hence its C_{in} has been permanently made 0. The rest of the connections are exactly same as that of n-bit parallel adder is shown in fig. The four bit parallel adder is a very common logic circuit.

BLOCK DIAGRAM



N-Bit Parallel Subtractor

The subtraction can be carried out by taking the 1's or 2's complement of the number to be subtracted. For example we can perform the subtraction (A-B) by adding either 1's or 2's complement of B to A. That means we can use a binary adder to perform the binary subtraction.

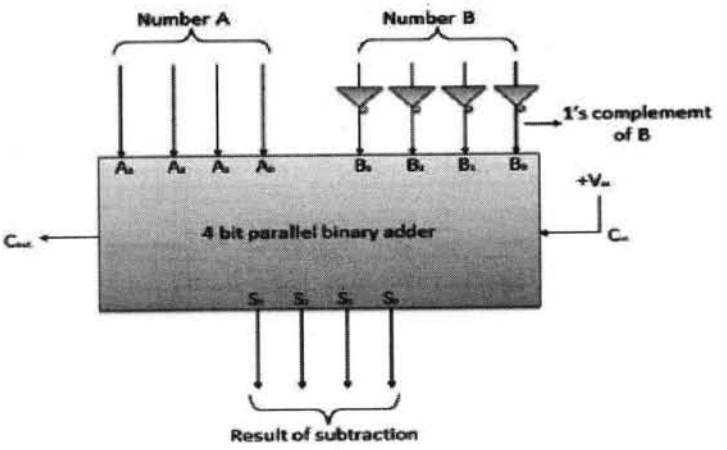
4 BIT PARALLEL SUBTRACTOR

The number to be subtracted (B) is first passed through inverters to obtain its 1's complement. The 4-bit adder then adds A and 2's complement of B to produce the subtraction. $S_3\ S_2\ S_1\ S_0$ represent the result of binary subtraction (A-B) and carry output C_{out} represents the polarity of the result. If A > B then Cout =0 and the result of binary form (A-B) then $C_{out} = 1$ and the result is in the 2's complement form.

HALF SUBTRACTORS

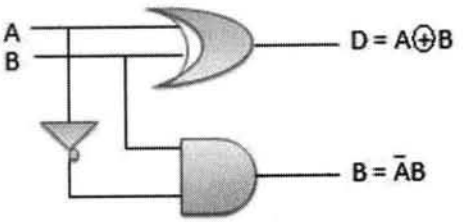
Half subtractor is a combination circuit with two inputs and two outputs (dif74ference and borrow). It produces the difference between the two binary bits at the input and also produces a output (Borrow) to indicate if a 1 has been borrowed. In the subtraction (A-B), A is called as Minuend bit and B is called as Subtrahend bit.

BLOCK DIAGRAM



TRUTH TABLE

Inputs		outputs	
a	b	Diff	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0



CIRCUIT DIAGRAM

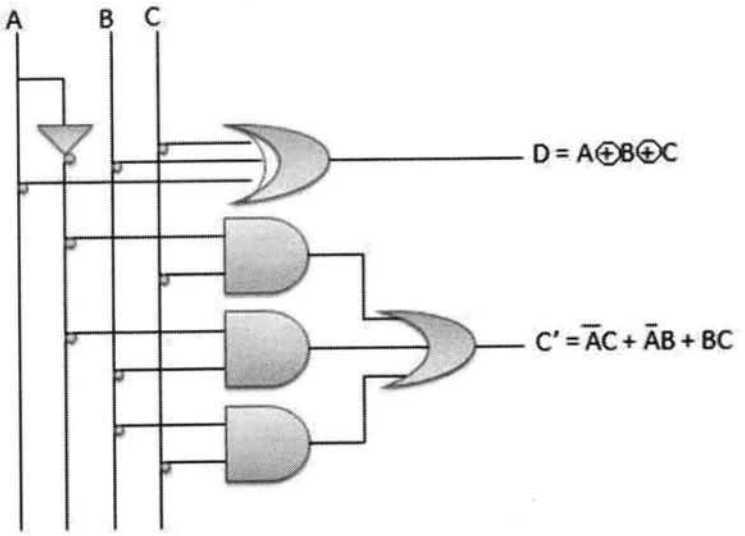
FULL SUBTRACTORS

The disadvantage of a half subtractor is overcome by full subtractor. The full subtractor is a combinational circuit with three inputs A,B,C and two output D and C'. A is the minuend, B is subtrahend, C is the borrow produced by the previous stage, D is the difference output and C' is the borrow output.

TRUTH TABLE

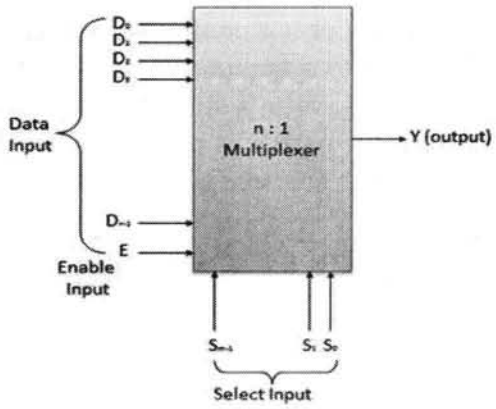
INPUT			OUTPUT	
A	B	C_{in}	DIFF	BORROW
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

CIRCUIT DIAGRAM



MULTIPLEXERS

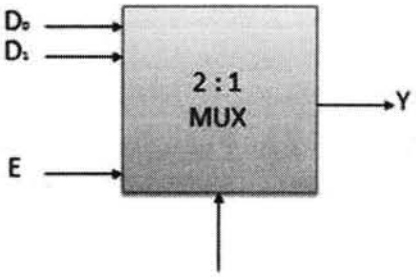
BLOCK DIAGRAM



Multiplexer is a special type of combinational circuit. There are n-data inputs, one output and m select inputs with 2m = n. It is a digital circuit which selects one of the n data inputs and routes it to the output. The selection of one of the n inputs is done by the selected inputs. Depending on the digital code applied at the selected inputs, one out of n data sources is selected and transmitted to the single output Y. E is called the strobe or enable input whi the cascading. It is generally an active low terminal, that means i the required operation when it is low.

Multiplexers come in multiple variations

- 2 : 1 multiplexer
- 4 : 1 multiplexer
- 16 : 1 multiplexer
- 32 : 1 multiplexer



BLOCK DIAGRAM

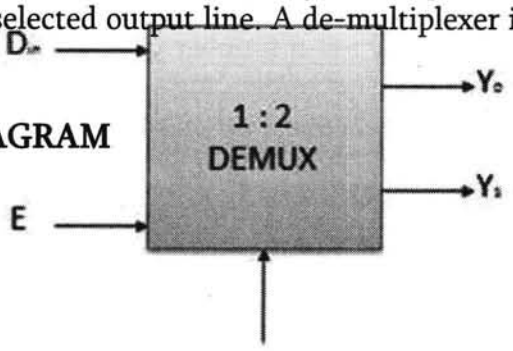
TRUTH TABLE

Enable	Select	Output
E	S	Y
0	x	0
1	0	D0
1	1	D1

x = Don't care

DEMULTIPLEXERS

A demultiplexer performs the reverse operation of a multiplexer i.e. it receives one input and distributes it over several outputs. It has only one input, n outputs, m select input. At a time only one output line is selected by the select lines and the input is transmitted to the selected output line. A de-multiplexer is equivalent to a single pole multiple way switch as shown in fig.



BLOCK DIAGRAM

Demultiplexers come in multiple variations

- 1 : 2 demultiplexer
- 1 : 4 demultiplexer
- 1 : 16 demultiplexer
- 1 : 32 demultiplexer

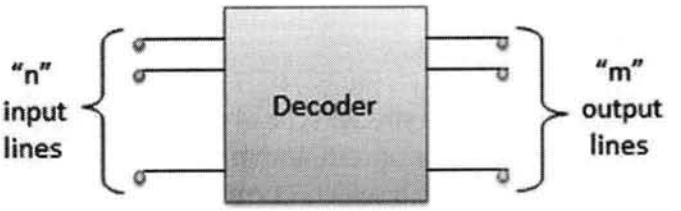
TRUTH TABLE

Enable	Select	Output
E	S	Y0 Y1
0	x	0 0
1	0	0 Din
1	1	Din 0

x = Don't care

DECODER

A decoder is a combinational circuit. It has n input and to a maximum m = 2n outputs. Decoder is identical to a demultiplexer without any data input. It performs operations which are exactly opposite to those of an encoder.



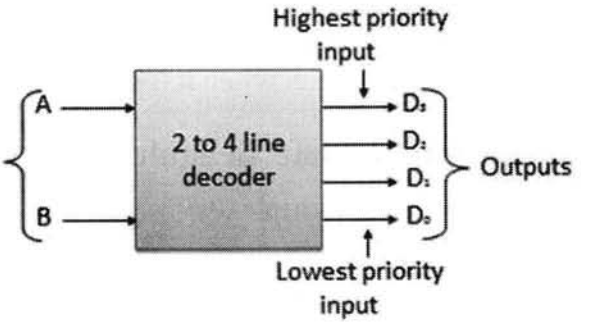
BLOCK DIAGRAM

Examples of Decoders are following.

- Code converters
- BCD to seven segment decoders
- Nixie tube decoders
- Relay actuator

2 to 4 Line Decoder

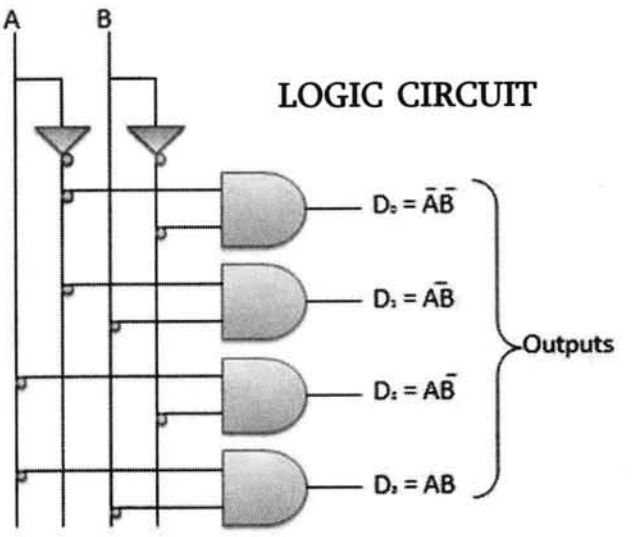
The block diagram of 2 to 4 line decoder is shown in the fig. A and B are the two inputs where D through D are the four outputs. Truth table explains the operations of a decoder. It shows that each output is 1 for only a specific combination of inputs.



TRUTH TABLE

Inputs		Output			
A	B	D_0	D_1	D_2	D_3
0	0	1	0	0	0
0	1	0	1	0	0
0	1	0	0	1	0
1	1	0	0	0	1

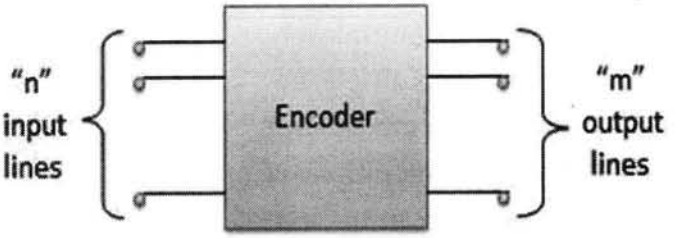
LOGIC CIRCUIT



ENCODER

Encoder is a combinational circuit which is designed to perform the inverse operation of the decoder. An encoder has n number of input lines and m number of output lines. An encoder produces an m bit binary code corresponding to the digital input number. The encoder accepts an n input digital word and converts it into an m bit another digital word.

BLOCK DIAGRAM



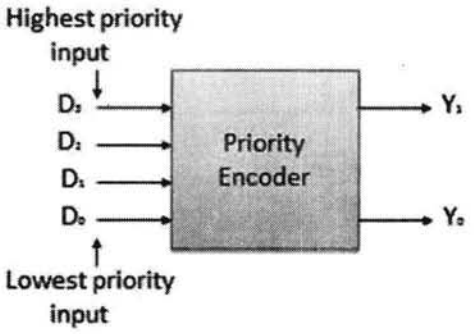
Examples of Encoders are following.

- Priority encoders
- Decimal to BCD encoder
- Octal to binary encoder
- Hexadecimal to binary encoder

PRIORITY ENCODER

This is a special type of encoder. Priority is given to the input lines. If two or more input line are 1 at the same time, then the input line with highest priority will be considered. There are four input D_0, D_1, D_2, D_3 and two output Y_0, Y_1. Out of the four input D_3 has the highest priority and D_0 has the lowest priority. That means if $D_3 = 1$ then $Y_1 Y_0 = 11$ irrespective of the other inputs. Similarly if $D_3 = 0$ and $D_2 = 1$ then $Y_1 Y_0 = 10$ irrespective of the other inputs.

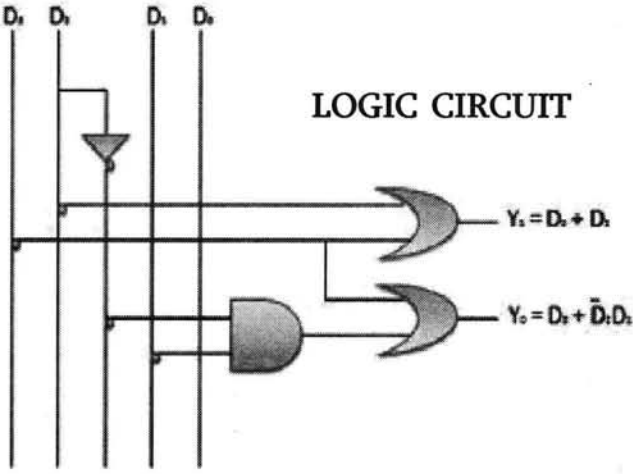
BLOCK DIAGRAM



TRUTH TABLE

Highest	Inputs		Lowest	Outputs	
D_3	D_2	D_1	D_0	Y_0	Y_1
0	0	0	0	x	x
0	0	0	1	0	0
0	0	1	x	0	1
0	1	x	x	1	0
1	x	x	x	1	1

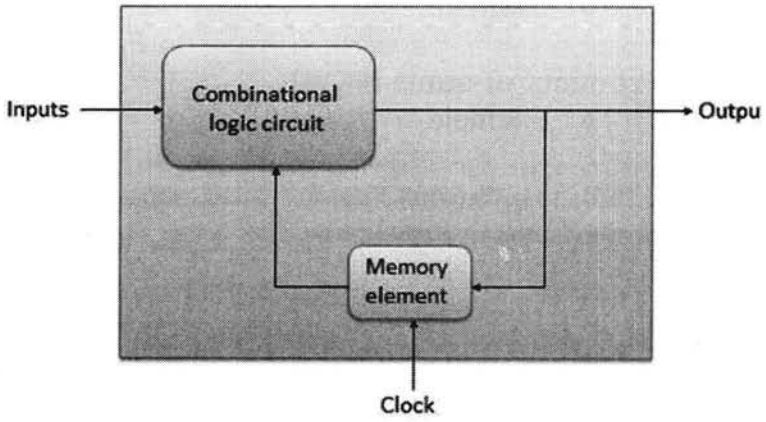
LOGIC CIRCUIT



THE COMBINATIONAL CIRCUIT DOES

not use any memory. Hence the previous state of input does not have any effect on the present state of the circuit. But sequential circuit has memory so output can vary based on input. This type of circuits uses previous input, output, clock and a memory element.

BLOCK DIAGRAM



Questions

1. Explain half adder with the neat circuit diagram.
2. What is full adder? How is a full adder is built using two half adders?
3. Elaborate on Full Subtractor.
4. Explain half subtractor with neat diagram.
5. Define Multiplexer.
6. Discuss working of Multiplexer.
7. What is de-multiplexer? Explain in detail.
8. What is an encoder?
9. Discuss the functions of decoder. Draw the circuit of 3 to 8 decoder and explain its working.
10. Explain Priority encoder.

CHAPTER 7

SIMPLIFICATION OF BOOLEAN EXPRESSIONS

Example: Simplify the following expression

$= BC + BC + BA$

2. Simplification

$F = B(C + C) + BA$

$F = B \text{Å}'' 1 + BA$

$F = B(1 + A)$

$F = B$

Example: Simplify the following expression

$\square = A + AB + ABC + ABCD + ABCDE$

❖ Simplification

$\square = A + A(B + BC + BCD + BCDE)$

$F = A + B + BC + BCD + BCDE$

$F = A + B + B(C + CD + CDE)$

$F = A + B + C + CD + CDE$

$F = A + B + C + C(D + DE)$

$F = A + B + C + D + DE$

$F = A + B + C + D + E$

Example: Show that the following equality holds

$A(BC + BC) = A + (B + C)(B + C)$

❖ Simplification

$A(BC + BC) = A + (BC + BC)$

$= A + (BC)(BC)$

$= A + (B + C)(B + C)$

STANDARD FORMS

❖ Boolean expressions can be manipulated into many forms.

❖ Some standardized forms are required for Boolean expressions to simplify communication of the expressions.

❖ Sum-of-products (SOP)

❖ Example:

$F(A, B, C, D) = AB + BCD + AD$

❖ **Products-of-sums (POS)**

❖ Example:

$F(A, B, C, D) = (A + B)(B + C + D)(A + D)$

❖ Sum-of-minterms standard form expresses the Boolean or switching expression in the form of a sum of products using minterms.

❖ For instance, the following Boolean expression using minterms

$F(A, B, C) = ABC + ABC + ABC + ABC$

could instead be expressed as

$F(A, B, C) = m_0 + m_1 + m_4 + m_5$

or more compactly

$F(A, B, C) = \text{"}m(0, 1, 4, 5) = \textit{one-set}(0, 1, 4, 5)$

❖ Product-of-maxterms standard form expresses the Boolean or switching expression in the form of product of sums using maxterms.

❖ For instance, the following Boolean expression using maxterms

F(A, B, C) = (A + B + C) (A + B + C) (A + B + C)

could instead be expressed as

F(A, B, C) = M_1 Å″ M_4 Å″ M_7

or more compactly as

F(A, B, C) = "*M*(1, 4, 7) = *zero-set*(1, 4, 7)

Example

F (A, B, C) = AB + B'(A' + C') = AB + A'B' + B'C'

1. **AB(C + C') + A'B'(C + C') + (A + A') B'C'**
2. **A'B'C' + A'B'C + AB'C' + ABC' + ABC**
3. "*m*(0 , 1 , 4 , 6 , 7)

A	B	C	F	
0	0	0	1	0
0	0	1	1	1
0	1	0	0	
0	1	1	0	
1	0	0	1	4
1	0	1	0	
1	1	0	1	6
1	1	1	1	7

Minterms listed as 1s in Truth Table

Example

F (A, B, C) = AB + B' (A' + C') = AB + A'B' + B'C'
= (A + B') (A + B' + C') (A' + B + C') (using distributivity)

1 **(A + B' + CC') (A + B' + C') (A' + B + C')**

2 **(A + B' + C) (A + B' + C') (A' + B + C')**

3 "*M*(2, 3, 5)

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
2	0	1	1
`0	3	1	0
0	1	1	0
1	0	5	1
1	0	1	1
1	1	1	

4 Maxterms listed as 0s in Truth Table

Converting between sum-of-minterms and product-of-maxterms

- The two are complementary, as seen by the truth tables.
- To convert interchange the " and " , then use missing terms.
- Example: The example from the previous slides

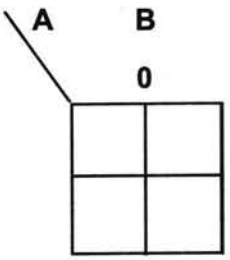
$F(A, B, C) = \Pi M(0, 1, 4, 6, 7)$

is re-expressed as

$F(A, B, C) = \Pi M(2, 3, 5)$

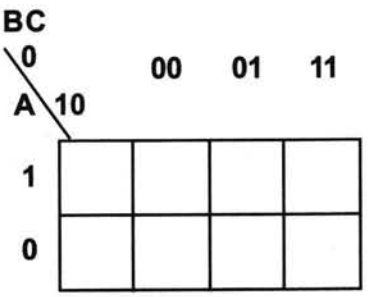
- Often it is desired to simplify a Boolean function. A quick graphical approach is to use Karnaugh maps.

2-variable arnaugh map



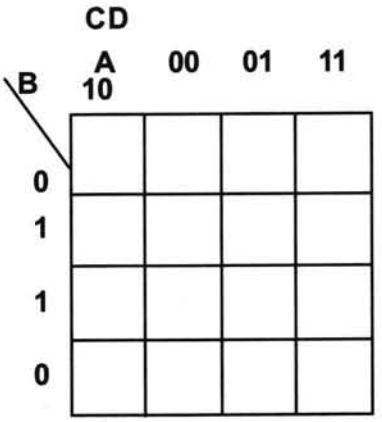
F = AB

3-variable Karnaugh map



F = AB + C

4-variable Karnaugh map



F = AB + C D

iii. Procedure for finding the SOP from a Karnaugh map

a. Step 1: Form the 2-, 3-, or 4-variable Karnaugh map as appropriate for the Boolean function.

b. Step 2: Identify all essential prime implicants for 1s in the Karnaugh map

c. Step 3: Identify non-essential prime implicants for 1s in the Karnaugh map.

d. Step 4: For each essential and one selected non-essential prime implicant from each set, determine the corresponding product term.

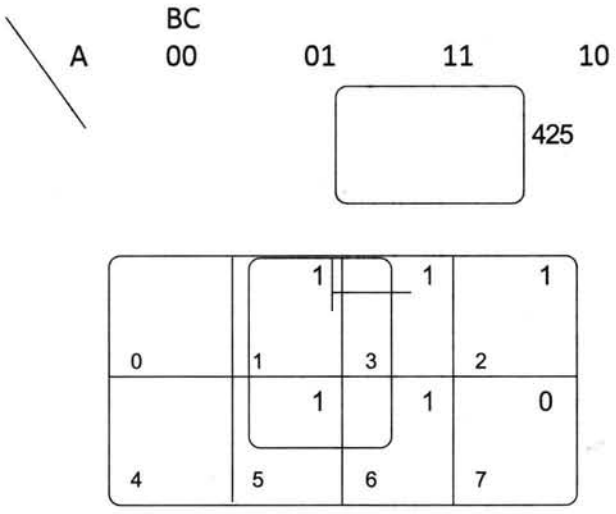
e. Step 5: Form a sum-of-products with all product terms from previous step.

❖Procedure for finding the SOP from a Karnaugh map

- Step 1: Form the 2-, 3-, or 4-variable Karnaugh map as appropriate for the Boolean function.
- Step 2: Identify all essential prime implicants for 0s in the Karnaugh map
- Step 3: Identify non-essential prime implicants for 0s in the Karnaugh map.
- Step 4: For each essential and one selected non-essential prime implicant from each set, determine the corresponding sum term.
- ❖Step 5: Form a product-of-sums with all sum terms from previous step.

Simplify using K-MAP
K-Map using Minterms
Y = F(A,B,C) = å(1,2,3,5,7)

Solution



The 3-Variable K-Map problem is shown in the above figure

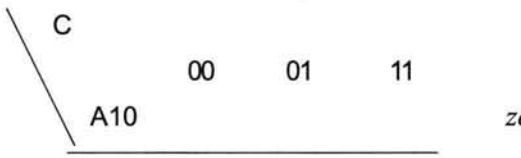
- Minterms m_1,m_3,m_5 and m_7 form a quad.
- For the quad Q (1,3,5,7) the reduced expression is C.
- Minterms m_2 and m_3 form a pair. For the pair p(2,3) the reduced expression is A'B.
- The pair and the quad overlap and it is allowed.
- Therefore the final expression is Y = F(A,B,C) = C+A'B

Simplify the following Boolean function

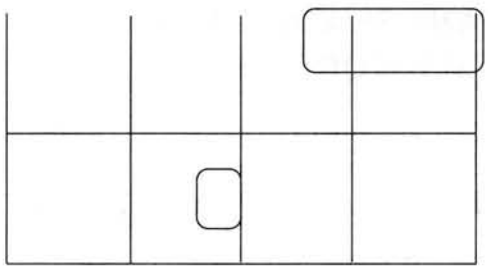
K-Map Using Maxterms

F (A, B, C) = "*M*(2, 3, 5) = (A + B' + C) (A + B' + C') (A' + B + C')

- **Solution:**



zero-set(2, 3, 5)



one-set(0, 1, 4, 6, 7)

- The essential prime implicants are A' + B + C' and A + B'
- There are no non-essential prime implicants.

The product-of-sums solution is F = (A + B') (A' + B + C') .

CHAPTER 8

INTRODUCTION TO MS-WORD

Word Processor is a Software package that enables you to create, edit, print and save documents for future retrieval and reference. Creating a document involves typing by using a keyboard and saving it. Editing a document involves correcting the spelling mistakes, if any, deleting or moving words sentences or paragraphs.

(a) Advantages of Word Processing

One of the main advantages of a word processor over a conventional typewriter is that a word processor enables you to make changes to a document without retyping the entire document.

(b) Features of Word Processing

Most Word Processor available today allows more than just creating and editing documents. They have wide range of other tools and functions, which are used in formatting the documents. The following are the main features of a Word Processor

- Text is typing into the computer, which allows alterations to be made easily.
- Words and sentences can be inserted, amended or deleted.
- Paragraphs or text can be copied /moved throughout the document.
- Margins and page length can be adjusted as desired.
- Spelling can be checked and modified through the spell check facility.
- Multiple document/files can be merged.
- Multiple copies of letters can be generated with different addresses throughthe mail-merge facility.

(c) Some Common Word Processing Packages

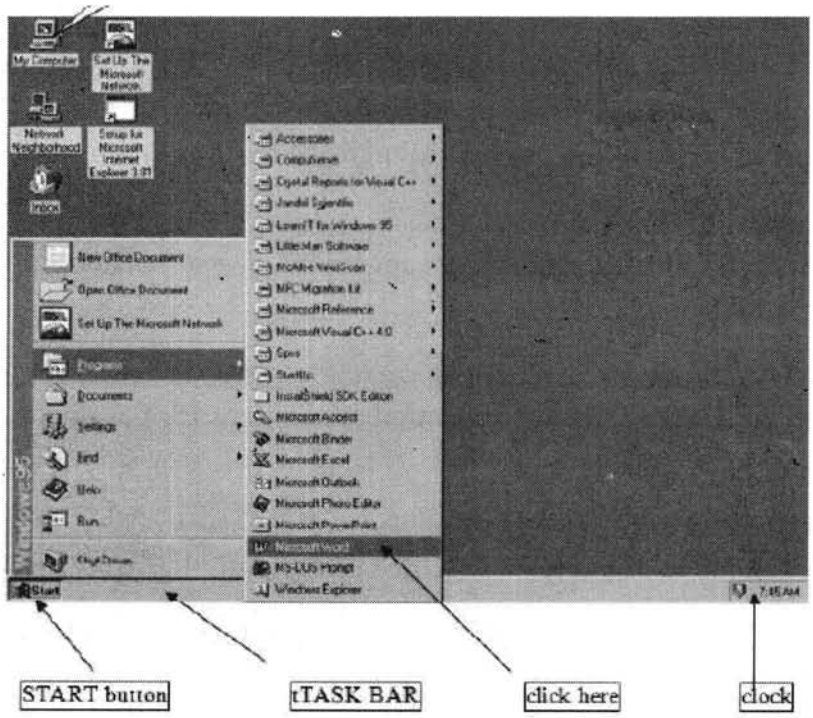
The followings are examples of some popular word processor available

- Softword
- WordStar
- Word perfect
- Microsoft word

IMPORTANT FEATURES OF MS-WORD

Ms-Word not only supports word processing features but also DTP features. Some of the important features of Ms-Word are listed below:

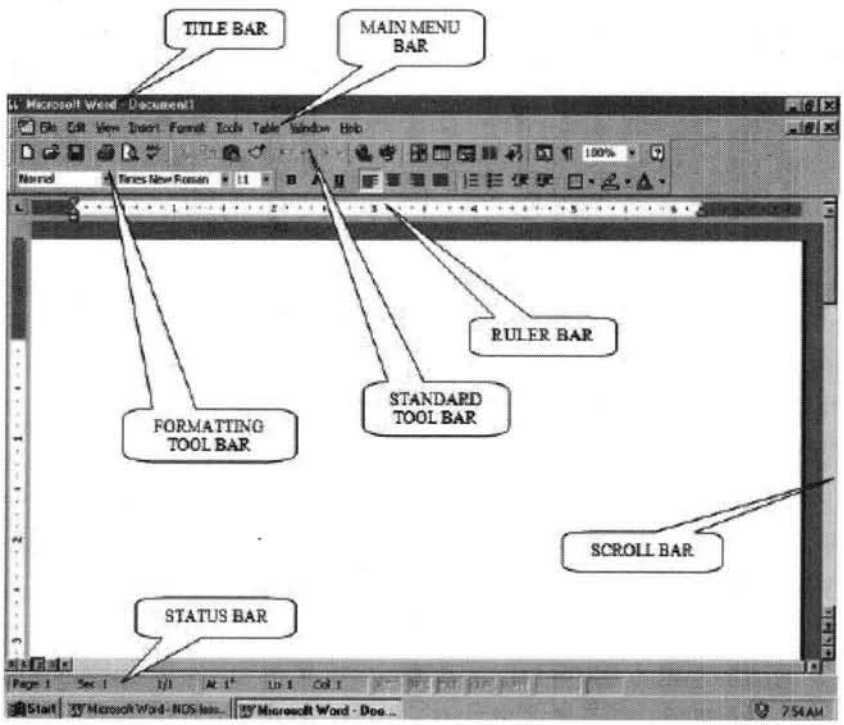
- Using word you can create the document and edit them later, as and when required, by adding more text, modifying the existing text, deleting/moving some part of it.
- Changing the size of the margins can reformat complete document or part of text.
- Font size and type of fonts can also be changed. Page numbers and Header and Footer can be included.
- Spelling can be checked and correction can be made automatically in the entire document. Word



count and other statistics can be generated.

- Text can be formatted in columnar style as we see in the newspaper. Text boxes can be made.
- Tables can be made and included in the text.
- Word also allows the user to mix the graphical pictures with the text. Graphical pictures can either be created in word itself or can be imported from outside like from Clip Art Gallery.
- Word also provides the mail-merge facility.
- Word also has the facility of macros. Macros can be either attached to some function/special keys or to a tool bar or to a menu.
- It also provides online help of any option.

The Following Diagram shows how to enter into MS-Word:



Various Components of the MS-Word Screen:

Let us discuss the important components of the screen.

(a) Title Bar

The title bar displays the name of the currently active word document. Like other WINDOWS applications, it can be used to alter the size and location of the word window.

(b) Tool Bars

Word has a number of tool bars

that help you perform task faster and with great ease. Two of the most commonly tool bars are the formatting tool bar and the standard tool bar. These two toolbars are displayed just below the title bar. At any point of time any tool bar can be made ON or OFF through the tool bar option of View Menu.

(c) Ruler Bar

The Ruler Bar allows you to format the vertical alignment of text in a document.

(d) Status Bar

The Status Bar displays information about the currently active document. This includes the page number that you are working, the column and line number of the cursor position and so on.

(e) Scroll Bar

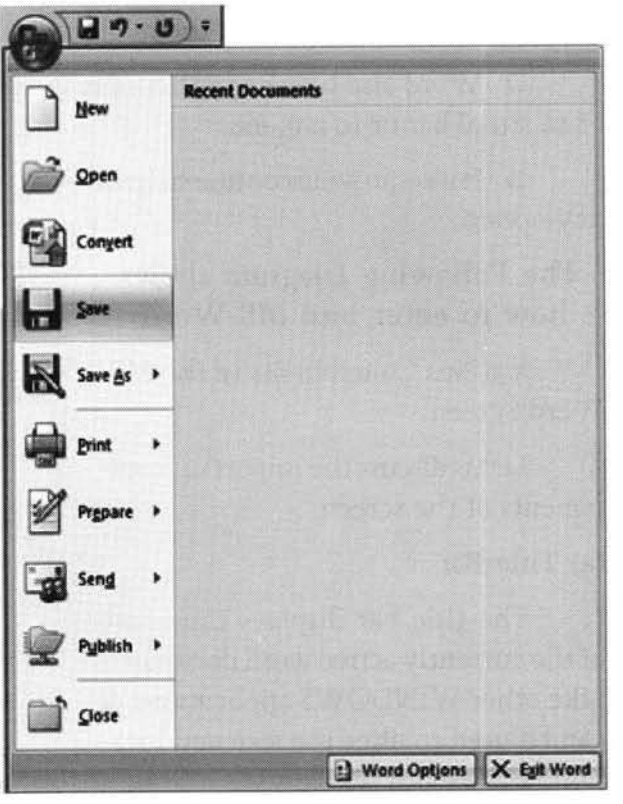
The Scroll Bar helps you scroll the content or body of document. You can do so by moving the elevator button along the scroll bar, or by click in on the buttons with the arrow marked on them to move up and down and left and right of a page.

(f) Workspace

The Workspace is the area in the document window were you enter/type the text of your document.

(g) Main Menu

The main menu further displays a sub menu. Some of the options are highlighted options and some of them appear as faded options. At any time, only highlighted options can be executed, faded options are not applicable. Infect if the option is faded you will not be able to choose it. You may not that any option faded under present situation may become highlighted under different situations.



CREATING AND SAVING THE DOCUMENT

Creating a document

You can create a document by clicking on **file** from the menu bar and then selecting **New**. Ms-Word will prompt you to choose a **document** or a **template**. In Ms-Word there is a keyboard equivalence of each command. In each option of the main menu you notice that an alphabet of that option is underlined (F in file, E in edit, V in view, etc.). If you type that alphabet while pressing the ALT key that particular option is invoked. For example, you can type in **Alt+F** to open the **file** option from the main menu.

Choose the default **Document** and **General** and then click on OK. A blank document will be displayed where in you can type the text. Ms-Word gives a temporary name to this file as 'Document 1', until you save that document v

Instead of clicking File and New you can directly open a new document by clicking at the NEW icon on the standard tool bar (the first icon on standard tool bar). Ms-word provides the facility that as you take

the mouse pointer to a particular icon a message will pop up. For example, as you take the mouse button to the first icon on the standard tool bar, you will suddenly find NEW written there.

SAVING YOUR WORK

To save your work in Word 2007, click the round Office button in the top left of your screen. You should see a menu appears then click to save your document.

EDITING OPERATIONS

When you enter your text, you are likely to make mistakes. Corrections of these mistakes are called editing. While editing the need may arise to

- Delete a part of the text.
- Move a block of text from one place to another.
- Copy a block of text from one place to other place.

Word provides facilities for all those editing activities but the work rule is to select the text first and then perform the action. Text can be selected using the mouse or the keyboard. The following table illustrates the methods, which basically follows click and drag rule.

To Select	Action
Any variable length of Text	Drag the mouse over the text to be selected.
A word	Double click the mouse on the particular word.
A graphic	Click the graphic.
A line of text	Click in the selection bar to the left of the line.
Multiple lines of text	Drag in the selection bar to the left of the lines.
A sentence	Hold down CTRL and click anywhere in the sentence.
A paragraph	Double click in the selection bar next to the paragraph. Multiple paragraph Drag in the selection bar

CUT TOOL AND PASTE TOOL

(g) Using the Menu Bar

Select the text to be shifted. Choose the Cut option from the Edit menu. Bring the cursor to the new location where the text has to appear and then choose the Paste option from the Edit menu.

(h) Using the Click and Drag Function

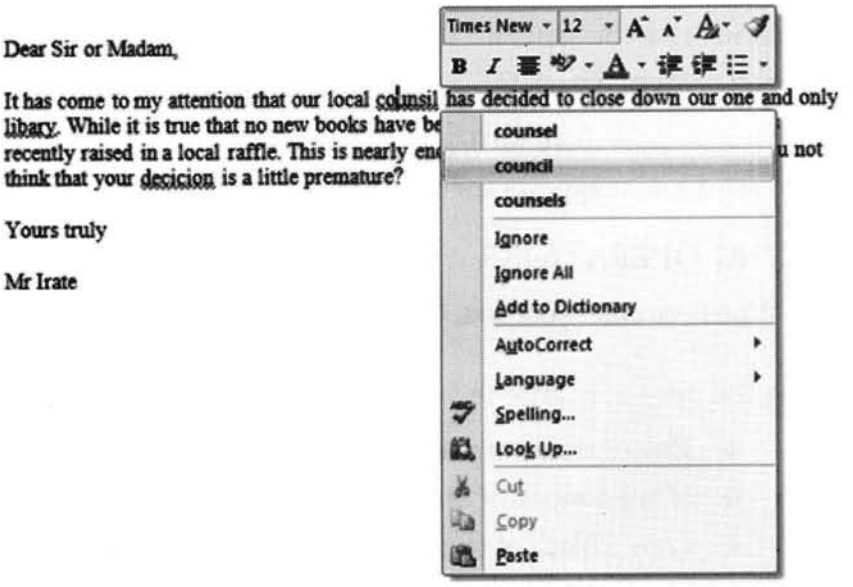
Select the text to be shifted. Click anywhere in the selected text and then drag it to the desired new location and leave it there.

COPYING TEXT

If you want to copy the text from one place to another in the document, you need to highlight the block of the text first. Select the block of the text you want to copy. You can copy the text using the toolbar, the menu bar or the drag function.

USING THE TOOLBAR

After you select the text, click on the Copy button in the standard toolbar and then bring the cursor to the new location where the text has to appear again and click on the Paste button in the standard toolbar



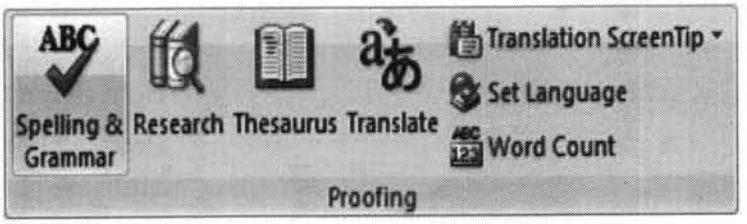
SPELLING AND GRAMMAR CHECKING

One thing you probably will have noticed is the spelling mistakes in the letter. You should have typed the letter exactly as it was, and left any spelling errors in. More than likely, the spelling mistakes are underlined in red in your document. Anything with a wiggly green line under it is a grammatical error, (or what Microsoft Word insists is a grammatical error).

The easiest way to correct spelling mistakes is to right click any word that has a red wavy underline. You'll then see a menu appear:

In the image above, we've clicked with the right-hand mouse button on the incorrectly spelt "counsil". The menu that appears shows three alternative words: counsel, council, and counsels. We meant council, of course. Click this option with your left mouse button to replace the misspelt word. The red wavy underline will disappear.

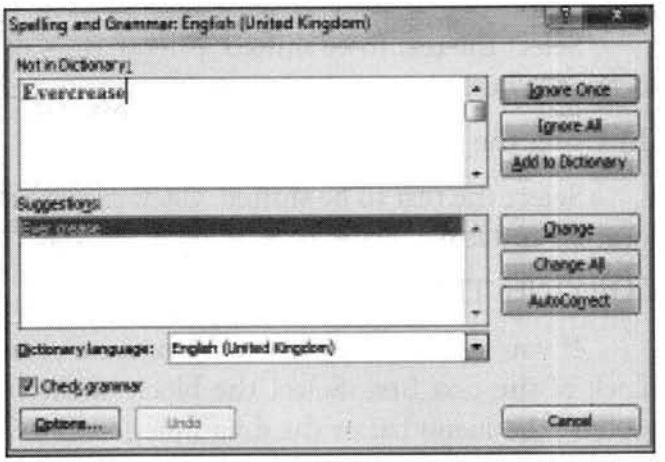
Do the same with the other two misspellings in your letter, and then save your work. Now highlight the address you added to the right.



SPELLING AND GRAMMAR OPTIONS

To check more than one word at a time, you can bring up the Spelling and Grammar dialogue box. To see it, click on the Review tab at the top of Word. On the Review tab, locate the Proofing section. Then click Spelling & Grammar:

When you click on Spelling & Grammar, you'll see a dialogue box appear in Word 2007 and Word 2010. This one:



CREATING A TABLE

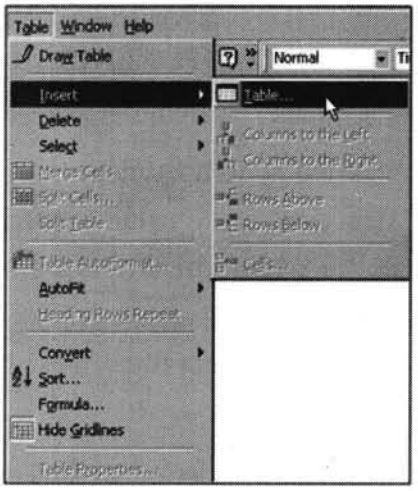
Introduction

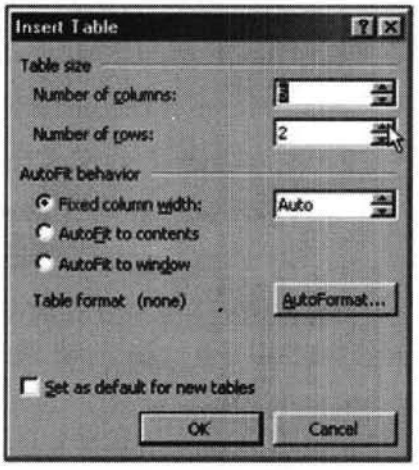
Tables can be inserted anywhere in a document. In this example, we will be inserting a table into this document to show some of the powerful and time saving formatting capabilities available.

Get Ready

Before you create a Table, you need to make sure

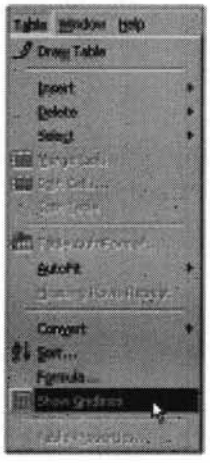
that the Gridlines (the lines around the cells) are visible. Go to Table, then click on Show Gridlines as shown to the right.





The Task

Here's our task. We need to create five columns for a primary site classroom reading book record. They will be: the teacher's last name, their first name, their grade level, their room number, and the number of reading books in their classroom. Each of the columns needs to have a heading.



Creating a Table

Click on Table, then on Insert, then on Table as shown to the left. A screen will appear that will allow you to change the number of rows and columns that are needed, shown here. I've selected 5 columns for our table.

Note: Making sure there are enough columns is more important than if there are enough rows. Rows can be added and removed easily.

This is what the table looks like.

Now we can enter some data. The first thing that we need to do is enter the column headings.

MAIL MERGE

INTRODUCTION

The Mail Merge feature has been described here. In Ms-Word Mail Merge option is an important and every way for office set up. Many times we required sending the same content of a letter to different individuals. By using Mail Merge you can send the same letter to a number of persons without typing the content of the letter again and again.

WHAT IS MAIL MERGE?

In any working environment, there are situations when a similar type of letter or document is to be sent to many persons who reside at different locations. The letters may contain the address of each recipient, in addition to the standard information contained in the letter. One way of doing this is to print the letters by changing the address each time in the document after printing such letter. But this would mean lot of effort and time and also results in bad organization.

Such problems are taken care of by the Mail Merge facility. In word processing, Mail Merge is the

process of transferring selected information from one document to another document.

CONCEPT OF MAIL MERGING AND ITS COMPONENTS

Mail Merge is the facility which requires the following three information

- General body of the letter called main document
- Header Row, the record structure or the name of the fields, which will identify the data
- Data for all the individuals, for whom the letters are to be generated also called data source

Mail Merge option of Word reads this data and physically merges it with Main document to generate letters for all the persons or for all records in the data file.

(a) Main Document

In Mail Merge, Main Document is the common letter, which contains the common information for each of the merged document. It also contains the field names, which contain the instructions for carrying out the merge.

(b) Data Source

Data Source is also called the Data File. It stores information to be brought into the Main document. The data file table contains a column for each category of information, or data field, in the data file. The Header Row is the first row of the table. It contains field names, which indicate the type of information in each column. For example list of names and addresses.

Each field name must be unique and must begin with an alphabet/letter.

(c) Form Letter

Form letter is the resultant document of the mail merge operations, which contains the copy of the main document along with each piece of information stored in the data file.

MAIL MERGE OPTION OF WORD

Thus by now it is clear that for Mail Merge document, you need to

- Create the main document
- Create data source
- Merge the data with document

All these operations can be performed by Mail Merge option of WORD. In order to invoke the Mail Merge option, choose the Mail Merge option of the Tools menu.

Mail Merge helper guides you through the steps of mail merging a document. There are three main options available in the box.

(a) Creating the Main Document

The first step in the mail merge is to create the main document. For this, choose 'Create' button of 'Main Document' option in Mail Merge Helper box. The following menu will be displayed

Form Letter...
Mailing Labels...
Envelopes...
Catalog...

Restore to Normal Word document

Now choose 'Form Letters' option from this menu as the type of main document.

Main Document

Choose the Active Window button from the above box. Type the main document and again invoke the Mail Merge Helper.

(b) Creating Data Source

Choose the 'Get Data' button from the Mail Merge Helper box. For creating data source, select Create Data Source.

The field names are already available in the Header row, which are default fields for an address list. Any field that is not required can be removed, and any new field can be added. For removing a field, highlight that particular field and click on the 'Remove field Name' button. For adding a new field, type the name of the field in the Field Name box and then click on the 'Add Field Name' button.

Click on the OK button and save your data structure as well as the data source.

Click on the 'Edit Data Source' button from the box to enter records in the data file.

Enter the records by typing in the boxes. For adding a record choose 'Add New' button. For removing a record, choose 'Delete' button. After you finish with adding records, click on the OK button.

(c) Opening the Data Source

You can also use a data source already created. You can open it by clicking the 'Get Data' option in the Mail Merge Helper and then selecting 'Open Data Source' A dialog box will appear with a list of data source file names. Select the name of the data source to open it.

(d) Merging the Text with Data

After creating the main document and data source, the third step is to merge the main document with the data source. For this, invoke the Mail Merge Helper again and choose the 'Merge' button.

Select 'New Document' from the 'Merge To' drop-down list and click on 'Merge' button. The form letters are generated and stored in the document which may be previewed for final adjustment in the main document, before printing the for letters.

MERGE PRINTING

You can directly print the Form Letters without previewing them. Select the Printer option, then the form letters are directly printed on the printer.

CONDITIONAL MERGING

You can also mail merge the document with a condition. There are two options available in the Merge dialog box 'Merge' and 'Query Options' options. Using Query Option' you can define the selection criteria so that at the time of merging only those records are selected which meet the defined selection criteria.

MACROS

The macro we're going to create will format some text for us. After all, it's such a chore to highlight text then open the Font dialogue box. Once the Font dialogue box is open we then have to choose a Font,

decide whether or not we want Bold, and then pick a size. The dialogue box then has to be closed. Much better to write a macro to do all that for us.

In case it's not clear what we want the macro to do, here's the long version of formatting the text.

1. Highlight the text you want formatting
2. From the menu bar, click on **Format**
3. From the drop down menu, click on **Font**
4. The Font dialogue box appears
5. Choose **Arial** as the Font
6. Click on **Bold**
7. Click on **16** for the size of the text
8. Click **OK** to close the dialogue box
9. The text is formatted

TEMPLATES

Templates are files that help you design interesting, compelling, and professional-looking documents. All the formatting is complete; you add what you want to them. Examples are resumes, invitations, memos, and newsletters. You can modify a sheet, workbook, or existing template, and then save it as your very own custom template.

Save a document as a template

1. Open the document.

2. Add, delete, or change any text, graphics, or formatting, and make any other changes that you want to appear in all new documents that you base on the template.

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

4. On the **Format** pop-up menu, click **Word Template (.dotx)**.

5. In the **Save As** box, type the name that you want to use for the new template, and then click **Save**.

Unless you select a different location, the template is saved in /Users/ *username*/Library/Application Support/Microsoft/Office/User Templates/My Templates.

Create a new template based on another template

You can customize an existing template to make it even more useful. Add static information to the existing template, and then save the file again (as a template).

1. On the **Standard** toolbar, click **New from template** .

2. In the left navigation pane, under TEMPLATES, click **All**.

Use a template to create a new document

1. On the **Standard** toolbar, click **New from template** .

2. In the left navigation pane, under TEMPLATES, click **My Templates**.

Note: If you crea ted folders to organize your templates, the folders are displayed under **My Templates**. You need to click the folder to see the templates.

1. Click the template that you created, and then click **Choose**.

Delete a template from My Templates

1. In the **Finder**, open /Users/ *username*/Library/Application Support/Microsoft/Office/User Templates/My Templates.

2. Drag the templates that you want to delete to the Trash.

QUESTIONS

1. What do you mean by Mail Merge?
2. What are the three information required for Mail Merge?
3. Define Form Letter.
4. Define Macros.
5. What is meant by Template?
6. List the features of MS-WORD.
7. What are the various components in the MS-WORD Screen?
8. How do we create and save our documents.

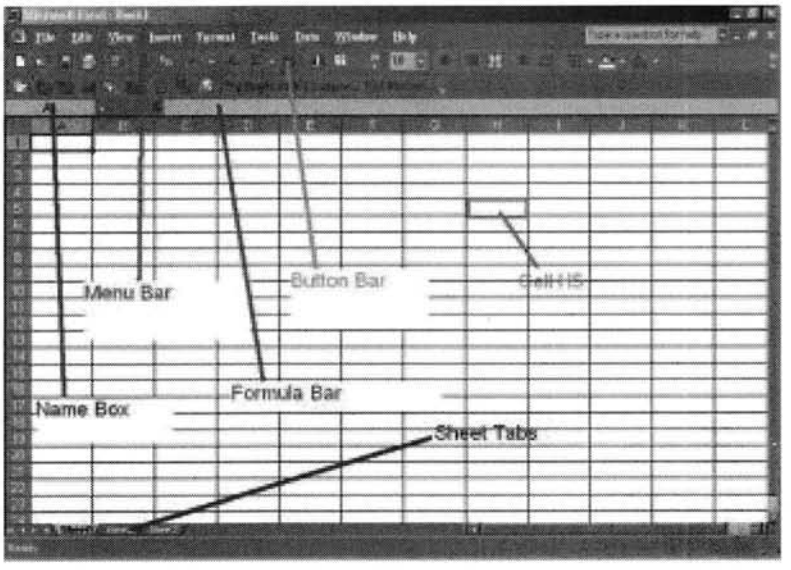
MSWORD Exercise

1. Text Manipulations.
2. Usage of Numbering, Bullets, Footer and Headers.
3. Usage of Spell check, and Find & Replace.
4. Text Formatting.
5. Picture insertion and alignment.
6. Creation of documents, using templates.
7. Creation templates.
8. Mail Merge Concepts.
9. Copying Text & Pictures from Excel.

CHAPTER 9

INTRODUCTION TO MS-EXCEL

Excel is the spreadsheet program created by Microsoft. Although you can use any spreadsheet program for analyzing data, the instructions given here are specific for Excel. Excel is, in its most basic form, a very fancy calculator. There are usually several different ways to perform the same function in Excel.



The Interface:

The first figure shows the typical Excel sheet with the important parts of the programs interface labeled. Please become familiar with these.

Inserting Data and Formulas

To insert data, you simply use your mouse to select a cell and then simply type. Start the Excel program. Select the cell A1 (that is the cell in column A, row 1) by using your mouse and clicking the left mouse button (this is the 'normal" mouse button). Note that the name of the cell is displayed in the **Name Box**. By default, the name of the cell is its address with reference to the row/column although you can name a cell anything you want using the **Insert/Name** menu item..

- Insert the following data into the first 6 rows of the A column:
- 56, 67, 76, 55, 62, 69.

To do this, simply select the cell (A1 should already be selected) and type in the number 56 and press the ENTER key. This will insert the number 56 into cell A1 and automatically move the active cell to A2. Now type in 67 into A2, and press enter. Continue in this fashion until all six numbers are inserted in the first 6 rows of column A.

- Insert the following set of numbers into the first 6 rows of column B.
- 34, 44, 123, 89, 22, 10

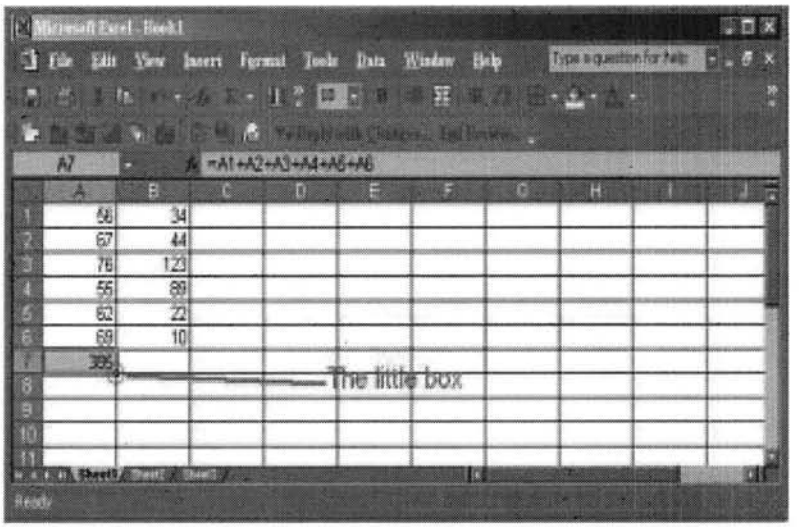
WARNING NOTE: In many instances, you will be using numbers with units (like meters, or grams). When using Excel, never mix numbers with letters in a cell. If you do, Excel assumes that you are inserting text and not inserting numbers. For example, if the units for the numbers you inserted in the previous example are grams, do not type **34 g** (or **34 grams**) in a single cell - Excel will not recognize this as a number. Simply type **34**. You can use a label on the column to indicate the units. You will learn later how to insert a label.

That should have been easy - now lets do some calculations.

Let's add the numbers in each column and place the sum in the 7th row of each column. One way (the hard way) would be as follows:

- Select cell A7. This is the cell where the sum will be displayed.
- Type in the equal sign (=). All calculations (or formulas) in Excel must begin with an equal sign.

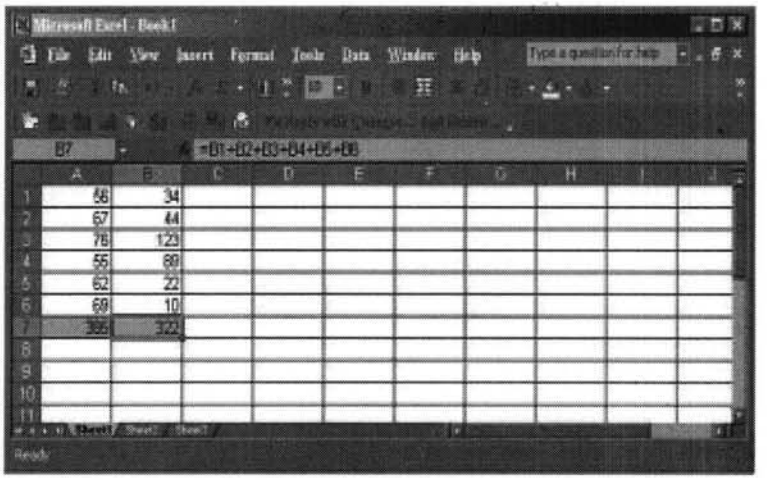
❖ Type in the arithmetic expression summing the various cells so that that the following expression is inserted into the cell =A1+A2+A3+A4+A5+A6, and press the ENTER key. Your sheet should look similar to the following figure.



Note that the sum of the numbers in column 1 is displayed in cell A7 and that the formula is shown in the window of the formula bar. If you were to change the value of cell A1 from 56 to 55, you would find that the sum shown in A7 would also change. (Try it, but remember to change it back). NOTE: If you were to forget to start the formula with the equal sign, Excel would assume that you are typing in text and would not do any calculations!

One can do the same procedure to sum the values in column B and type =B1+B2+B3+B4+ B5+B6 into cell B7 (actually, you could type it into any cell, but it is more logical to use B7). But there is an easier way. Note that there is small box in the lower right corner of any selected cell. Select cell A7 (as shown above) and move, without pressing a button, the cursor over the box. You should note that the cursor changes when over the box, changing from a hollow cross to a simple line cross. This will occur automatically whenever the cursor lies over the little box. Do this several times so that you are familiar with its appearance.

Now, with the cursor over the box in cell A7 (and thus in the line format), press down and hold the left mouse button and drag the mouse over cell B7. Once you observe that B7 becomes selected, release the button. If done correctly, you should find that the formula was copied into B7 but that it changed so that it summed the contents of Column B! Pretty amazing! Your screen should look like the following figure (with cell B7 selected). This is much easier than typing in all of the cell names into the formula. This process (where you use the little box to copy a formula to adjacent boxes) will be know as "dragging the box" in this tutorial.



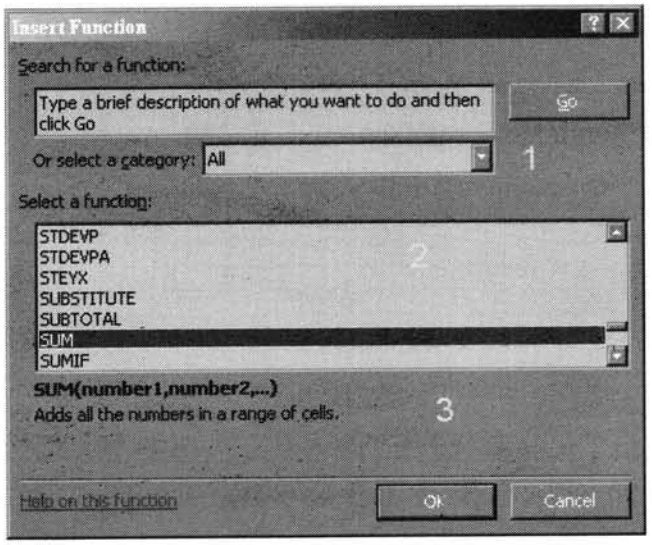
An easier way to insert a formula

While the ability to create your own formulas in Excel is powerful, it is time consuming (not to mention that it requires that you know the formula!). The people at Excel realize this and have created a set of formulas (they call them functions) ready for you to use. There are several hundred predetermined functions in Excel, one of them is the SUM function (which sums a series of cells).

How to get to SUM

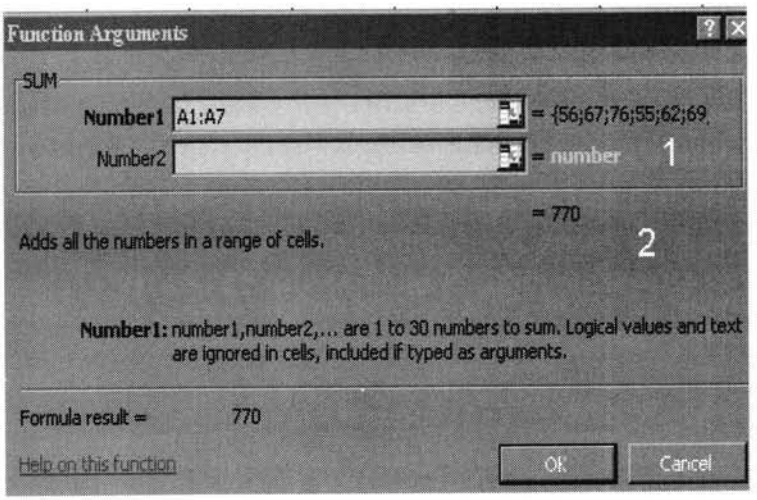
In your spreadsheet, select the cell A8. To access the formulas, use the INSERT menu item and select FUNCTIONS. You should now get the FUNCTION dialog box which is shown below.

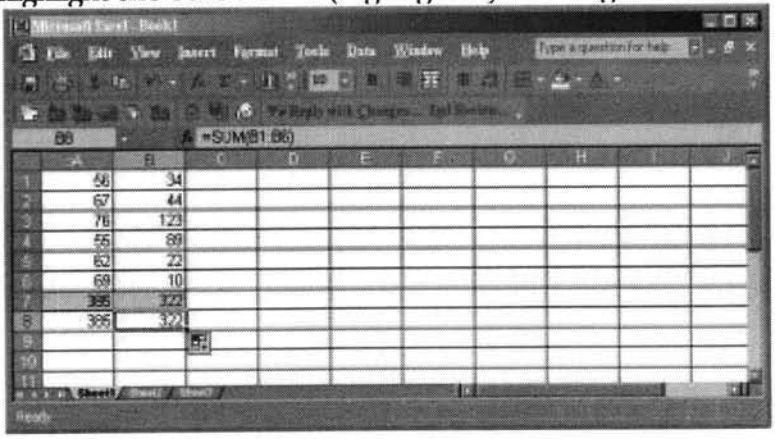
In the category select window (labeled 1 in the figure), select All (as shown). As you become familiar with the different categories, you can use them to make your search a bit easier, but for now, we know that all the



functions will be found in the All category. Scroll down the selection window (section 2) until you reach the SUM function and highlight it with a single mouse click (as shown in the figure). The functions are sorted in alphabetical order, so you will need to scroll down to the S's. Note that a brief description of the function is shown in section 3 of the dialog box. With the SUM function selected, press the OK button. You will now see a new dialog box titled FUNCTION ARGUMENTS. In this dialog box, you will indicate which numbers you want summed. This box is shown below:

The important section is the input box (number 1 in the figure). As you should see, Excel automatically inputs a range of values that it thinks you want summed. In this case, it is the column of number above the cell containing the function (A8 in this case) - A1:A7. The colon (:) is the Excel convention to indicate all cells between A1 and A7 inclusive. One could also write this by typing all cells individually, but the shortcut is easier. Note, this is not the range of cells you want to sum as it includes A7 (which is the sum function you previously created) - you do not want to include this in the sum. In other words, you want the sum of A1:A6. Use the mouse and click on the first input box (labeled Number 1) so that the cursor is blinking to the right of the 7. Use the backspace to erase the 7 and replace it with a 6. The input box should now read A1:A6, which is the range you want to sum. By the way, suppose you wanted to sum all the numbers in rows 1-6 of both columns (A and B). You can input the B column range in the window 'Number 2' by clicking on the window and typing B1:B6. You will notice two thing after doing this, one is that the sum (shown next to 2 in the dialog box) is now 707 and that a third input window is formed. You can add up to 30 (I think) different input windows. Delete the values in "Number 2" but make sure that the cursor in blinking in that window. Here is another way to input values into an input window. With the cursor blinking in the "Number 2" window, use your mouse and highlight the cells B1-B6 (highlight by clicking on B1 and drag the cursor down to B6 - do not release the mouse button until you reach B6 - and do not 'drag the box', you do not want to change the values in the cells). When you finish, you will find that the highlighted cells are now included in the input box. I find that this is generally the easiest way to input values into input windows. Now, delete all values in 'Number 2" and press the OK button. You should find the value in A8 is equal to that in A7. "Drag the box" and copy A8 into B8. Your screen should look like this:





Note the function listed in the formula bar.

Now, insert 6 values of your own choosing and place in the first 6 rows of column D. Sum the column in D7 (the hard way) and D8 (the function way). In cell E2, please sum all the values in cells A1-A6, B1-B6 and D1-D6 for a grand total.

Editing and Saving

You are essentially finished with data manipulation for this exercise. However, the spreadsheet is not clearly labeled. In order to make the sheet easier to understand, you will now insert some labels.

Highlight cell A1. Use the right mouse button (the one you normally do not use!). This will bring up a menu specific for dealing with cells. An example is shown below.

All these menu items deal with cells. Note, any changes you make will only occur on the highlighted cells. In this case, the changes will only occur to cell A1. If you highlight several cells and thenright click, the changes will occur to all the highlighted one. Also, you will find that the right click is a very convenient trick in Excel. You can right click over almost anything and get a menu specific for that item. It always pays to try it. Play with the various menu items to see what they do.

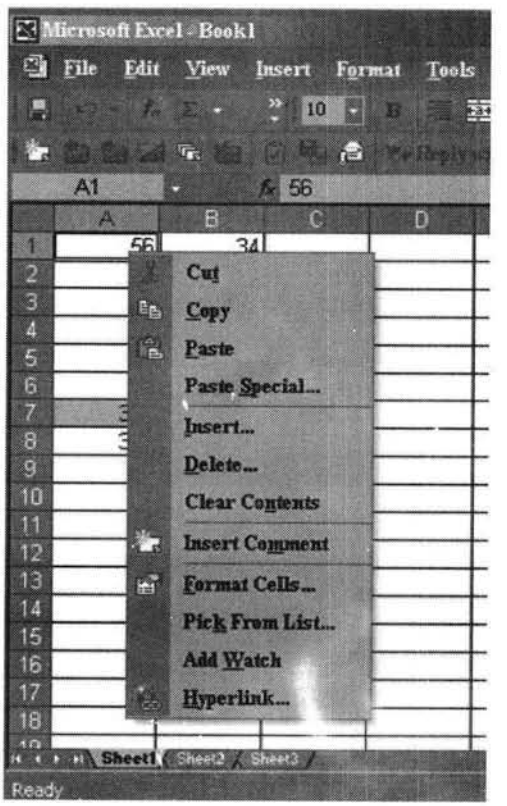
In any case, let us select the INSERT item. This will bring up a new dialog box, check "entire row" and press OK. This will insert a new, empty row and shift all other rows down 1 row. Insert a column to the left of column A using the same technique. You should now have an empty row 1 and an empty column A.

Insert Labels

Type "Dogs" into cell B1, "Cats" into cell C1 and "Aardvarks" into cell E1. In A8 and A9, type in "Total". Finally, in F1, type "Total Animals". By using labels, you can identify what the values in the spreadsheet represent.

Save the File

You are now done with the exercise and must now save the file. From the FILE menu item, select save and complete the dialog box. Name the file .xls - the xls extension will be added automatically). Save the file in some place where you will be able to access it.

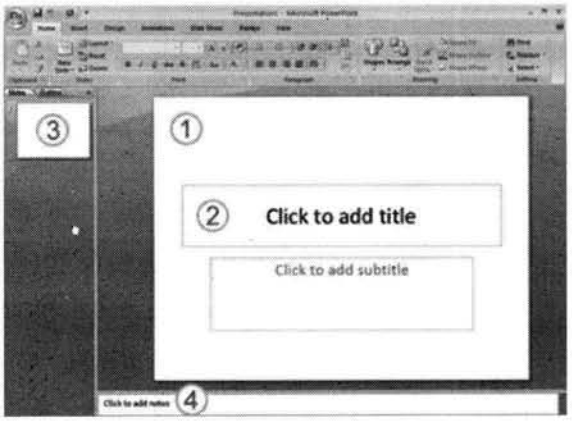


MS – EXCEL EXERCISES

1. Cell Editing.
2. Usage of Formulae and Bulit-in Functions.
3. File Manipulations.
4. Data Sorting (both number and alphabets).
5. Worksheet Preparation.
6. Drawing Graphs.
7. Usage of Auto Formatting.

CHAPTER 10

INTRODUCTION TO MS-POWERPOINT



❑ What is PowerPoint?

❖ Microsoft Office PowerPoint 2007 is a program that enables you to create slide-show presentations. The 2007 version offers expanded graphics and formatting capabilities, making it easier to create professional presentations.

❖ Creating the Presentation

❖ When you start PowerPoint, it opens in Normal view, where you create and work on slides.

1. In the Slide pane, you can work directly on individual slides.

2. Dotted borders identify placeholders, where you can type text or insert pictures, charts, and other objects.

3. The Slides tab shows a thumbnail version of each full size slide shown in the Slide pane. After you add other slides, you can click a thumbnail on the Slides tab to make the slide appear in the Slide pane, or you can drag thumbnails to rearrange the slides in your presentation. You can also add or delete slides on the Slides tab.

4. In the Notes pane at the bottom, you can type notes about the current slide. You can hand out your notes to your audience or refer to your notes in Presenter view when you give your presentation.

❖ By default, PowerPoint 2007 applies the Blank Presentation template, which appears in the preceding illustration, to new presentations. Blank Presentation is the simplest and most generic of the templates in PowerPoint 2007. Blank Presentation is a good template to use when you first start working with PowerPoint because it is straightforward and can be adapted to many presentation types.

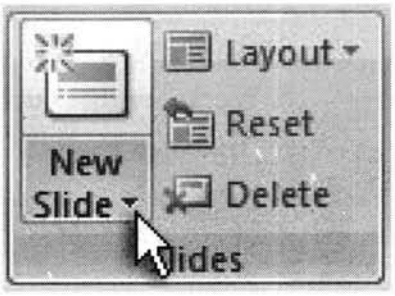
Naming and Saving your PowerPoint

❖ As with any software program, it is a good idea to name and save your presentation right away and then *to save your changes frequently while you work*:

❖ Click the Microsoft Office Button point to Save As, and then do one of the following:

❖ For a presentation that can be opened only in PowerPoint 2007, click PowerPoint Presentation.

❖ For a presentation that can be opened in either PowerPoint 2007 or earlier versions of PowerPoint, click PowerPoint 97-2003 Presentation.

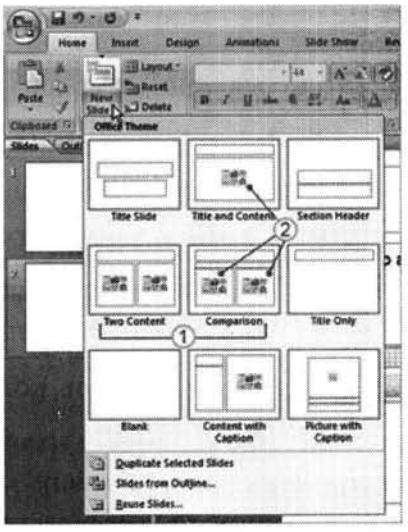


❖ In the Save As dialog box, in the Save in drop down menu, select the folder or other location where you want to save your presentation.

❖ In the File name box, accept the default name or type a new name for your presentation; in the Save as type box, select the file type (the default is .pptx); then click Save.

❖ From now on, you can press CTRL+S or click Save near the top of the screen to save your presentation quickly at any time.

Adding, Rearranging and Deleting Slides



❖ The default New Presentation provides a single slide with two placeholders: the top for a title; the bottom for subtitles. The arrangement of placeholders on a slide is called a layout. PowerPoint 2007 also provides other types of layouts, such as those for including pictures and SmartArt graphics.

❖ When adding a slide to your presentation, you can do the following to choose a layout for the new slide at the same time:

❑ On the **Slides** tab, click just below the single slide that already appears there.

❑ On the **Home** tab, in the **Slides** group, click the arrow next to **New Slide**.

❑ A gallery appears, showing thumbnails of the various slide layouts that are available.

1. The name identifies the content that each layout is designed for.

2. Placeholders that display icons can contain text, but you can also click the icons to insert objects automatically, including SmartArt graphics and clip art.

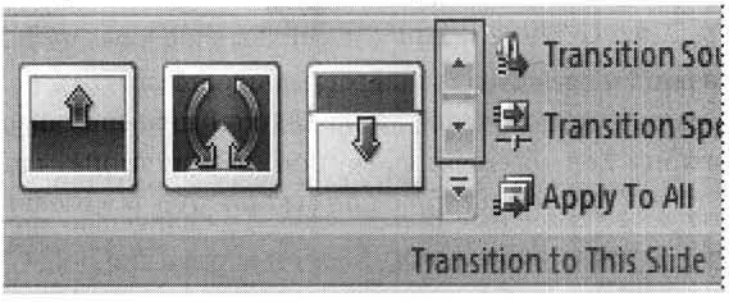
❖ Click the layout that you want for your new slide. The new slide now appears both on the **Slides** tab, where it is highlighted as the current slide, and in the **Slide** pane. *Repeat this procedure for each new slide that you want to add.*

❖ If you want to create two slides that are similar in content and layout, you can save work by creating one slide that has all of the formatting and content that both slides will share and then copying that slide. This can be done before or after adding content.

❑ On the **Slides** tab, right-click the slide that you want to copy, and then click **Copy** on the shortcut menu.

❑ Still on the **Slides** tab, right-click where you want to add the new copy of the slide, and then click **Paste** on the shortcut menu.

❑ You can also insert a copy of a slide from one presentation into another presentation.



❖ To rearrange the order of slides, on the **Slides** tab, click the slide that you want to move, and then drag it to the location that you want. To select multiple slides, click a slide that you want to move, and then press and hold CTRL while you click each of the other slides that you want to move.

❖ To delete a slide, on the **Slides** tab, right-click the slide that you want to delete, and then click **Delete Slide** on the shortcut menu.

Applying a New Layout to a Slide

To change the layout of an existing slide, do the following:

❑ On the **Slides** tab, click the slide that you want to apply a new layout to.

❑ On the **Home** tab, in the **Slides** group, click **Layout**, and then click the new layout that you want.

❑ If you apply a layout that doesn't have enough of the right kind of placeholders for the content

that already exists on the slide, additional placeholders are automatically created to contain that content.

Transitioning between the Slides

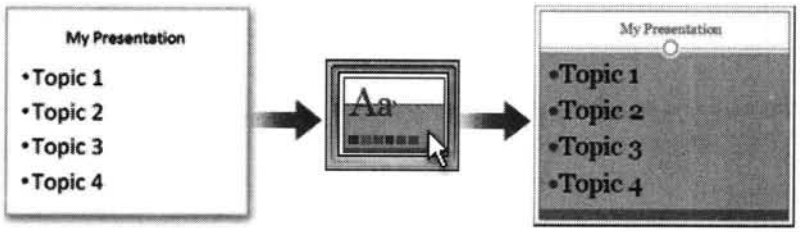
❖ Slide transitions are animation-like effects that occur when you move from one slide to the next. PowerPoint 2007 provides many types of slide transitions, including standard fades, dissolves, cuts, and wipes, as well as more unusual transitions such as wheels and checkerboards.

❑ Note: Be careful not to overdo it with transitions; too many or overly animated transitions make presentations look tacky.

❖ On the **Animations** tab, in the **Transition to This Slide** group, click the transition that you want.

❖ To preview how the current slide looks with a particular transition applied, rest your pointer on the thumbnail of that transition.

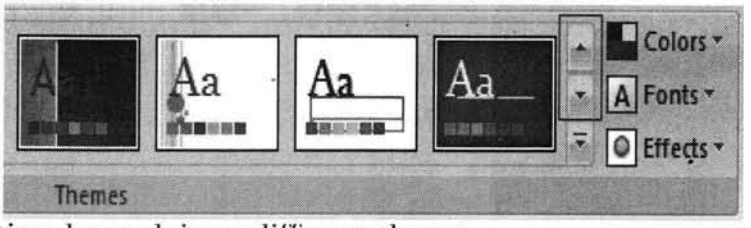
❖ To see thumbnails of additional transitions, click the arrows next to the row of thumbnails.



❖ You can choose other options in the **Transition to This Slide** group to control the transition speed, to add a sound, and to apply the same transition to all of the slides in the presentation.

Using Themes

· PowerPoint 2007 provides a wide variety of design themes that make it easy to change the overall look of your presentation. A theme is a set of design elements that provides a specific, unified appearance for all of your Office documents by using particular combinations of colors, fonts and effects. PowerPoint 2007 automatically applies the Office theme to presentations that are created by using the Blank Presentation template, but you can change the look of your presentation at any time by applying a different theme.

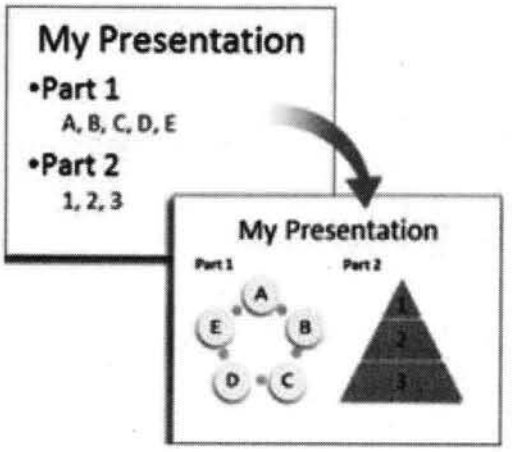


❖ On the **Design** tab, in the **Themes** group, click the document theme that you want to apply.

❖ To preview how the current slide looks with a particular theme applied, rest your pointer on the thumbnail of that theme.

❖ To see thumbnails of additional themes, click the arrows next to the row of thumbnails.

❖ Unless you specify otherwise, PowerPoint 2007 applies themes to the entire presentation. To change the appearance of only selected slides, on the **Slides** tab, press and hold CTRL while you click each slide that you want to change. When all of the slides are selected, right-click the theme that you want to apply to them, and then click **Apply to Selected Slides** on the shortcut menu.

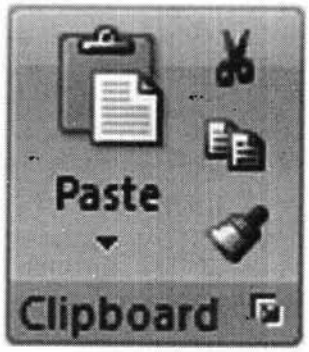


❖ Note: Alternating slides with different themes may help maintain your audience's attention.

Adding ClipArt

! Note: You want to create the most effective visual presentation possible — often, a series of slides that contains only bulleted lists is not the most dynamic choice. Lack of visual variety can cause your audience's attention to drift. And many kinds of information aren't most clearly expressed in a paragraph or a bulleted list. As such, Clip Art, SmartArt graphics, charts, and sound are available options for curing "slide burnout."

❖ To add clip art, click the placeholder that you want to add clip art to. If you don't select a placeholder, or if you select a placeholder that cannot contain an image, the clip art is inserted at the center of the slide.



- ❑ On the **Insert** tab, in the **Illustrations** group, click **Clip Art**.
- ❑ In the **Clip Art** task pane, locate the clip art you want, and then click it.
- ❑ You can move the clip art, resize it, rotate it, add text to it, and make other changes.
- ❑ You can search for additional clip art on the Microsoft Office Online site; click the **Clip art on Office Online** link at the bottom of the **Clip Art** task pane.

Adding a Chart

- ❖ In Excel, select the chart that you want to copy to a PowerPoint presentation.
- ❖ On the **Home** tab, in the **Clipboard** group, click **Copy**.
- ❖ Click in the PowerPoint presentation where you want to paste the copied chart.
- ❖ On the **Home** tab, in the **Clipboard** group, click **Paste**.
- ❖ Click **Paste Options** next to the chart, and then do one of the following:

- ❖ To paste the chart with a link to its source data, click **Chart (linked to Excel data)**.
- ❖ To paste the chart and to include access to the entire workbook in the presentation, click **Excel Chart (entire workbook)**.
- ❖ To paste the chart as a static picture, click **Paste as Picture**.
- ❖ To paste the chart in its original format, click **Keep Source Formatting**.
- ❖ To paste the chart and format it by using the document theme that is applied to the presentation, click **Use Destination Theme**.

Adding Sounds

! Note: To prevent possible problems with links, it is a good idea to copy the sounds into the same folder as your presentation before you add the sounds to your presentation.

- ❖ In the pane that contains the Outline and Slides tabs, click the **Slides** tab.
- ❖ Click the slide to which you want to add a sound.
- ❖ On the **Insert** tab, in the **Media Clips** group, click the arrow under **Sound**.

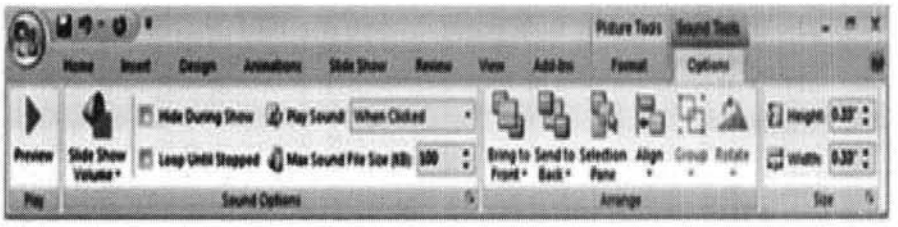
Either:

❑ click **Sound from File**, locate the folder that contains the file, and then double-click the file that you want to add or…

❑ click **Sound from Clip Organizer**, scroll to find the clip that you want in the Clip Art task pane, and then click it to add it to the slide.

❑ You can preview a clip before adding it to your presentation. In the **Clip Art** task pane, in the **Results** box that displays the available clips, move your mouse pointer over the clip's thumbnail. Click the arrow that appears, and then click **Preview/Properties**.

❑ When you insert a sound, you are prompted with a message asking how you want the sound to start: automatically (**Automatically**) or when you click the sound icon (**When Clicked**).



❑ To automatically start the sound when you show the slide, click **Automatically**. The sound plays automatically when you show the slide unless there are other media effects on the slide. If there are other effects, such as an animation, the sound plays after that effect.

❑ To manually start the sound when you click it on the slide, click **When Clicked**.

❖ Multiple sounds are added on top of each other and play in the order in which they were added. If you want each sound to start when you click it, drag the sound icons off of each other after you insert them.

❖ You can play a sound **continuously during just one slide** or **across many slides**.

To play a sound continuously for one slide

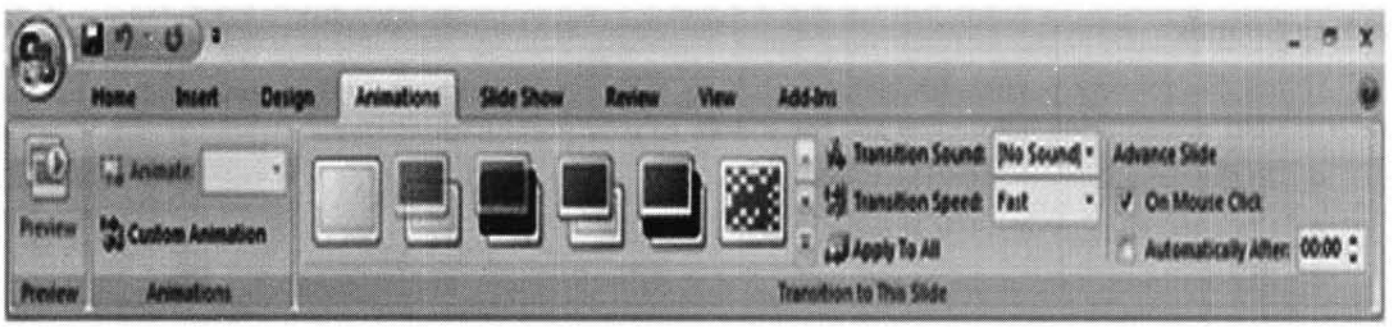
❑ Click the sound icon. 

❑ Under **Sound Tools**, on the **Options** tab, in the **Sound Options** group, select the **Loop Until Stopped** check box.

❑ When you loop a sound, it plays continuously until you advance to the next slide.

❑ To play a sound across multiple slides, on the **Animations** tab, in the **Animations** group, click **Custom Animation**.

❑ In the **Custom Animation** task pane, click the arrow to the right of the selected sound in the **Custom Animation** list, and then click **Effect Options**.



❑ On the Effect tab, under Stop playing, click After, and then select the total number of slides on which the file should play.

❑ The sound file should be as long as the specified display times of the slides. You can see the length of the sound file on the Sound Settings tab, under Information.

Adding Hyperlinks

❖ You can use hyperlinks to move from one slide to another, to a network or Internet location, or even to another file or program altogether.

❑ Select the text that you want to click to activate the hyperlink. Alternatively, you can select an object (a piece of clip art, for example, or a SmartArt graphic).

❑ On the Insert tab, in the Links group, click Hyperlink.

❑ In the Insert Hyperlink dialog box, click the appropriate button in the My Places box for the target of your link (that is, the place where the link takes you).

❑ To go to another slide in your presentation, for example, click Place in This Document.

❑ Find and click the target location, make any changes that you want in the Text to display and Address boxes, and then click OK.

Previewing your presentation

❖ To view your presentation on your computer screen exactly the way that it will look to your audience when you are presenting, do the following:

❑ On the Slide Show tab, in the Start Slide Show group, do one of the following: 1) To start with the first slide in the presentation, click From Beginning, or 2) To start with the slide that currently appears in the Slide pane, click From Current Slide.

❑ Click to advance to the next slide.

❑ To return to Normal view at any time, press ESC.

MS-POWER POINT EXERCISES

1. Inserting Clip arts and Pictures.
2. Frame movements of the above.
3. Insertion of new slides.
4. Preparation of Organisation Charts.
5. Presentation using Wizards.
6. Usage of design templates.

CHAPTER 11

INTRODUCTION TO MS-ACCESS

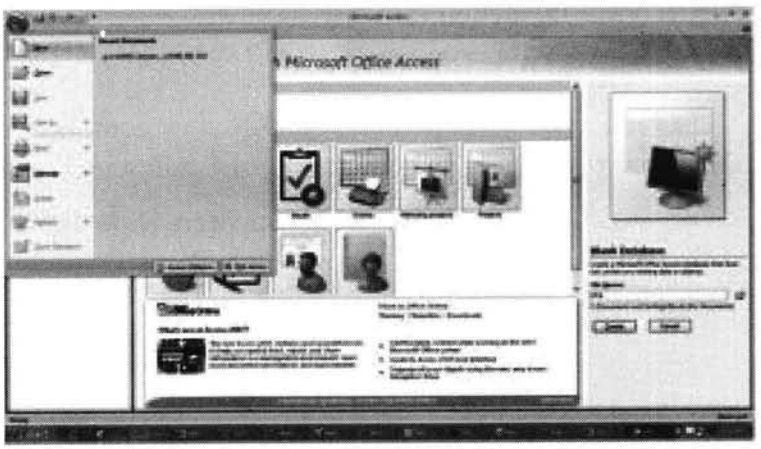
Microsoft Access is a database and, more specifically, a relational database.

Microsoft Access is a database management system. It is a piece of software that acts as a database. A database is used to store information, display it in many formats, and answer questions about the data such questions are called queries, and are a very important reason for using databases.

Before you can use queries on a database, you have to have data. Data in Access is stored in tables, which are a lot like Sheets in Excel.

Access has an .mdb extension by default, whereas Microsoft® Word has the .doc extension. Although this has changed in Access 2007 where the extension is now an accdb extension. Early versions of Access cannot read accdb extensions but Microsoft Access 2007 can read and change earlier versions of Access.

First, get into the Access Program itself. This task is done just like getting into Excel or Word: simply find the icon (it is usually red and has a key on it) or name ("Start / Programs / Microsoft Office / Microsoft Access" on many machines) and choose it. When Access (we're currently using 2007) comes up, it looks like this below:



What is Microsoft Access made up of?

The Microsoft Access Database is made up of 7 major components:

- Tables;
- Relationships;
- Queries;
- Forms;
- Reports;
- Macros;
- Modules.

The following gives a quick overview of each component.

Tables

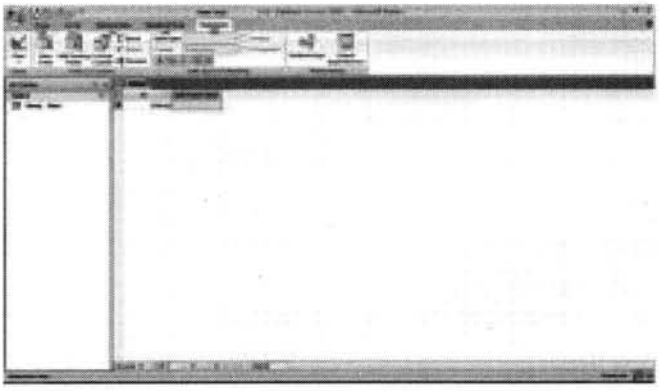
The tables are the backbone and the storage container of the data entered into the database. If the tables are not set up correctly, with the correct relationships, then the database may be slow, give you the wrong results or not react the way you expect. So, take a bit of time when setting up your tables.

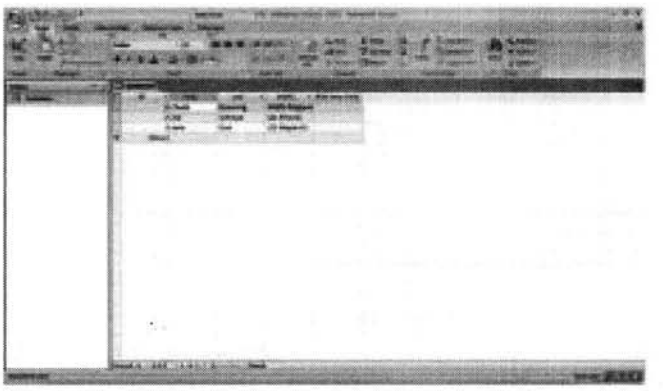
Queries, forms, etc. are usually based on a table.

The tables that contain data look a bit like a table in Microsoft® Word or a Microsoft® Excel Spreadsheet, when opened. They have columns and rows as does a table in Microsoft® Word and an Excel worksheet. Each of the columns will have a field name at the top and each of the rows will represent a record.

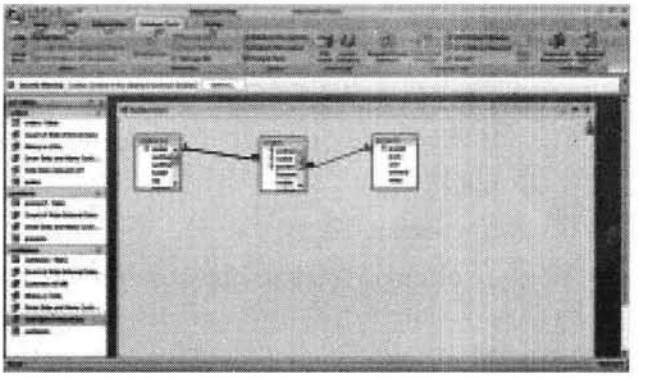
As an example:

ID	First Name	Surname	Street	Town	Post code
1	Tim	Reynolds	50 High Street	Bendigo	3550
2	Joan	Pilcher	23 Barkley Street	Bendigo	3550
3	Alice	Jones	1 McIvor Road	Bendigo	3550





Relationships



Relationships are the bonds you build between the tables. They join tables that have associated elements. To do this there is a field in each table, which is linked to each other, and have the same values.

Queries

Are the means of manipulating the data to display in a form or a report. Queries can sort, calculate, group, filter, join tables, update data, delete data, etc. Their power is immense. The Microsoft® Access database query language is SQL (Structured Query Language). The need to know SQL is not required in the early stages of learning Access. Microsoft® Access writes the SQL for you, after you tell it what you want, in the Design view of the queries window.

Forms

Forms are the primary interface through which the users of the database enter data. The person who enters the data will interact with forms regularly. The programmer can set the forms to show only the data required. By using queries, properties, macros and VBA (Visual Basic for Applications), the ability to add, edit and delete data can also be set. Forms can be set up and developed to reflect the use they will be required for.

Reports

Reports are the results of the manipulation of the data you have entered into the database. Unlike forms, they cannot be edited. Reports are intended to be used to output data to another device or application, i.e. printer, fax, Microsoft® Word or Microsoft® Excel.

Macros

Macros are an automatic way for Access to carry out a series of actions for the database. Access gives you a selection of actions that are carried out in the order you enter. Macros can open forms; run queries, change values of a field, run other Macros, etc. the list is almost endless.

Modules

Modules are the basis of the programming language that supports Microsoft® Access, The module window is where you can write and store Visual Basic for Applications (VBA). Advanced users of Microsoft Access tend to use VBA instead of Macros.

All of the above components are persistent; this means that changes are saved when you move from one component to another, not when the database is closed, as in a Microsoft® Word Document.

Limitations

The total size of a database file (.MDB) is limited only by the storage capacity of your PC (Microsoft® quote the maximum database size of 2 Gigabyte (2000 Megabytes)). These figures are for pre 2007 versions of Microsoft Access.

Very few realistic limitations exist, though here are some parameters:

Maximum table size	1 Gb
No. if fields in a record or table	255
No. of indexes in a table or a record	32
Ni. of fields in an index	10
No. of tables in a query	32
Maximum size of a form or report	22"
Characters in a memo field	64,000
MDB size	2 Gb
Max Integer	2,147,483,648
Concurrent Users	255
No. of characters in object names	64

Questions

1. Define Database.
2. What is Microsoft Access made up of?
3. Define Table.
4. What are Queries?
5. What is meant by primary key?
6. What are the limitations of MS-Access?
7. Define Forms.
8. What are Reports?
9. Create a Student Database and perform addition, deletion and modification operations in it.
10. What are the advantages of Database.

MODEL QUESTION PAPER

Subject Name : Computer Fundamentals & Office Automation
Subject code : HDAB

Section A (2 x 12 Marks = 24 Marks)
Answer Any 2 Questions in about 500 Words

1. Discuss on various Generations of a Computer.
2. What are Combinational Circuits? Explain Full Adder with the neat diagram.
3. What is Mail Merge? List the steps involved in Mail Merging.

Section B (2 x 7 Marks = 14 Marks)
Answer Any 2 of the following Questions in about 300 Words

4. Define Computer. Explain the various characteristics of a computer.
5. Explain various laws of Boolean Algebra with Truth Table.
6. Describe the important features of Ms-WORD.

Section C (5 x 4 Marks = 20 Marks)
Answer Any 2 of the following Questions in about 200 Words

7(a) Convert the Octal Number $(12570)_8$ into Decimal Equivalent.

7(b) What is Excess-3 Code? Give Example.

7(c) What is Multiplexer? Explain the operations of Multiplexer with circuit diagram.

7(d) With the circuit diagram explain working of T FlipFlop.

7(e) Discuss on Templates in MS-WORD.

7(f) How do we add an image into the PowerPoint?

7(g) How do we insert data and formulas into MS-EXCEL?

Section C (6 x 2 Marks = 12 Marks)
Answer All Questions in about 100 Words

8(a) Define Logic Gates.

8(b) What is Flip-flop?

8(c) Define Encoder.

8(d) List the components of MS-EXCEL Interface.

8(e) What is PowerPoint?

8(f) What are the Components of MS-ACCESS.

Answers

Section A (2 x 12 Marks = 24 Marks)
Answer Any 2 Questions in about 500 Words

1. Discuss on various Generations of a Computer. There are totally five computer generations known till date

First Generation

The period of first generation: 1946-1959. Vacuum tube based.

Second Generation

The period of second generation: 1959-1965. Transistor based.

Third Generation

The period of third generation: 1965-1971. Integrated Circuit based.

Fourth Generation

The period of fourth generation: 1971-1980. VLSI microprocessor based.

Fifth Generation

The period of fifth generation: 1980-onwards.ULSI microprocessor based

First Generation

The period of first generation was 1946-1959. The computers of first generation used vacuum tubes as the basic components for memory and circuitry for CPU (Central Processing Unit). These tubes, like electric bulbs, produced a lot of heat and were prone to frequent fusing of the installations, therefore, were very expensive and could be afforded only by very large organizations. In this generation mainly batch processing operating system were used. Punched cards, paper tape, and magnetic tape were used as input and output devices. The computers in this generation used machine code as programming language.

The main features of first generation are:

- Vacuum tube technology
- Unreliable
- Supported machine language only
- Very costly
- Generated lot of heat
- Non-portable

Second Generation

The period of second generation was 1959-1965. In this generation transistors were used that were cheaper, consumed less power, more compact in size, more reliable and faster than the first generation machines made of vacuum tubes. In this generation, magnetic cores were used as primary memory and magnetic tape and magnetic disks as secondary storage devices. In this generation assembly language and high-level programming languages like FORTRAN, COBOL was used. The computers used batch processing and multiprogramming operating system.

The main features of second generation are:

- Use of transistors
- Reliable in comparison to first generation computers
- Smaller size as compared to first generation computers
- Generated less heat as compared to first generation computers
- Consumed less electricity as compared to first generation computers
- Faster than first generation computers

- Still very costly
- A.C. needed
- Supported machine and assembly languages

Third Generation

The period of third generation was 1965-1971. The computers of third generation used integrated circuits (IC's) in place of transistors. A single IC has many transistors, resistors and capacitors along with the associated circuitry. The IC was invented by Jack Kilby. This development made computers smaller in size, reliable and efficient. In this generation remote processing, time-sharing, multi-programming operating system were used. High-level languages (FORTRAN-II TO IV, COBOL, PASCAL PL/1, BASIC, ALGOL-68 etc.) were used during this generation.

The main features of third generation are:

- IC used
- More reliable in comparison to previous two generations
- Smaller size
- Generated less heat
- Faster

Fourth Generation

The period of fourth generation was 1971-1980. The computers of fourth generation used Very Large Scale Integrated (VLSI) circuits. VLSI circuits having about 5000 transistors and other circuit elements and their associated circuits on a single chip made it possible to have microcomputers of fourth generation. Fourth generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to personal computer (PC) revolution. In this generation time sharing, real time, networks, distributed operating system were used. All the high-level languages like C, C++, DBASE etc. were used in this generation.

The main features of fourth generation are:

- VLSI technology used
- Very cheap
- Portable and reliable
- Use of PC's
- Very small size
- Pipeline processing

Fifth Generation

The period of fifth generation is 1980-till date. In the fifth generation, the VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having ten million electronic components. This generation is based on parallel processing hardware and AI (Artificial Intelligence) software. AI is an emerging branch in computer science, which interprets means and method of making computers think like human beings. All the high-level languages like C and C++, Java, .Net etc. are used in this generation.

- AI includes:
- Robotics
- Neural networks
- Game Playing
- Development of expert systems to make decisions in real life situations.
- Natural language understanding and generation.

The main features of fifth generation are:

- ULSI technology
- Development of true artificial intelligence
- Development of Natural language processing
- Advancement in Parallel Processing
- Advancement in Superconductor technology

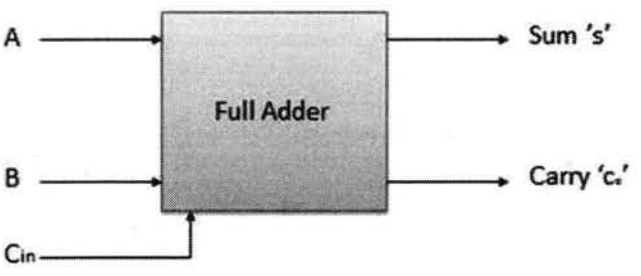
2. What are Combinational Circuits? Explain Full Adder with the neat diagram.

Combinational circuit is circuit in which we combine the different gates in the circuit for example encoder, decoder, multiplexer and demultiplexer. Some of the characteristics of combinational circuits are following.

- The output of combinational circuit at any instant of time, depends only on the levels present at input terminals.
- The combinational circuit do not use any memory. The previous state of input does not have any effect on the present state of the circuit.
- A combinational circuit can have **n** number of inputs and **m** number of outputs.

FULL ADDER

Full adder is developed to overcome the drawback of Half Adder circuit. It can add two one-bit numbers A and B, and carry c. The full adder is a three input and two output combinational circuit.

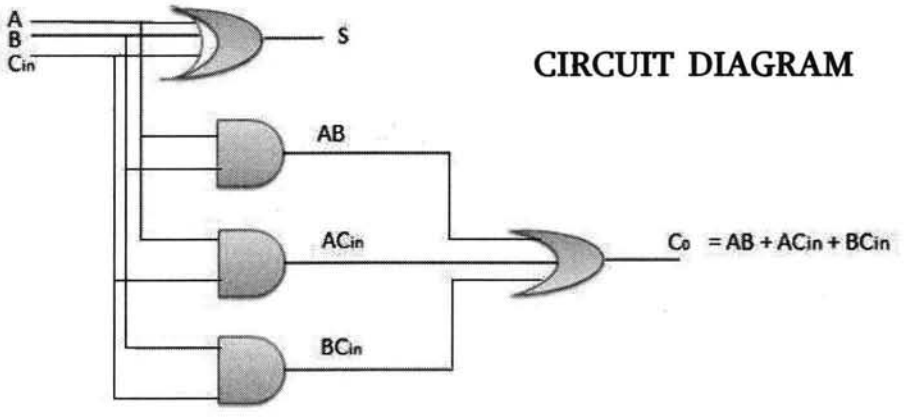


BLOCK DIAGRAM

TRUTH TABLE

INPUT			OUTPUT	
A	B	C_{in}	S	C_o
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

CIRCUIT DIAGRAM



N-Bit Parallel Adder

The Full Adder is capable of adding only two single digit binary number along with a carry input. But in practical we need to add binary numbers which are much longer than just one bit. To add two n-bit binary numbers we need to use the n-bit parallel adder. It uses a number of full adders in cascade. The carry output of the previous full

3. What is Mail Merge? List the steps involved in Mail Merging.

Mail Merge is the process of transferring selected information from one document to another document.

Mail Merge is the facility which requires the following three information

- General body of the letter called main document
- Header Row, the record structure or the name of the fields, which will identify the data
- Data for all the individuals, for whom the letters are to be generated also called data source

Mail Merge option of Word reads this data and physically merges it with Main document to generate letters for all the persons or for all records in the data file.

- Create the main document
- Create data source
- Merge the data with document

All these operations can be performed by Mail Merge option of WORD. In order to invoke the Mail Merge option, choose the Mail Merge option of the Tools menu.

Mail Merge helper guides you through the steps of mail merging a document. There are three main options available in the box.

(a) Creating the Main Document

The first step in the mail merge is to create the main document. For this, choose 'Create' button of 'Main Document' option in Mail Merge Helper box. The following menu will be displayed

Form Letter...
Mailing Labels...
Envelopes...
Catalog...
Restore to Normal Word document

Now choose 'Form Letters' option from this menu as the type of main document.

Main Document

Choose the Active Window button from the above box. Type the main document and again invoke the Mail Merge Helper.

(b) Creating Data Source

Choose the 'Get Data' button from the Mail Merge Helper box. For creating data source, select Create Data Source.

The field names are already available in the Header row, which are default fields for an address list.

Any field that is not required can be removed, and any new field can be added. For removing a field, highlight that particular field and click on the 'Remove field Name' button. For adding a new field, type the name of the field in the Field Name box and then click on the 'Add Field Name' button.

Click on the OK button and save your data structure as well as the data source. Click on the 'Edit Data Source' button from the box to enter records in the data file. Enter the records by typing in the boxes. For adding a record choose 'Add New' button. For removing a record, choose 'Delete' button. After you finish with adding records, click on the OK button.

(c) Opening the Data Source

You can also use a data source already created. You can open it by clicking the 'Get Data' option in the Mail Merge Helper and then selecting 'Open Data Source' A dialog box will appear with a list of data source file names. Select the name of the data source to open it.

(d) Merging the Text with Data

After creating the main document and data source, the third step is to merge the main document with the data source. For this, invoke the Mail Merge Helper again and choose the 'Merge' button. Select 'New Document' from the 'Merge To' drop-down list and click on 'Merge' button. The form letters are generated and stored in the document which may be previewed for final adjustment in the main document, before printing the for letters.

MERGE PRINTING

You can directly print the Form Letters without previewing them. Select the Printer option, then the form letters are directly printed on the printer.

Section B (2 x 7 Marks = 14 Marks)

Answer Any 2 of the following Questions in about 300 Words

4. Define Computer. Explain the various characteristics of a computer.

Computer can be defined as an electronic device that performs rapid computations and generates desired output for users based on input data and programs. Computer can capture, store, retrieve and process data.

CHARACTERISTICS OF COMPUTER

High Speed

- Computer is a very fast device.
- It is capable of performing calculation of very large amount of data.
- The computer has units of speed in microsecond, nanosecond, and even the picosecond.
- It can perform millions of calculations in a few seconds.

Accuracy

- In addition to being very fast, computers are very accurate.
- The calculations are error free.
- Computers perform all jobs with accuracy provided that correct input has been given.

Storage Capability

- Memory is a very important characteristic of computers.
- A computer has much more storage capacity.
- It can store large amount of data.
- It can store any type of data such as images, videos, text, audio and many others.

Diligence

- Unlike human beings, a computer is free from monotony, tiredness and lack of concentration.

- ❖ It can work continuously without any error and boredom.
- ❖ It can do repeated work with same speed and accuracy.

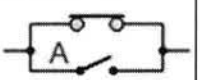
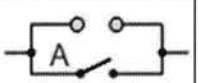
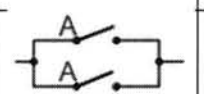
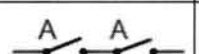
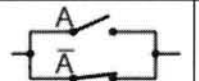
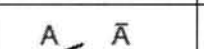
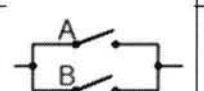
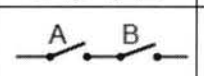
Versatility

- ❖ A computer is a very versatile machine.
- ❖ A computer is very flexible in performing the jobs to be done.
- ❖ This machine can be used to solve the problems related to various fields.
- ❖ At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

Reliability

- ❖ A computer is a reliable machine.
- ❖ Modern electronic components have long lives.
- ❖ Computers are designed to make maintenance easy.

5. Explain various laws of Boolean Algebra with Truth Table.

Boolean Expression	Description	Equivalent Switching Circuit	Boolean Algebra Law or Rule
A + 1 = 1	A in parallel with closed = "CLOSED"		Annulment
A + 0 = A	A in parallel with open= "A"		Identity
A . 1 = A	A in series with closed= "A"		Identity
A . 0 = 0	A in series with open= "OPEN"		Annulment
A + A = A	A in parallel with A = "A"		Indempotent
A . A = A	A in series with A = "A"		Indempotent
NOT A = A	NOT NOT A(double negative) = "A"		Double Negation
A + A = 1	A in parallel with not " A= "CLOSED		Complement
A . A = 0	A in series with not A= "OPEN"		Complement
A+B = B+A	A in parallel with B =B i n parallel with A		Commutative
A.B = B.A	A in series with B =B in series with A		Commutative

6. Describe the important features of Ms-WORD.

IMPORTANT FEATURES OF MS-WORD

Ms-Word not only supports word processing features but also DTP features. Some of the important features of Ms-Word are listed below:

- Using word you can create the document and edit them later, as and when required, by adding more text, modifying the existing text, deleting/moving some part of it.
- Changing the size of the margins can reformat complete document or part of text. Font size and type of fonts can also be changed. Page numbers and Header and Footer can be included.
- Spelling can be checked and correction can be made automatically in the entire document. Word count and other statistics can be generated.
- Text can be formatted in columnar style as we see in the newspaper. Text boxes can be made.
- Tables can be made and included in the text.
- Word also allows the user to mix the graphical pictures with the text. Graphical pictures can either be created in word itself or can be imported from outside like from Clip Art Gallery.
- Word also provides the mail-merge facility.
- Word also has the facility of macros. Macros can be either attached to some function/special keys or to a tool bar or to a menu.
- It also provides online help of any option.

Section C (5 x 4 Marks = 20 Marks)

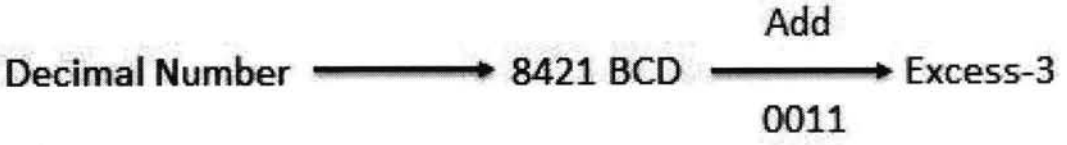
Answer Any 2 of the following Questions in about 200 Words

7(a) Convert the Octal Number $(12570)_8$ into Decimal Equivalent.

Octal Number $(12570)_8$ = Decimal Equivalent. $(5496)_{10}$

7(b) What is Excess-3 Code? Give Example.

The Excess-3 code is also called as XS-3 code. It is non-weighted code used to express decimal numbers. The Excess-3 code words are derived from the 8421 BCD code words adding (0011)2 or (3)10 to each code word in 8421. The excess-3 codes are obtained as follows



Example

Decimal	BCD 8 4 2 1	Excess –3 BCD + 0011
0	0000	0011
1	0001	0100
2	0010	0101
3	0011	0110
4	0100	0111
5	0101	1000
6	0110	1001
7	0111	1010
8	1000	1011
9	1001	1100

7(c) What is Multiplexer? Explain the operations of Multiplexer with circuit diagram.

MULTIPLEXERS

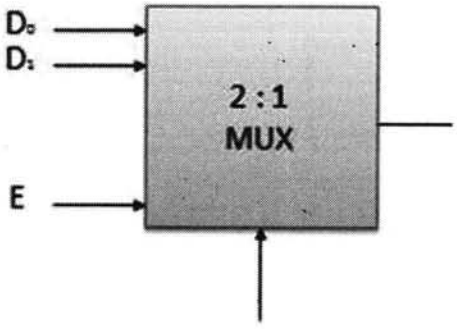
Multiplexer is a special type of combinational circuit. There are n-data inputs, one output and m select inputs with 2m = n. It is a digital circuit which selects one of the n data inputs and routes it to the output. The selection of one of the n inputs is done by the selected inputs. Depending on the digital code applied at the selected inputs, one out of n data sources is selected and transmitted to the single output Y. E is called the strobe or enable input which is useful for the cascading. It is generally an active low terminal, that means it will perform the required operation when it is low.

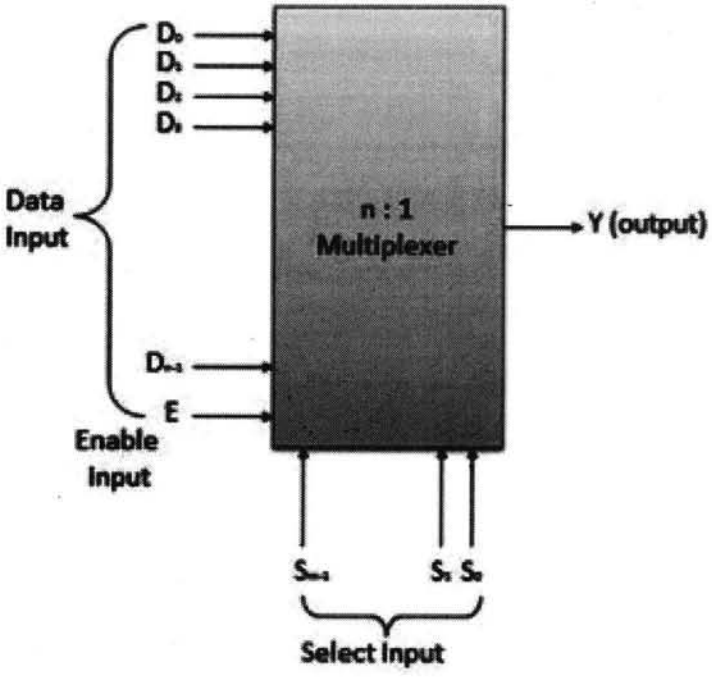
BLOCK DIAGRAM

Multiplexers come in multiple variat

- 2 : 1 multiplexer
- 4 : 1 multiplexer
- 16 : 1 multiplexer
- 32 : 1 multiplexer

BLOCK DIAGRAM





TRUTH TABLE

Enable	Select	Output
E	S	Y
0	x	0
1	0	D_0
1	1	D_1

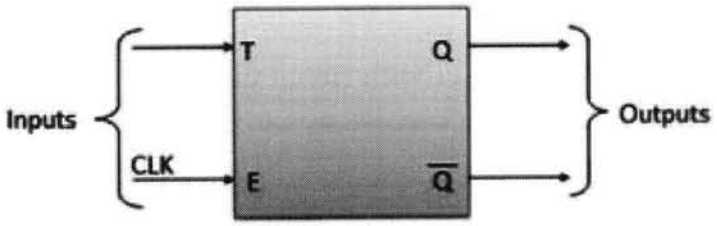
x = Don't care

7(d) With the circuit diagram explain working of T FlipFlop.

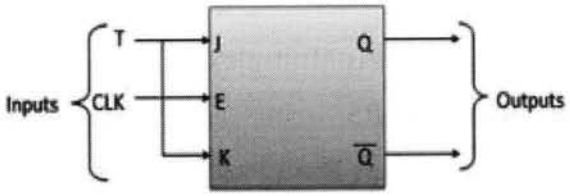
Toggle Flip Flop / T Flip Flop

Toggle flip flop is basically a JK flip flop with J and K terminals permanently connected together. It has only input denoted by T is shown in the Symbol Diagram. The symbol for positive edge triggered T flip flop is shown in the Block Diagram.

SYMBOL DIAGRAM



BLOCK DIAGRAM



TRUTH TABLE

Inputs		Outputs		Comments
E	T	Q_{n+1}	$\overline{Q}_{n+1}$	
1	0	Q_n	$\overline{Q}_n$	No change
1	1	$\overline{Q}_n$	Q_n	Toggle

7(e) Discuss on Templates in MS-WORD.

TEMPLATES

Templates are files that help you design interesting, compelling, and professional-looking documents. All the formatting is complete; you add what you want to them Examples are resumes, invitations, memos, and newsletters. You can modify a sheet, workbook, or existing template, and then save it as your very own custom template.

Save a document as a template

1. Open the document.
2. Add, delete, or change any text, graphics, or formatting, and make any other changes that you want to appear in all new documents that you base on the template.
3. On the File menu, click Save As.
4. On the Format pop-up menu, click Word Template (.dotx).
5. In the Save As box, type the name that you want to use for the new template, and then click Save.

Unless you select a different location, the template is saved in /Users/ *username*/Library/Application Support/Microsoft/Office/User Templates/My Templates.

7(f) How do we add an image into the PowerPoint?

Adding from from ClipArt

Lack of visual variety can cause your audience's attention to drift. And many kinds of information

aren't most clearly expressed in a paragraph or a bulleted list. As such, Clip Art, SmartArt graphics, charts, and sound are available options for curing "slide burnout."

To add image from clip art, click the placeholder that you want to add clip art to. If you don't select a placeholder, or if you select a placeholder that cannot contain an image, the clip art is inserted at the center of the slide.

- On the **Insert** tab, in the **Illustrations** group, click **Clip Art**.
- In the **Clip Art** task pane, locate the clip art you want, and then click it.
- You can move the clip art, resize it, rotate it, add text to it, and make other changes.
- You can search for additional clip art on the Microsoft Office Online site; click the **Clip art on Office Online** link at the bottom of the **Clip Art** task pane.

7(g) How do we insert data and formulas into MS-EXCEL?

To insert data, you simply use your mouse to select a cell and then simply type. Start the Excel program. Select the cell A1 (that is the cell in column A, row 1) by using your mouse and clicking the left mouse button (this is the 'normal" mouse button). Note that the name of the cell is displayed in the **Name Box**. By default, the name of the cell is its address with reference to the row/column although you can name a cell anything you want using the **Insert/Name** menu item..

- Insert the following data into the first 6 rows of the A column:
- 56, 67, 76, 55, 62, 69.

To do this, simply select the cell (A1 should already be selected) and type in the number 56 and press the ENTER key. This will insert the number 56 into cell A1 and automatically move the active cell to A2. Now type in 67 into A2, and press enter. Continue in this fashion until all six numbers are inserted in the first 6 rows of column A.

- Insert the following set of numbers into the first 6 rows of column B.
- 34, 44, 123, 89, 22, 10

An easier way to insert a formula

While the ability to create your own formulas in Excel is powerful, it is time consuming (not to mention that it requires that you know the formula!). The people at Excel realize this and have created a set of formulas (they call them functions) ready for you to use. There are several hundred predetermined functions in Excel, one of them is the SUM function (which sums a series of cells).

How to get to SUM

In your spreadsheet, select the cell A8. To access the formulas, use the INSERT menu item and select FUNCTIONS.

Section C (6 x 2 Marks = 12 Marks)

Answer All Questions in about 100 Words

8(a) Define Logic Gates.

Basic logic circuits with one or more inputs and one output are known as gates. Gates are used as the building blocks in the design of more complex digital logic circuit.

Basic Logic Gates are AND,OR and NOT.

8(b) What is Flip-flop?

Flip flop is a sequential circuit which generally samples its inputs and changes its outputs only at particular instants of time and not continuously. Flip flop is said to be edge sensitive or edge triggered rather than being level triggered like latches. Flip-flop is a 1 bit memory cell which can be used for storing the digital data. To increase the storage capacity in terms of number of bits, we have to use a group of flip-flop.

8(c) Define Encoder.

ENCODER

Encoder is a combinational circuit which is designed to perform the inverse operation of the decoder. An encoder has n number of input lines and m number of output lines. An encoder produces an m bit binary code corresponding to the digital input number. The encoder accepts an n input digital word and converts it into an m bit another digital word.

8(d) List the components of MS-EXCEL Interface.

Menu Bar, Formula Bar, Button Bar, Cell, Sheets Tabs, Name Bar

8(e) What is PowerPoint?

Microsoft Office PowerPoint 2007 is a program that enables you to create slide-show presentations. The 2007 version offers expanded graphics and formatting capabilities, making it easier to create professional presentations.

8(f) What are the Components of MS-ACCESS.

The Microsoft Access Database is made up of 7 major components:

- Tables;
- Relationships;
- Queries;
- Forms;
- Reports;
- Macros;
- Modules

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