Department of Commerce (CA)

INTRODUCTION TO INFORMATION TECHNOLOGY

SEMESTER:I **SUB CODE:18BCA14C**

I B.COM(CA)

UNIT 2: Operating systems-features-types-number system-conversion-programming language-machine language-assembly language-flow chart-data and information-data processing-typesof data processing.

REFERENCE BOOK:

*INTRODUCTION TO INFORMATION TECHNOLOGY BY ALX LEON AND MATHEW LEON

*INTRODUCTION TO INFORMATION TECHNOLOGY BY PARAMESHWARAN

*COMPUTERS AND COMMON SENSE BY ROGER HUNT AND JOHN SHELLRY

PREPARED BY: DR. E.N. KANJANA,

ASST. PROFESSOR.

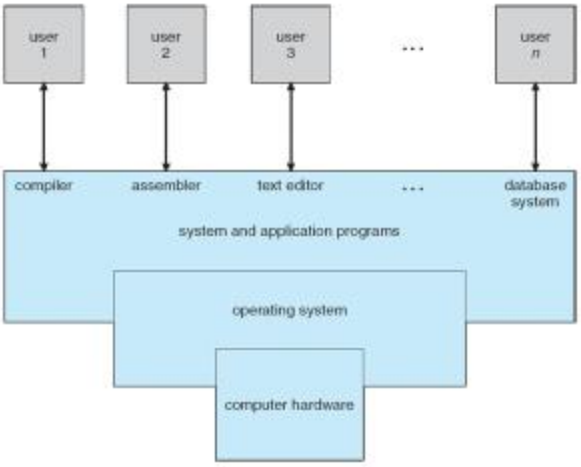
What is an Operating System?

- A program that acts as an intermediary between a user of a computer and the computer hardware
- Operating system goals:
  - Execute user programs and make solving user problems easier
  - Make the computer system convenient to use
  - Use the computer hardware in an efficient manner

Computer System Structure

- Computer system can be divided into four components:
  - Hardware – provides basic computing resources
    - CPU, memory, I/O devices
  - Operating system
    - Controls and coordinates use of hardware among various applications and users
  - Application programs – define the ways in which the system resources are used to solve the computing problems of the users
    - Word processors, compilers, web browsers, database systems, video games
  - Users
    - People, machines, other computers

Four Components of a Computer System



What Operating Systems Do

- Depends on the point of view
- Users want convenience, **ease of use** and **good performance**
  - Don't care about **resource utilization**
- But shared computer such as **mainframe** or **minicomputer** must keep all users happy
- Users of dedicate systems such as **workstations** have dedicated resources but frequently use shared resources from **servers**
- Handheld computers are resource poor, optimized for usability and battery life
- Some computers have little or no user interface, such as embedded computers in devices and automobiles

Operating System Definition

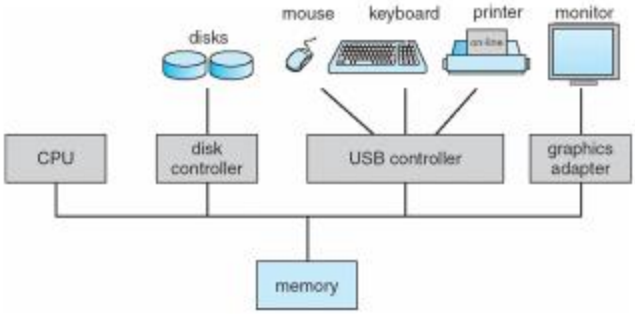
- OS is a **resource allocator**
  - Manages all resources
  - Decides between conflicting requests for efficient and fair resource use
- OS is a **control program**
  - Controls execution of programs to prevent errors and improper use of the computer

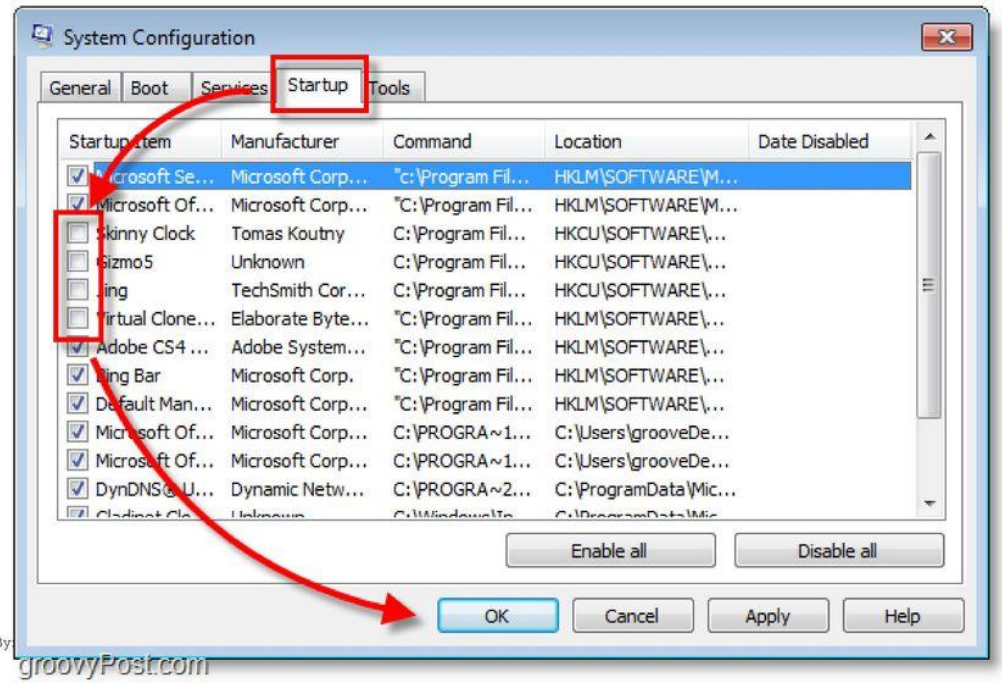
Computer Startup

- **bootstrap program** is loaded at power-up or reboot
  - Typically stored in ROM or EPROM, generally known as **firmware**
  - Initializes all aspects of system
  - Loads operating system kernel and starts execution

Computer System Organization

- Computer-system operation
  - One or more CPUs, device controllers connect through common bus providing access to shared memory
  - Concurrent execution of CPUs and devices competing for memory cycles





By groovyPost.com

BASIC FUNCTIONS OF AN OPERATING SYSTEMS

1. **Process Management:**

- It handles the creation, deletion, suspension, resumption, and synchronization of process.
  - ✓ Press Ctrl+Alt+Del.
    - Use this shortcut if your computer freezes while you are middle in of running a particular application
  - ✓ Press Ctrl+Alt+Del -> Start up
    - Many applications these days hook into your Windows Startup process and automatically load up each time you start your computer which make your computer takes longer and longer time to startup so the solution is **Disable Startup Programs** " see the picture in the next slide"

BASIC FUNCTIONS OF AN OPERATING SYSTEMS

2. **Memory Management:**

- It handles allocation and de-allocation of memory space as required by various programs.
  - Press Ctrl+Alt+Del.
    - Use this shortcut if your computer stops working suddenly – Memory capacity is full.

3. **File Management:**

- It is responsible for creation and deletion of files and directories. It also organizes, stores, retrieves, names, and protects all the files.
  - Right click to the file ->Copy "Ctrl + C"
  - Right click to the file ->Cut "Ctrl + X"
  - Right click to the file -> rename

BASIC FUNCTIONS OF AN OPERATING SYSTEMS

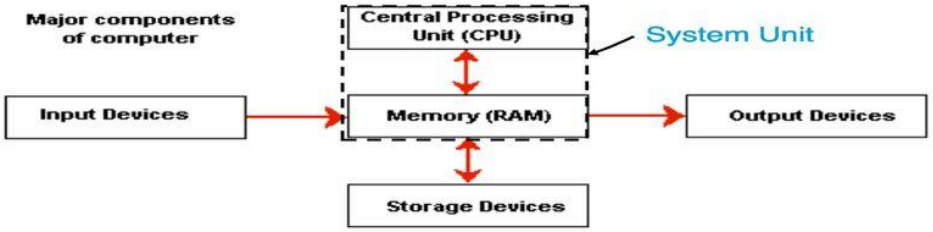
4. **Device Management:**
   - It manages all the devices of the computer system such as printers and modems. If any device fails, it detects the device failure and notifies the same to the user.
     - Control panel -> view by "small icon" -> Device manger
5. **Security Management:**
   - Protects system resources and information against destruction and unauthorized use.
     - Password to enter your account
       - Control Panel -> user accounts
     - Change permission for each file to the different accounts
     - Right click to the file ->Property ->security -> edit
     - Firewall

BASIC FUNCTIONS OF AN OPERATING SYSTEMS

The basic functions of an operating systems are:

6. **User interface:**
   - Provides the interface between the user and the hardware
     - ➢ The Graphical User Interface (GUI)
       - ❑Represents all the program / computer resources as *icons*
       - ❑Workspace represented graphically
       - ❑More usable: led to wider use of computers

WHAT DOES A COMPUTER DO?



A computer is an *electronic machine* that can be programmed to *accept data* (***input***), *process* it into *useful information* (***output***), and *store* it in a ***storage*** media for future use.

Why Binary System?

- Computers are made of a series of switches
- Each switch has two states: ON or OFF
- Each state can be represented by a number – 1 for "ON" and 0 for "OFF"

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Converting Base-2 to Base-10

$(1\ 0\ 0\ 1\ 1)_2$

ON/OFF	ON	OFF	OFF	ON	ON
Exponent:	2^4	~~2^3~~	~~2^2~~	2^1	2^0
Calculation:	16	+ 0	+ 0	+ 2	+ 1 =

$$(19)_{10}$$

7

- Number systems include decimal, binary, octal and hexadecimal
- Each system have four number base

Number System	Base	Symbol
Binary	Base 2	B
Octal	Base 8	O
Decimal	Base 10	D
Hexadecimal	Base 16	H

- Decimal to Binary

There are two methods, that may be used to convert from integer number in decimal form to binaryform:

1-Repeated Division By 2

- For this method, divide the decimal number by 2,
- If the remainder is 0, on the right side write down a 0.
- If the remainder is 1, write down a 1.
- When performing the division, the remainders which will represent the binary equivalent of the decimal number are written beginning at the least significant digit (right) and each new digit is written to more significant digit (the left) of the previous digit.

Octal System

- Computer scientists are often looking for shortcuts to do things
- One of the ways in which we can represent binary numbers is to use their octal equivalents instead
- This is especially helpful when we have to do fairly complicated tasks using numbers

- The octal numbering system includes eight base digits (0-7)
- After 7, the next placeholder to the right begins with a "1"
- 0, 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13 ...

S.N.	Number System and Description
1	Decimal number system Base 10, Digit used : 0 to 9
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
4	Binary Number System Base 2. Digits used : 0, 1

Binary Number systems

- **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 systems

- **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 -

S.N.	Number System and Description
1	Decimal number system Base 10, Digit used : 0 to 9
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4	Binary Number System Base 2. Digits used : 0, 1

Decimal Number systems

- 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)+ (4x1)
- (1x103)+ (2x102)+ (3x101)+ (4x100)
- 1000 + 200 + 30 + 4
- 1234

Binary Number systems

- **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 systems

- **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 -

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	$19FDE_{16}$	$= ((1 \times 16^4)+(9 \times 16^3)+(15 \times 16^2)+(13x\ 16^1)+(14x\ 16^0))_{10}$
Step 3	$19FDE_{16}$	$=(65536+ 36864 + 3840 + 208 + 14)_{10}$
Step 4	$19FDE_{16}$	$=106462_{10}$

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

Number Conversion

- 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

- **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.

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

DEFINITION OF COMPUTER LANGUAGES

- A computer languages are the languages by which a user command a computer to work on the algorithm which a user has written to get an output.

TWO TYPES OF COMPUTER LANGUAGES

- Low-level languages
- High-level languages

Lower Level Language

A low-level programming language is a programming language that provides little or no abstraction from a computer's instruction set architecture. It consists of numeric codes i.e 0 & 1. These codes are easily understandable to computer but difficult to human.. A lower level language is used in two generations of computer.

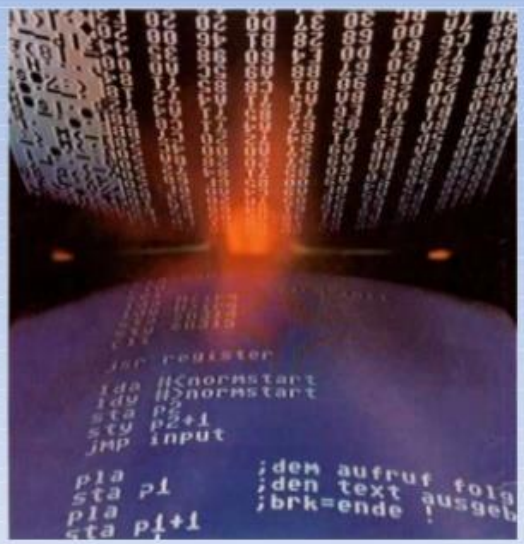
- first generation
- second generation

First generation languages or 1GL

Represent the very early, primitive computer languages that consisted entirely of 1's and 0's - the actual language that the computer understands (machine language).

Second generation languages (2GL)

Represent a step up from the first generation languages. Allow for the use of symbolic names instead of just numbers. Second generation languages are known as assembly languages. Code written in an assembly language is converted into machine language (1GL).



CHARACTERSTICS OF LOW LEVEL LANGUAGES

- Direct memory management
- Little-to-no abstraction from the hardware
- Register access
- Statements usually have an obvious correspondence with clock cycles
- Superb performance

Advantages

- Computational Speed is very fast.
- Directly understandable by computer.

Disadvantages

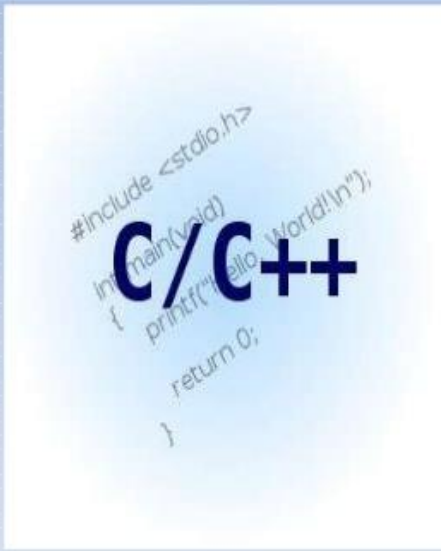
- Development of a program in machine language is very time consuming.
- Error correction is tedious process.

HIGH LEVEL LANGUAGES

- **High-level** programming languages allow the specification of a problem solution in terms closer to those used by human beings. These languages were designed to make programming far easier, less error-prone and to remove the programmer from having to know the details of the internal structure of a particular computer. This language is used in third generation.

Third generation languages (3GL)

With the languages introduced by the third generation of computer programming, words and commands (instead of just symbols and numbers) were being used. These languages therefore, had syntax that was much easier to understand. Third generation languages are known as "high level languages" and include C, C++, Java, and Javascript, among others.



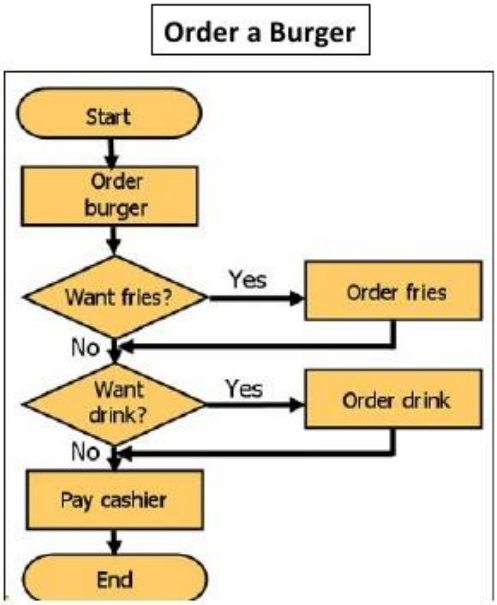
TYPES

- C++
- VISUAL BASIC
- JAVA
- JAVASCRIPT

What is flow chart?

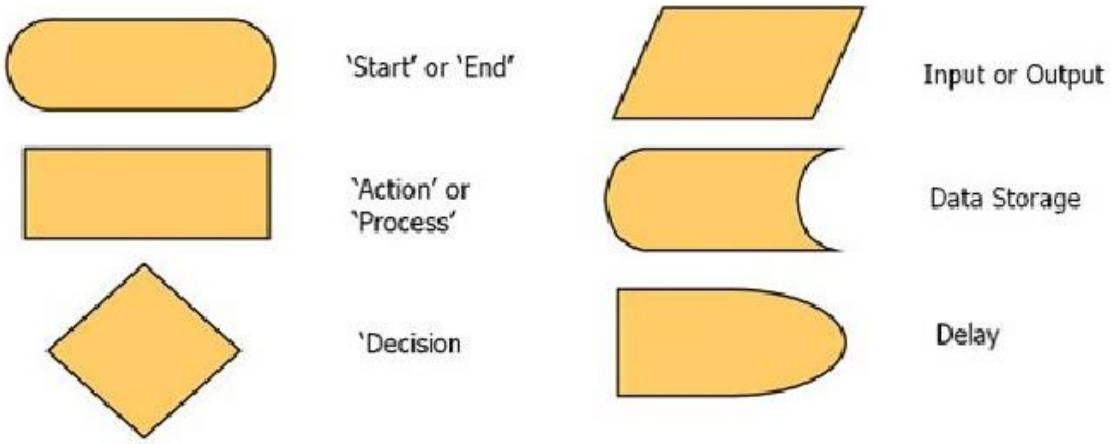
A flow chart shows the break down of a task into separate steps

They can be used to represent how programs work



Flow Chart Symbols

Flow charts use *standard* symbols to represent different activities. Having standard symbols means that the diagrams are *universally understood*

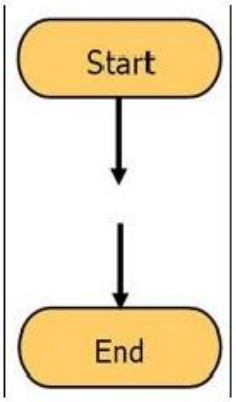


Drawing Flow Charts

- When drawing a flow diagram, every stage should be listed in a logical order.
- It should neat
- Easy to follow
- No room for misunderstanding or ambiguity

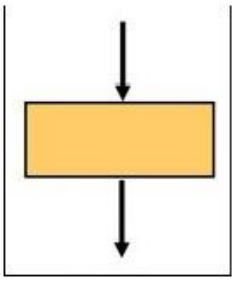
Drawing Flow Charts

All flow charts have a **Start** point using this symbol ->



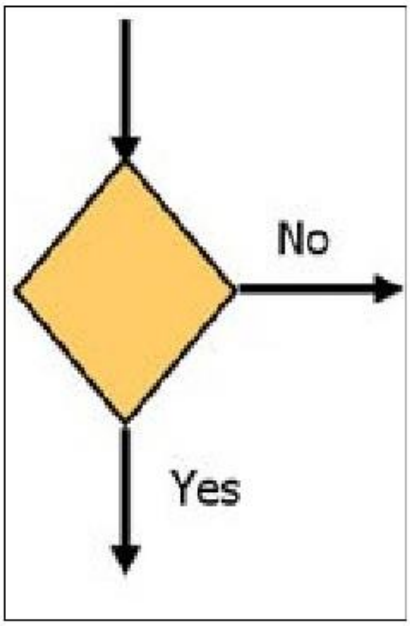
All flow charts have an **End** point using this symbol ->
This is the 'terminator'. It ends the flow.

All flow charts have at least one process box ->
The direction of flow is one way



Drawing Flow Charts

Only one flow line should enter a decision symbol but two or three lines may leave it depending on the options that can be chosen



Advantages of Flow Charts

- A good way to communicate the details of a task or processes to others
- An excellent way of documenting each stage of the process
- Acts a blue print guiding the programmer through the development

Disadvantages of Flow Charts

- Some tasks are difficult to represent using a flow chart
- If and alteration is made then the flow chart may need to be redrawn
- People need to understand what the symbols mean

WHAT IS DATA?

- Facts, statistics used for reference or analysis.
- Numbers, characters, symbols, images etc., which can be processed by a computer.
- Data must be interpreted, by a human or machine, to derive meaning
- So data is meaningless

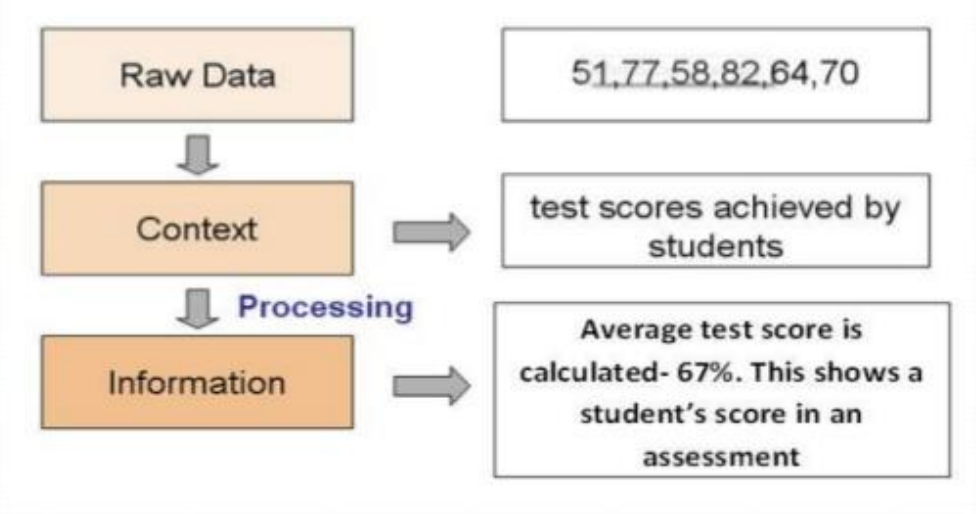
DATA CAN TAKE MANY FORMS

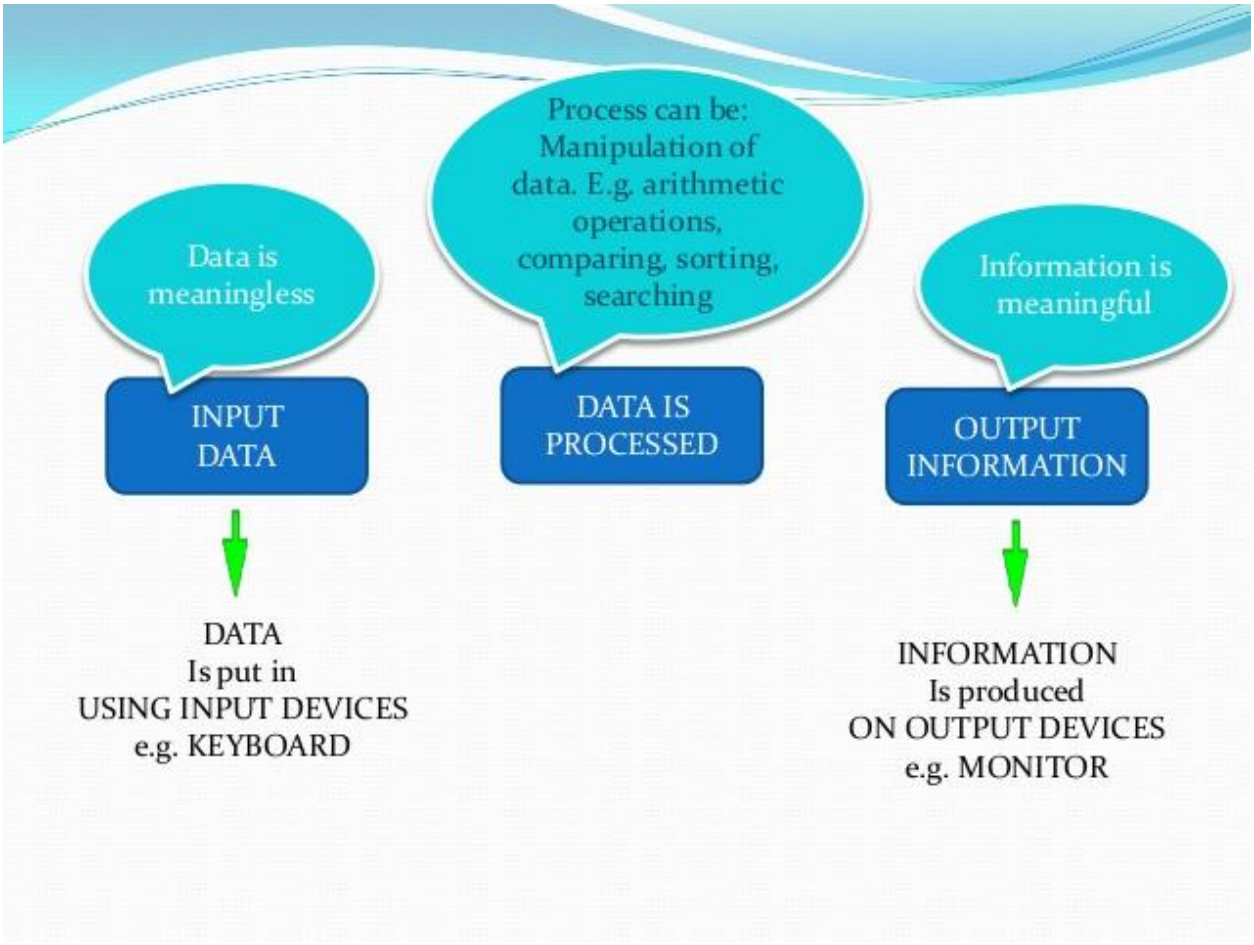
- ALPHANUMERIC DATA (COMBINATION OF NUMBERS AND LETTERS)
- TEXT DATA (SENTENCES & PARAGRAPHS USED IN WRITTEN COMMUNICATION)
- IMAGE DATA (GRAPHICS, SHAPES, FIGURES ETC)
- AUDIO (HUMAN VOICE & OTHER SOUNDS)

WHAT IS INFORMATION?

- Data that has been processed within a context to give it meaning.
- "Information is data that has been processed"
- "Information is interpreted data"
- Information is meaningful

EXAMPLE 1


Raw Data
51,77,58,82,64,70
Context
test scores achieved by students
Processing
Information
Average test score is calculated- 67%. This shows a student's score in an assessment


Data is meaningless
INPUT DATA
Process can be: Manipulation of data. E.g. arithmetic operations, comparing, sorting, searching
DATA IS PROCESSED
Information is meaningful
OUTPUT INFORMATION
DATA
Is put in
USING INPUT DEVICES
e.g. KEYBOARD
INFORMATION
Is produced
ON OUTPUT DEVICES
e.g. MONITOR

CONCLUSION

IN SIMPLE TERMS WE CAN SAY THAT:

DATA IS RAW FACTS AND FIGURES &
DATA IS MEANINGLESS

WHILE

INFORMATION IS DATA THAT HAS BEEN PROCESSED
INFORMATION IS MEANINGFUL

Data Processing

Data processing:

Any operation or set of operations performed upon data, whether or not by automatic means, such as collection, recording, organization, storage, adaptation or alteration to convert it into useful information.

Data Processing Cycle

Once data is collected, it is processed to convert it into useful information. The data is processed again and again until the accurate result is achieved. This is called data processing cycle.

The data processing is very important activity and involves very careful planning. Usually, data processing activity involves three basic activities.

- Input
- Processing
- Output

Data Processing Cycle
Step-1

1. Input

It is the process through which collected data is transformed into a form that computer can understand. It is very important step because correct output result totally depends on the input data. In input step, following activities can be performed.

i) Verification

The collected data is verified to determine whether it is correct as required. For example, the collected data of all B.Sc. students that appeared in final examination of the university is verified. If errors occur in collected data, data is corrected or it is collected again.

ii) Coding

The verified data is coded or converted into machine readable form so that it can be processed through computer.

iii) Storing

The data is stored on the secondary storage into a file. The stored data on the storage media will be given to the program as input for processing.

Data Processing Cycle
Step-2

2.Processing

The term processing denotes the actual data manipulation techniques such as classifying, sorting, calculating, summarizing, comparing, etc. that convert data into information.

i) Classification

The data is classified into different groups and subgroups, so that each group or sub-group of data can be handled separately.

ii) Storing

The data is arranged into an order so that it can be accessed very quickly as and when required.

iii) Calculations

The arithmetic operations are performed on the numeric data to get the required results. For example, total marks of each student are calculated.

iv) Summarizing

The data is processed to represent it in a summarized form. ft means that the summary of data is prepared for top management. For example, the summary of the data of student is prepared to show the percentage of pass and fail student examination etc.

Data Processing Cycle
Step-3

3. Output

After completing the processing step, output is generated. The main purpose of data processing is to get the required result. Mostly, the output is stored on the storage media for later user. In output step, following activities can be performed.

i) Retrieval

Output stored on the storage media can be retrieved at any time. For example, result of students is prepared and stored on the disk. This result can be retrieved when required for different purposes.

ii) Conversion

The generated output can be converted into different forms. For example, it can be represented into graphical form.

iii) Communication

The generated output is sent to different places. For example, weather forecast is prepared and. sent to different agencies and newspapers etc. where it is required.

Types of Data Processing

1. **Manual Data Processing:**

   This method of data processing involves human intervention. The manual process of data entry implies many opportunities for errors, such as delays in data capture, as every single data field has to be keyed in manually, a high amount of operator misprints or typos, high labor costs from the amount of manual labor required. Manual processing also implies higher labor expenses in regards to spending for equipment and supplies, rent, etc.

Types of Data Processing

- **EDP**

  EDP (electronic data processing), an infrequently used term for what is today usually called "IS" (information services or systems) or "MIS" (management information services or systems), is the processing of data by a computer and its programs in an environment involving electronic communication. EDP evolved from "DP" (data processing), a term that was created when most computing input was physically put into the computer in punched card form or in ATM cards form and output as punched cards or paper reports.

Types of Data Processing

3.Real time processing

In a real time processing, there is a continual input, process and output of data. Data has to be processed in a small stipulated time period (real time), otherwise it will create problems for the system.

For example, when a bank customer withdraws a sum of money from his or her account it is vital that the transaction be processed and the account balance updated as soon as possible, allowing both the bank and customer to keep track of funds.

Types of Data Processing

4.Batch processing

In a batch processing group of transactions collected over a period of time is collected, entered, processed and then the batch results are produced. Batch processing requires seperate programs for input, process and output. It is an efficient way of processing high volume of data. For example: Payroll system, Examination system and billing system.