Problem Solving Through Programming (18ESCS01)

Unit-1: Introduction

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PSP – Syllabus, LP, CDS

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UNIT-1
INTRODUCTION

TOPICS

- INTRODUCTION
- GENERATION & CLASSIFICATION OF COMPUTERS
- BASIC ORGANIZATION OF COMPUTER
- NUMBER SYSTEM(BINARY-DECIMAL—CONVERSION)
- NEED FOR LOGICAL ANALYSIS & THINKING
- ALGORITHM – PSUEDOCODE - FLOWCHART

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INTRODUCTION

INTRODUCTION

WHAT IS A COMPUTER?

- A **computer** is an **electronic device** or **data processor.**
- It can accept the **input** **(data, instructions).**
- It **stores** or **processes** **the input** as per user instructions by storing it in memory cells.
- It gives out **the output/result** of the **input in arithmetic or logical computations** as output information.
- The computer accepts **input** and **outputs** data in an alphanumeric form.

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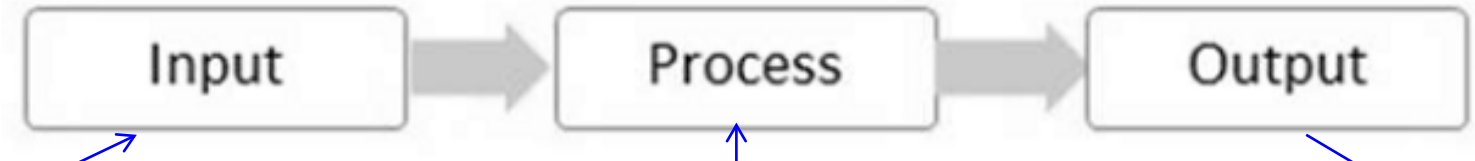
INTRODUCTION

WHAT IS A COMPUTER?

- Internally, it converts the **input data** to meaningful **binary digits**, **performs** the **instructed operations** on the binary data, and **transforms** the data from binary digit form to understandable alphanumeric form.



Data

Data can be combination of arithmetic and logical operations:
Data are of two types:

(i) **Arithmetic Operations –**
Addition (+), Subtraction (-), Multiplication (*), Division (/), etc.

(ii) **Logical Operations –**
Greater than (>), Less than (<), Equal to (=) etc.

Provides output in desired format.

INTRODUCTION

CHARACTERISTICS OF COMPUTER

- **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.
  - A computer can carry out 3-4 million instructions per second.

- **Accuracy:**
  - In addition to being very fast, computers are very accurate.
  - The calculations are 100% error free.
  - Computers perform all jobs with 100% accuracy provided that the input is correct.

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INTRODUCTION

CHARACTERISTICS OF COMPUTER

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

- **Versality:**
  - 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.

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CHARACTERISTICS OF COMPUTER

- **Storage Capability:**

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

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INTRODUCTION

ADVANTAGES OF COMPUTER

- Computers can do the same task repetitively with same accuracy.
- Computers do not get tired or bored.
- Computers can take up routine tasks while releasing human resource for more intelligent functions.

DISADVANTAGES OF COMPUTER

- Computers have no intelligence; they follow the instructions blindly without considering the outcome.
- Regular electric supply is necessary to make computers work, which could prove difficult everywhere especially in developing nations.

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INTRODUCTION

APPLICATIONS OF COMPUTER

(a) Banking:

- Banking is almost totally dependent on computers.
- Banks provide the following facilities –
  - Online accounting facility, which includes checking current balance, making deposits and overdrafts, checking interest charges, shares, and trustee records.
  - ATM machines which are completely automated are making it even easier for customers to deal with banks.

INTRODUCTION

APPLICATIONS OF COMPUTER

(b) Education:

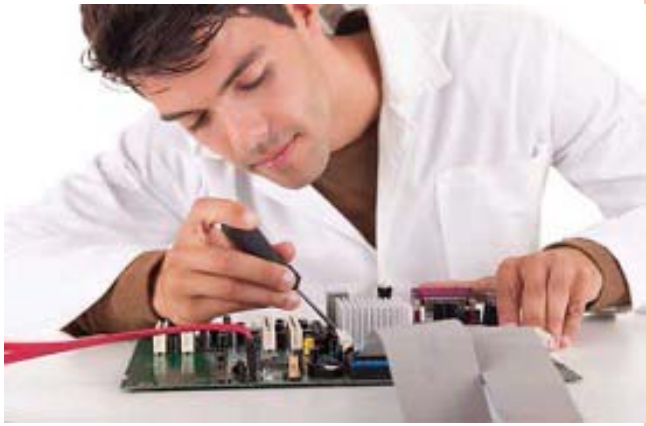
- The computer helps in providing a lot of facilities in the education system:
  - The computer provides a tool in the education system known as CBE (Computer Based Education).
  - CBE involves control, delivery, and evaluation of learning.
  - Computer education is rapidly increasing the graph of number of computer students.
  - There are a number of methods in which educational institutions can use a computer to educate the students.
  - It is used to prepare a database about performance of a student and analysis is carried out on this basis.

INTRODUCTION

APPLICATIONS OF COMPUTER

(c) Engineering Design:

- Computers are widely used for Engineering purpose.
- One of the major areas is CAD (Computer Aided Design) that provides creation and modification of images. Some of the fields are –
  - **Structural Engineering** – Requires stress and strain analysis for design of ships, buildings, budgets, airplanes, etc.
  - **Industrial Engineering** – Computers deal with design, implementation, and improvement of integrated systems of people, materials, and equipment.
  - **Architectural Engineering** – Computers help in planning towns, designing buildings, determining a range of buildings on a site using both 2D and 3D drawings.



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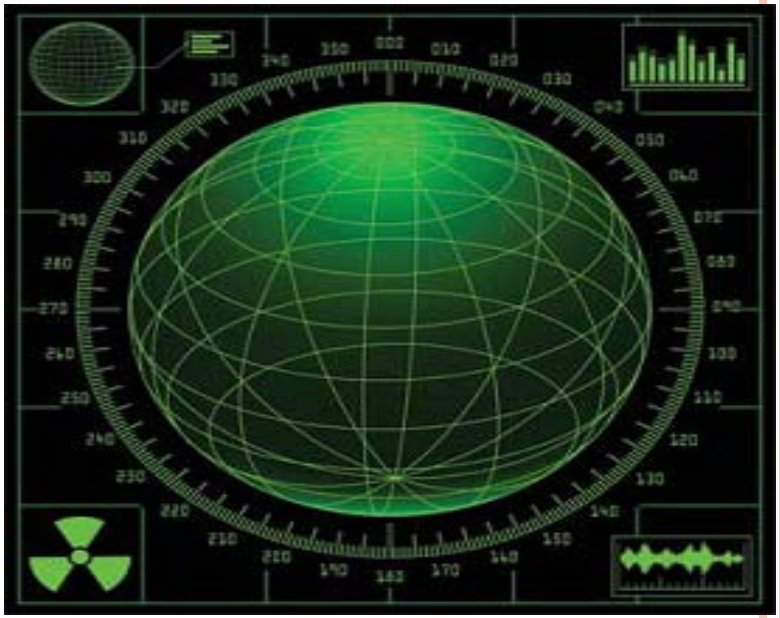
APPLICATIONS OF COMPUTER

(d) Military:

- Computers are largely used in defence. Modern tanks, missiles, weapons, etc. Military also employs computerized control systems. Some military areas where a computer has been used are –
  - Missile Control
  - Military Communication
  - Military Operation and Planning
  - Smart Weapons



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INTRODUCTION

APPLICATIONS OF COMPUTER

(e) Communication:

- Communication is a way to convey a message, an idea, a picture, or speech that is received and understood clearly and correctly by the person for whom it is meant. Some main areas in this category are –
  - E-mail
  - Chatting
  - Usenet
  - FTP
  - Telnet
  - Video-conferencing

INTRODUCTION

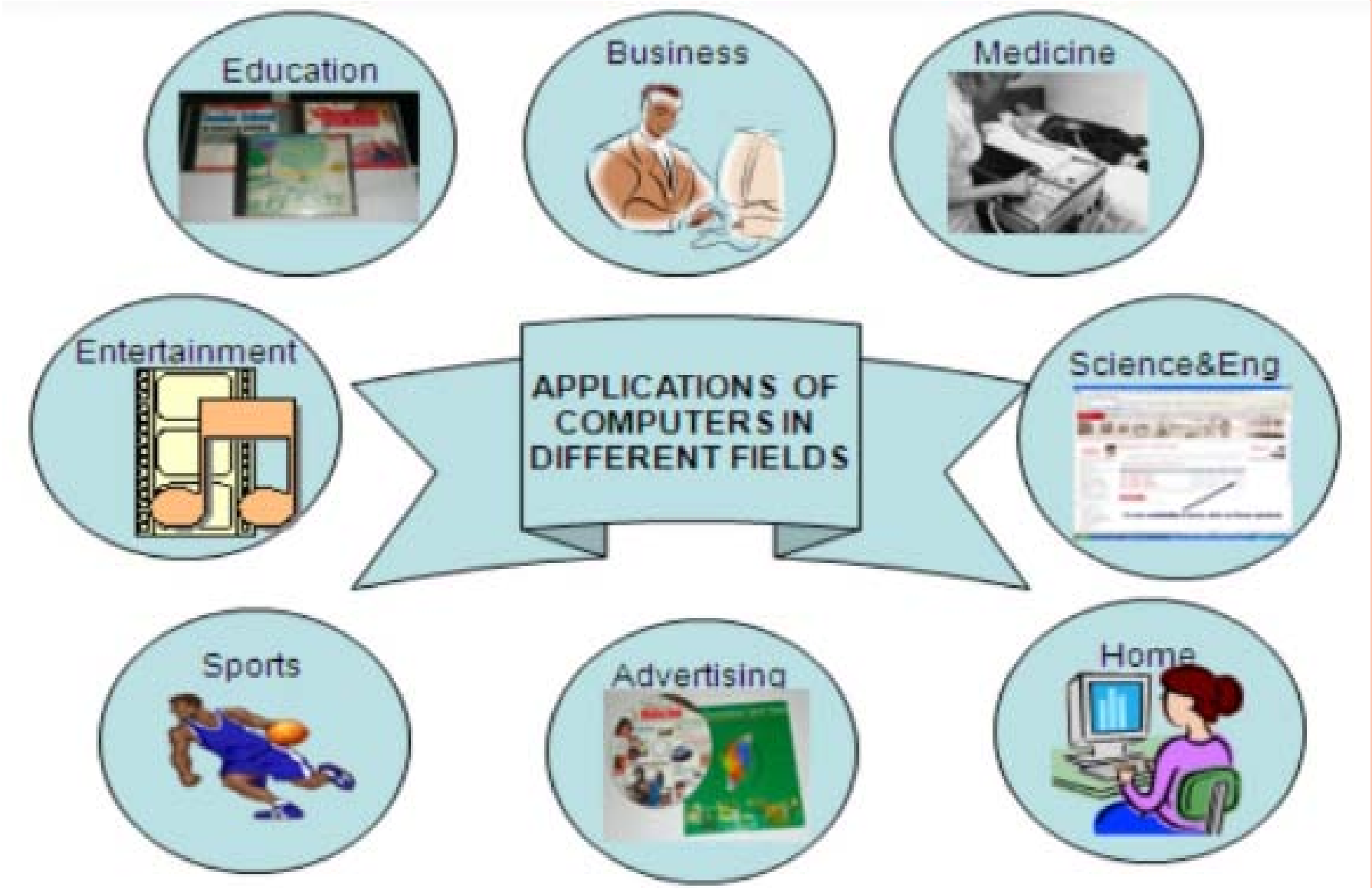
APPLICATIONS OF COMPUTER

(f) Government:

- Computers play an important role in government services. Some major fields in this category are –
  - Budgets
  - Sales tax department
  - Income tax department
  - Computation of male/female ratio
  - Computerization of voters lists
  - Computerization of PAN card
  - Weather forecasting

INTRODUCTION

FEW MORE APPLICATIONS OF COMPUTER



GENERATION OF COMPUTER

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GENERATION OF COMPUTERS

- **First Generation:** 1940– 1956. Vacuum tube based.
- **Second Generation:** 1956 – 1963. Transistor based.
- **Third Generation:** 1964– 1971. Integrated Circuit based.
- **Fourth Generation:** 1971 – 1980. VLSI Microprocessor.
- **Fifth Generation:** 1980 – onwards. ULSI Microprocessor.

GENERATION OF COMPUTERS

Subject	1st generation	2nd generation	3rd generation	4th generation	5th generation
Period	1940-1956	1956-1963	1964-1971	1971-present	present & beyond
Circuitry	Vacuum tube	Transistor	Integrated chips (IC)	Microprocessor (VLSI)	ULSI (Ultra Large Scale Integration) technology
Memory Capacity	20 KB	128KB	1MB	Magnetic core memory, LSI and VLSI. High Capacity	ULSI
Processing Speed	300 IPS instructions Per sec.	300 IPS	1MIPS (1 million inst. Per sec.)	Faster than 3rd generation	Very fast
Programming Language	Machine, Language	Assembly language & early high-level languages(FORTRAN, COBOL, ALGOL)	C,C++	Higher level languages,C,C++,Java	All the Higher level languages,,Neural networks,
Example of computers	UNIVAC, EDVAC	IBM 1401, IBM 7094, CDC 3600,D UNIVAC 1108	IBM 360 series, 1900 series	Pentium series,Multimedia,	Artificial Intelligence, Robotics

GENERATION OF COMPUTERS

FIRST GENERATION:

- The computers of first generation used vacuum tubes as the basic components for memory and circuitry for CPU (Central Processing Unit).
- The computers in this generation used machine code as the programming language.
- The main features of the first generation are:
  - Vacuum tube technology
  - Unreliable
  - Supported machine language only
  - Very costly
  - Generated a lot of heat
  - Slow input and output devices
  - Huge size
  - Need of AC
  - Non-portable
  - Consumed a lot of electricity

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GENERATION OF COMPUTERS

SECOND GENERATION:

- Transistors were used.
- Magnetic cores were used as the primary memory and magnetic tape and magnetic disks as secondary storage devices.
- Assembly language and high-level programming languages like FORTRAN, COBOL were used.
- The computers used batch processing and multiprogramming operating system.
- The main features of second generation are:
  - Still very costly
  - Reliable
  - Smaller size
  - Generated less heat
  - Consumed less electricity
  - Faster than first generation computers

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GENERATION OF COMPUTERS

THIRD GENERATION:

- The computers of third generation used Integrated Circuits (ICs) in place of transistors.
- A single IC has many transistors, resistors, and capacitors along with the associated circuitry.
- 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
  - Smaller size
  - Generated less heat
  - Faster & costly
  - Lesser maintenance
  - AC required
  - Consumed lesser electricity
  - Supported high-level language

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GENERATION OF COMPUTERS

FOURTH GENERATION:

- Computers of fourth generation used Very Large Scale Integrated (VLSI) circuits.
- 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 PCs
  - Very small size
  - Pipeline processing
  - No AC required
  - Concept of internet was introduced

GENERATION OF COMPUTERS

FIFTH GENERATION:

- 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.
- All the high-level languages like C and C++, Java, .Net etc., are used in this generation.
- The main features of the first 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

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CLASSIFICATION OF COMPUTER

CLASSIFICATION OF COMPUTERS

SUPERCOMPUTER:

- Super computers are more expensive & fast computers that can perform hundreds of millions of instructions per second.
- **Example:** Cray supercomputer

MAINFRAME COMPUTER:

- A Mainframe computer supports a vast number of users to work simultaneously & remotely.
- Mainframe computers are capable of supporting many hundreds or thousands of users simultaneously.
- **Example:** IBM 370, IBM 3090

MINICOMPUTER:

- Mini computers are used by multiple users (between 10 – 100) but smaller in size and memory & cheaper than mainframes.
- **Example:** Digital Equipment Corporation VAX, IBM AS/400.

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CLASSIFICATION OF COMPUTERS

MICRO COMPUTER:

- The microcomputer has been intended to meet the personal computing needs of an individual.
- It typically consists of a microprocessor chip, a memory system, interface units and various I/O ports, typically resided in a motherboard.

DESKTOP/PERSONAL COMPUTER:

- A micro computer sufficient to fit on a desk.

LAPTOP COMPUTER:

- Portable microcomputer with an integrated screen & keyboard.

BASIC ORGANIZATION OF COMPUTER

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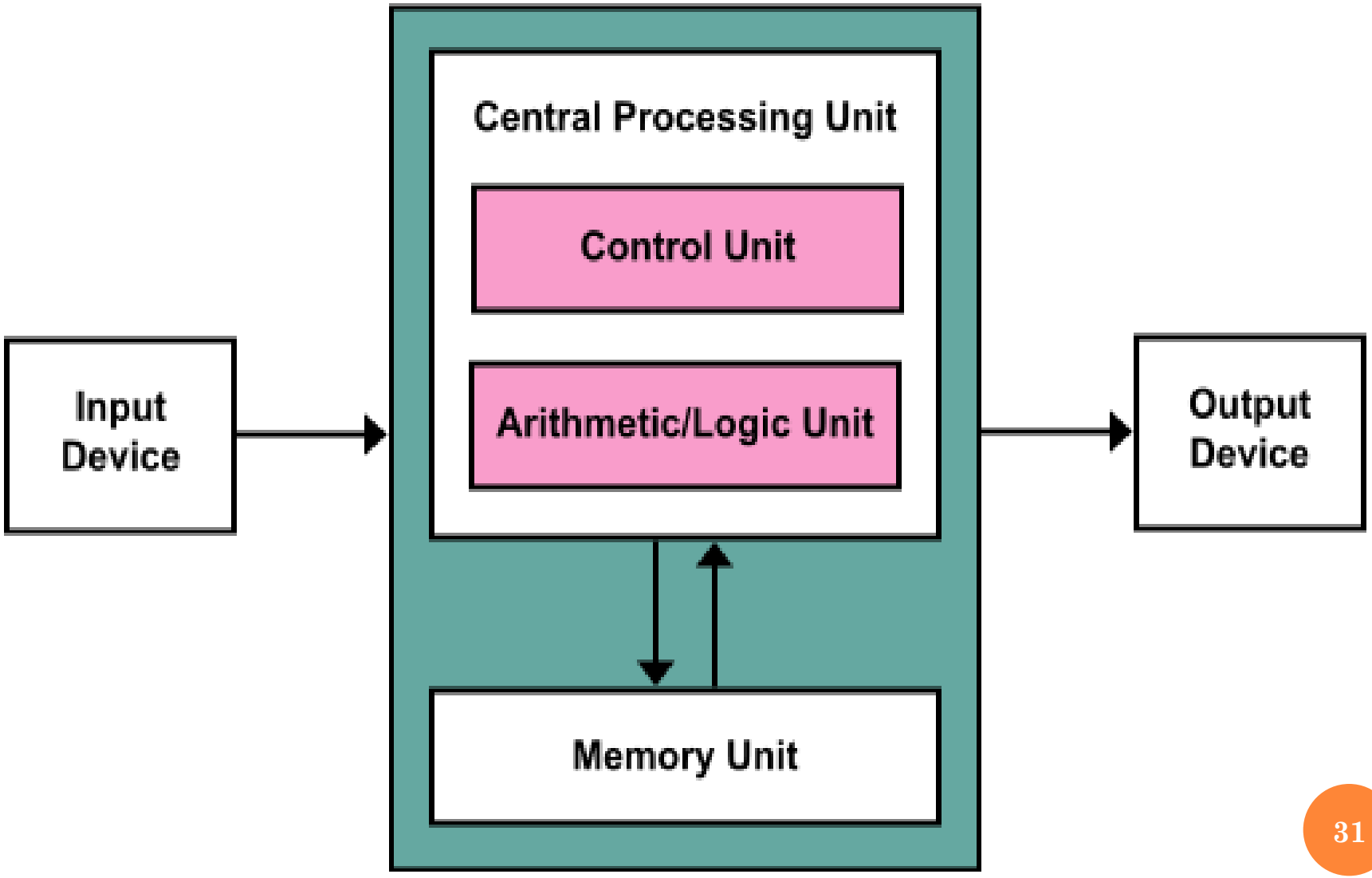
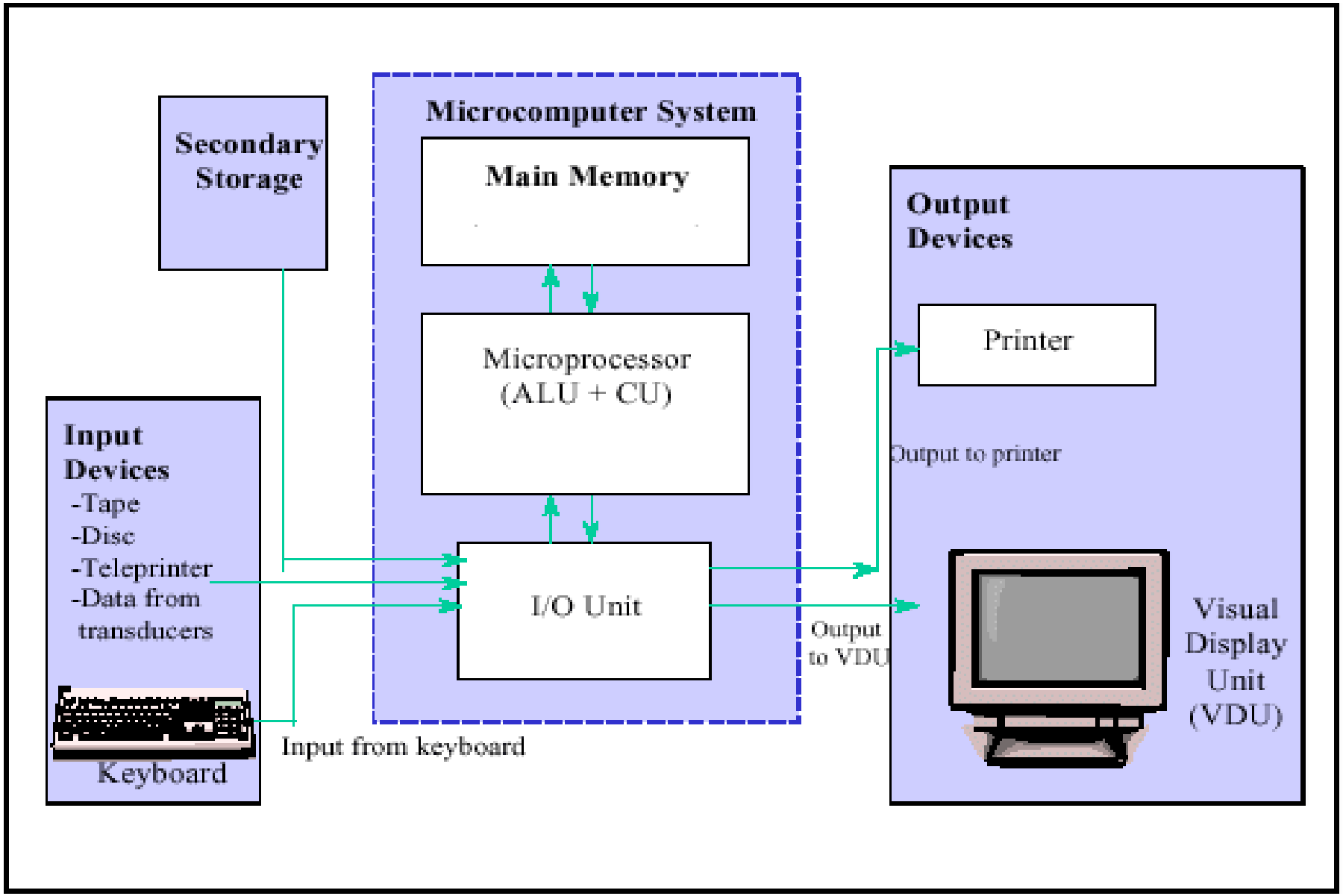
BASIC ORGANIZATION OF COMPUTER



BASIC ORGANIZATION OF COMPUTER

BLOCK DIAGRAM / ELEMENTS OF A COMPUTER:



BASIC ORGANIZATION OF COMPUTER

BLOCK DIAGRAM / ELEMENTS OF A COMPUTER:

- A computer is responsible for providing the mechanisms :
  - to input and output data,
  - to manipulate and to process data,
  - to electronically control the various input, output, and their storage.

- A computer consists of the following components:
  - **Input & Output devices**
  - **Central Processing Unit (CPU)**
  - **Memory unit**
  - **Storage devices**

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BASIC ORGANIZATION OF COMPUTER

INPUT/OUTPUT DEVICES:

- Input/Output devices enable the user to interact with the computer:
  - **Input devices** – keyboard, mouse, scanners, etc.
  - **Output devices** – display screens, speakers, printers, etc.

STORAGE DEVICES

- Storage devices are one of the core components of any computing device.
- They store all the data and applications on a computer.
- Storage devices includes: RAM, cache, a hard disk, an optical disk drive and externally connected USB drives.
- Storage device can be classified as Primary and Secondary memory devices.

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BASIC ORGANIZATION OF COMPUTER

MEMORY UNIT (PRIMARY STORAGE):

- Holds the instructions/data that is fetched from secondary storage for computation.
- It is a volatile memory in nature; the data will be wiped off when the power supply is disconnected.
- Types of primary storage is a RAM (Random Access Memory) & ROM (Read Only Memory).
- RAM – volatile memory & ROM – Non-volatile memory.

MEMORY UNIT (SECONDARY STORAGE):

- Stores the data permanently.
- It is non-volatile memory.
- Examples of secondary storage devices can be hard disk drives, CD and DVD ROMs, Flash drives etc.

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BASIC ORGANIZATION OF COMPUTER

DIFFERENCE B/W PRIMARY & SECONDARY STORAGE:

Primary Memory	Secondary Memory
It can be volatile or non-volatile memory.	It is usually non-volatile memory.
Access time is faster than secondary memory.	Access time is slower than primary memory.
Primary memories are usually connected via slots	Secondary memories are connected via ports or cables.
At present the capacities of primary memory ranges from 512 MB to 16GB for desktop computers and can be of higher capacities for Servers.	The capacities of hard disk drive currently can be up to 60 Tera Bytes.
This is a temporary memory when we speak in terms of RAM.	Secondary memory devices can be used to store data permanently.
These are made up of semiconductor memory.	These are made up of magnetic & optical memory.
Example: RAM and ROM.	Example: DVD ROM, CD-ROM and Hard disk.

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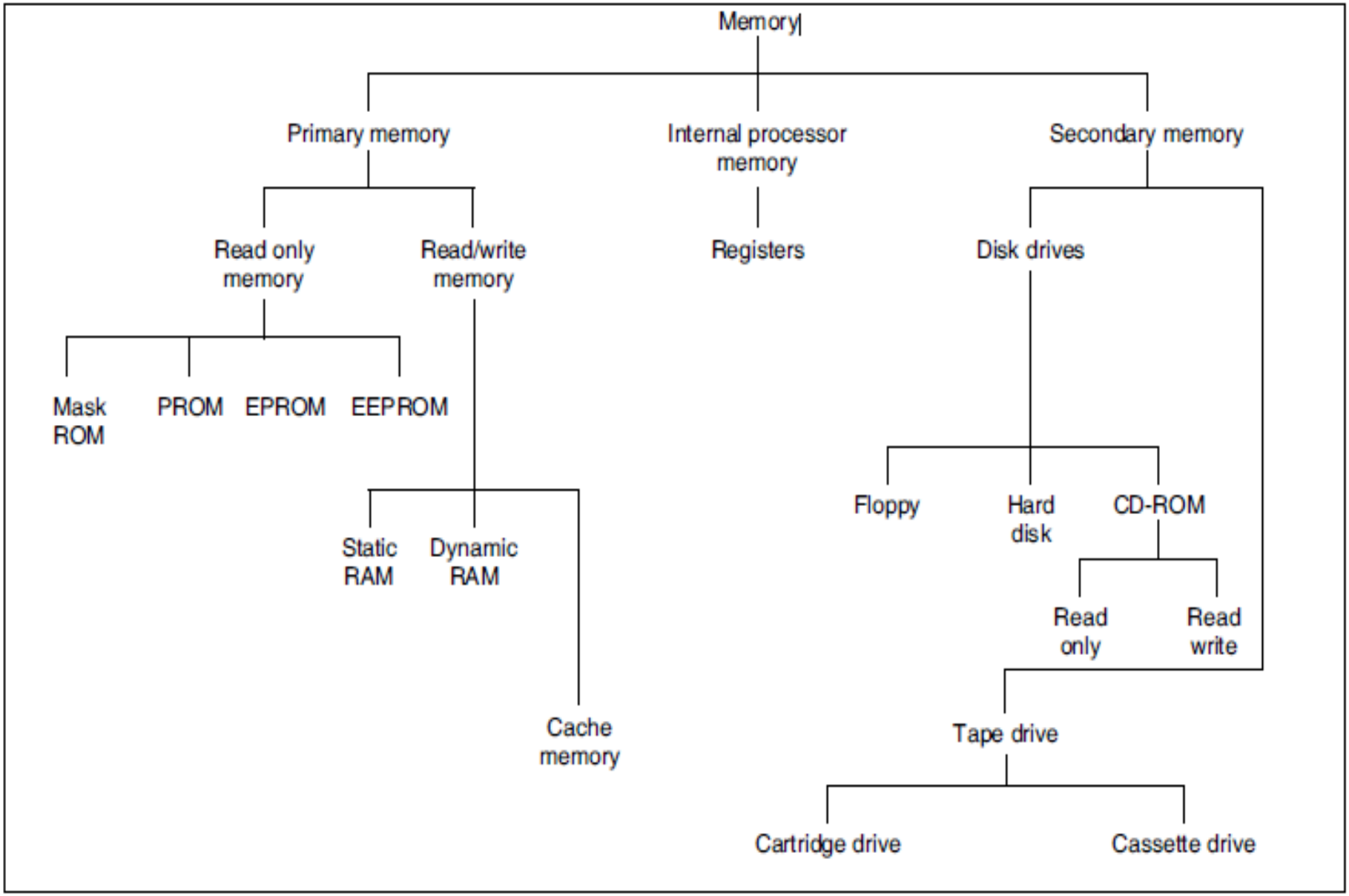
BASIC ORGANIZATION OF COMPUTER

TYPES OF MEMORY:



BASIC ORGANIZATION OF COMPUTER

DIFFERENCE BETWEEN STATIC & DYNAMIC RAM

Static RAM	Dynamic RAM
It does not require refreshing.	It requires extra electronic circuitry that "refreshes" memory periodically; otherwise its content will be lost.
It is more expensive than dynamic RAM.	It is less expensive than static RAM.
It is lower in bit density.	It holds more bits of storage in a single integrated circuit.
It is faster than dynamic RAM.	It is slower than SRAM, due to Refreshing.

BASIC ORGANIZATION OF COMPUTER

CPU – CENTRAL PROCESSING UNIT:/MICROPROCESSOR

- **CPU** acts as the brain of the computer
  - it fetches data and instructions from memory
  - it executes the instructions
  - it stores results back to memory
- **ALU - Arithmetic/Logic Unit**
  - Performs arithmetic and logic operations (e.g. addition, subtraction, multiplication, AND, OR, etc.)

BASIC ORGANIZATION OF COMPUTER

CU - CONTROL UNIT:

- The control unit
  - **fetches** instructions from memory
  - **decodes** the instruction
  - **executes** the instruction

- The control unit has two important registers:
  - **PC- program counter** - contains the address in main memory of the next instruction
  - **IR- instruction register** - holds the instruction that is currently executing

NUMBER SYSTEM

NUMBER SYSTEM

- A number system (or **numeral system)** is the one which is used for expressing (or) writing numbers.
- It uses digits or other symbols to represent the numbers of a given set in appropriate manner.
- Number systems are: **Decimal, Binary, Octal, Hexadecimal.**

S.No	Description of Number System
1	**Decimal Number System** Base 10. Digits used : 0 to 9
2	**Binary Number System** Base 2. and Bits used : 0, 1
3	**Octal Number System** Base 8. Digits used : 0 to 7
4	**Hexadecimal Number System** Base 16. Digits used: 0 to 9, Letters used : A- F

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NUMBER SYSTEM

Decimal (Base-10)	Binary (Base-2)	Octal (Base-8)	Hexadecimal (Base-16)
0	0000	0	0
1	0001	1	1
2	0010	2	2
3	0011	3	3
4	0100	4	4
5	0101	5	5
6	0110	6	6
7	0111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

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NUMBER SYSTEM

BINARY NUMBER SYSTEM:

- Consists of two digits – 0 and 1
- All numbers formed using combination of 0 and 1. E.g.1001, 11000011, 10110101

Position	3	2	1	0	.	-1	-2	-3
Position Value	2^3	2^2	2^1	2^0		2^{-1}	2^{-2}	2^{-3}
Quantity	8	4	2	1		1/2	1/4	1/8

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NUMBER SYSTEM

BINARY NUMBER SYSTEM:

- Characteristics of the binary number system are as follows:
  - Uses two digits, 0 and 1
  - Also called as 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.

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NUMBER SYSTEM

BINARY NUMBER SYSTEM: (EXAMPLE)

- **Example for Binary Number: 10101_2**

Example for 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.

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NUMBER SYSTEM

DECIMAL NUMBER SYSTEM:

- Consists of 10 digits – 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
- All numbers represented as combination of digits 0-9. E.g. 34, 5965, 867321

Position	3	2	1	0	.	-1	-2	-3
Position Value	10^3	10^2	10^1	10^0		10^{-1}	10^{-2}	10^{-3}
Quantity	1000	100	10	1		.1	.01	.001

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NUMBER SYSTEM

DECIMAL NUMBER SYSTEM:

- Decimal number system is a **base 10** number system having 10 digits from 0 to 9.
- The value of digits will depend on its position.
- **For example:** the decimal number 1234 consists of:
  - The digit 4 in the units position,
  - 3 in the tens position,
  - 2 in the hundreds position, and
  - 1 in the thousands position.

  Its value can be written as:

$$(1 \times 1000) + (2 \times 100) + (3 \times 10) + (4 \times 1)$$

$$(1 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + (4 \times 10^0)$$

$$1000 + 200 + 30 + 4$$

$$1234$$

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NUMBER SYSTEM

OCTAL NUMBER SYSTEM:

- Consists of eight digits – 0 to 7
- All numbers represented using these eight digits.
  E.g. 273, 103, 2375

Position	3	2	1	0	.	-1	-2	-3
Position Value	8^3	8^2	8^1	8^0		8^{-1}	8^{-2}	8^{-3}
Quantity	512	64	8	1		1/8	1/64	1/512

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NUMBER SYSTEM

OCTAL NUMBER SYSTEM:

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

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NUMBER SYSTEM

OCTAL NUMBER SYSTEM: (EXAMPLE)

- **Example for Octal Number: 12570_8**

Example for Octal Number: 12570_8

Calculating Decimal Equivalent –

Step	Binary 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.

NUMBER SYSTEM

HEXADECIMAL NUMBER SYSTEM:

- Consists of sixteen digits – 0 to 9, A, B, C, D, E, F, where (A -10, B - 11, C -12, D-13, E-14, F-15)
- All numbers represented using these sixteen digits. E.g. 3FA, 87B, 113

Position	3	2	1	0	.	-1	-2	-3
Position Value	16^3	16^2	16^1	16^0		16^{-1}	16^{-2}	16^{-3}
Quantity	4096	256	16	1		1/16	1/256	1/4096

NUMBER SYSTEM

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 represent the numbers starting from 10.

    A = 10. B = 11, C = 12, D = 13, E = 14, F = 15
  - Also called as 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

NUMBER SYSTEM

HEXADECIMAL NUMBER SYSTEM: (EXAMPLE)

- **Example for Hexadecimal Number: $19FDE_{16}$**

Example for 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.

NUMBER SYSTEM

CONVERSIONS OF DECIMAL INTEGER

- Decimal integer converted to any other base, using division operation
- To convert decimal integer to
  - Binary: divide by 2
  - Octal: divide by 8
  - Hexadecimal: divide by 16

NUMBER SYSTEM

BINARY – DECIMAL CONVERSIONS

- **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.

NUMBER SYSTEM

BINARY – DECIMAL CONVERSIONS

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}

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NUMBER SYSTEM

DECIMAL – BINARY CONVERSIONS

- **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 the 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.

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NUMBER SYSTEM

DECIMAL - BINARY CONVERSIONS

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

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

NUMBER SYSTEM

TRY

- Solve the following :

Convert binary number to decimal system.

(a) $(10101)_2$ (b) $(1011.011)_2$

Convert octal number to decimal form.

(a) $(12570)_8$ (b) $(231.25)_8$

Convert hexadecimal number to decimal form.

(a) (A124)16 (b) $(A02.B7)_{16}$

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NEED FOR LOGICAL ANALYSIS & THINKING

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- Instructions in a program have 3 parts:
  - Accept input data that needs to be processed.
  - Act upon input data and process it.
  - Provide output to user.

- Instructions are defined in a specific sequence.

- Program writing is not a straightforward task as it follows **Program Development Lifecycle**.

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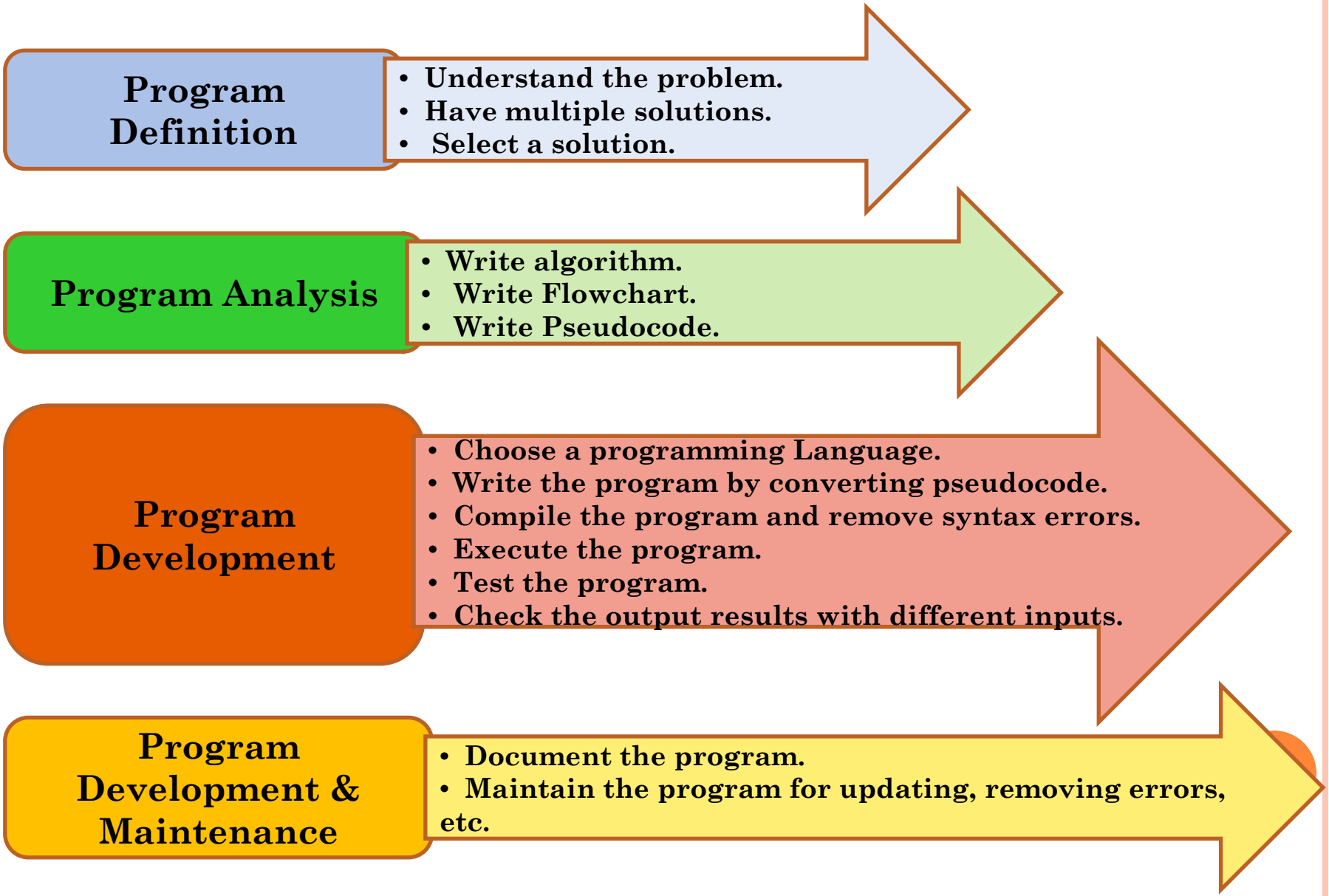
NEED FOR LOGICAL ANALYSIS & THINKING

PROGRAM DEVELOPMENT LIFECYCYE



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ALGORITHM – PSUEDOCODE - FLOWCHART

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ALGORITHM – PSUEDOCODE - FLOWCHART

- **Algorithm:** A sequence of instructions used to solve a particular problem.

- **Pseudocode and Flowchart:** Tools to document and represent algorithm:
  - **Pseudocode:** Readable, formally styled English like language representation of algorithm.
  - **Flowchart:** Graphical Representation of algorithm.

- No knowledge of programming language required to write or understand flowchart or pseudocode.

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ALGORITHM – PSUEDOCODE - FLOWCHART

ALGORITHM

- An algorithm is an effective procedure for solving a problem in a finite number of steps.
- **Program = Algorithm + Data.**
- Step-by-step procedure for solving a problem.
- Algorithm is represented in various ways:
  - **Step–form:**– The procedure of solving a problem is started with written statements.
  - **Pseudo-code form:-** It is a written form representation of an algorithm.
  - **Flowchart:** It is a graphical representation form.

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ALGORITHM – PSUEDOCODE - FLOWCHART

ALGORITHM EXAMPLE 1

- Write an algorithm for finding the sum of any two numbers:

- Let the two numbers be A and B and let their sum be equal to C. Then the algorithm is as follows:

Step 1: Start

Step 2: Print "Enter two numbers:"

Step 3: Input A, B

Step 4: C <- A + B

Step 5: Print C

Step 6: Stop

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ALGORITHM – PSUEDOCODE - FLOWCHART

ALGORITHM EXAMPLE 2

- Write an algorithm for interchanging the numeric values of two variables:

- Let the two variables be A and B. Consider C to be a third variable to store the value during the process of interchanging the values.

Step 1: Start

Step 2: Print "Enter two values of A and B:"

Step 3: Input A, B

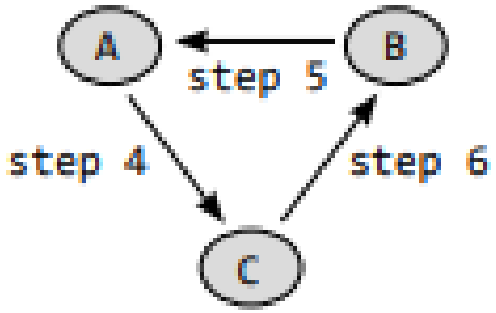
Step 4: C <- A

Step 5: A <- B

Step 6: B <- C

Step 5: Print A, B

Step 6: Stop



ALGORITHM – PSUEDOCODE - FLOWCHART

ALGORITHM EXAMPLE 3

- Write an algorithm to print largest number among three numbers

- Let the three numbers be A, B and C .

Step 1: Start
Step 2: Print "Enter three numbers A, B and C:"
Step 3: Input A, B, C
Step 4: if A > = B and B > = C
then Print A
Step 5: if B > = C and C > = A
then Print B
else
Print C
Step 6: Stop

ALGORITHM – PSUEDOCODE - FLOWCHART

PSUEDOCODE

- Consists of short, readable and formally-styled English language used for explaining an algorithm.
- Easily translated into a programming language.
- No standard for syntax of pseudocode exists.
- Does not include details like variables declarations, subroutines etc.
- Cant be compiled or executed.

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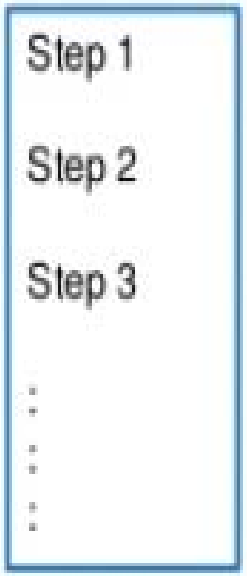
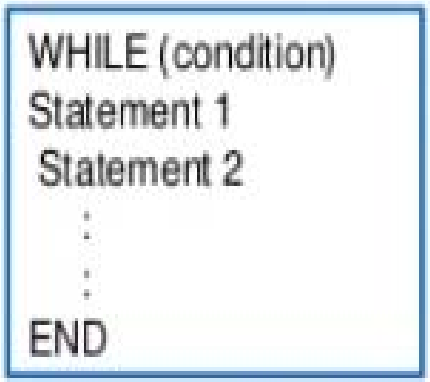
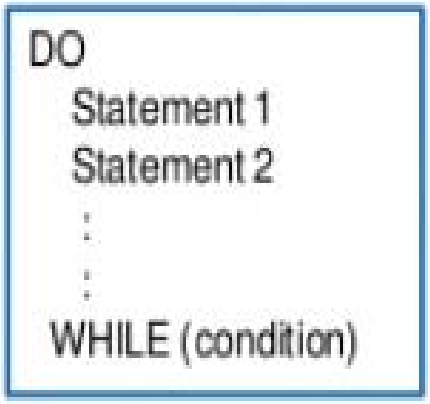
ALGORITHM – PSUEDOCODE - FLOWCHART

CONTROL STRUCTURES OF PSUEDOCODE

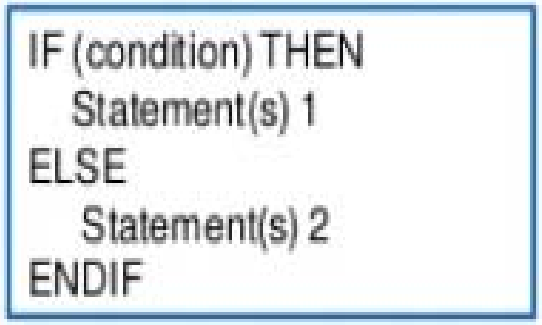


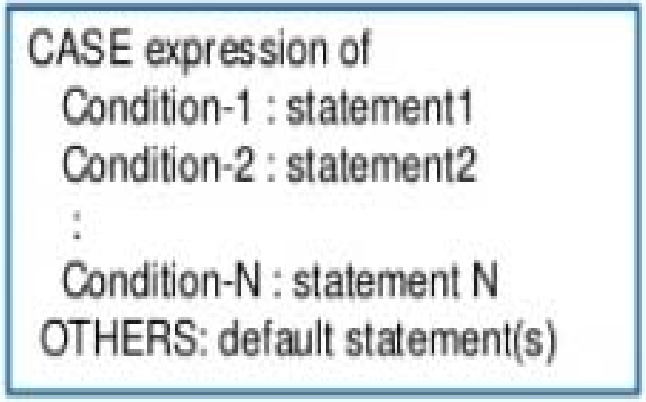
Sequence





Selection





Iteration

ALGORITHM – PSUEDOCODE - FLOWCHART

FLOWCHART

- Diagrammatic representation of logic for solving task.
- Drawn using boxes of different shapes with lines connecting them to show the flow of control.
- Make logic of program clearer in a visual form.
- Drawn using different kinds of symbols.

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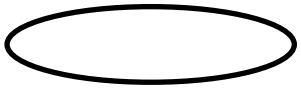
ALGORITHM – PSUEDOCODE - FLOWCHART

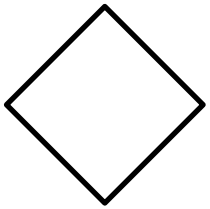
FLOWCHART SYMBOLS



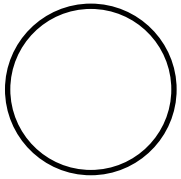
Start or end of the program or flowchart.

Computational steps or processing function of a program.

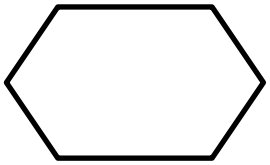
Input entry or output display operation.



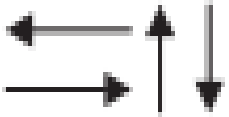
A decision making and branching operation that has two alternatives.



Connects remote parts of the flowchart on the same page.



Display .



Flow lines

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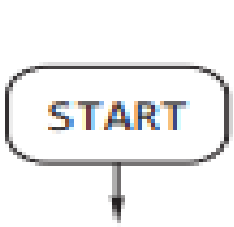
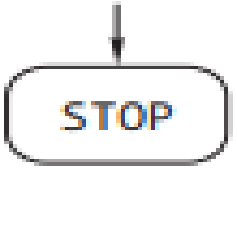
ALGORITHM – PSUEDOCODE - FLOWCHART

PREPARING A FLOWCHART

- Common symbols that are used to draw a flowchart:
  - Process, Decision, Data, Terminator, Connector and Flow lines.





- Rules:
  - Should have START & STOP
  - Direction of flow must be from top to bottom and left to right.
  - Relevant symbols must be used while drawing a flowchart.

ALGORITHM – PSUEDOCODE - FLOWCHART

ADVANTAGES OF A FLOWCHART

- **Communication:** Flowcharts are a better way of communicating the logic of a system to all concerned.
- **Effective analysis:** With the help of flowcharts, problems can be analyzed more effectively.
- **Proper documentation:** Program flowcharts serve as a good program documentation needed for various purposes.
- **Efficient coding:** Flowcharts act as a guide or blueprint during the systems analysis and program development phase.
- **Proper debugging:** Flowcharts help in the debugging process.
- **Efficient program maintenance:** The maintenance of an operating program becomes easy with the help of a flowchart.

LIMITATIONS OF A FLOWCHART

- May run into multiple pages, difficult to understand.
- Updating with changing requirements.

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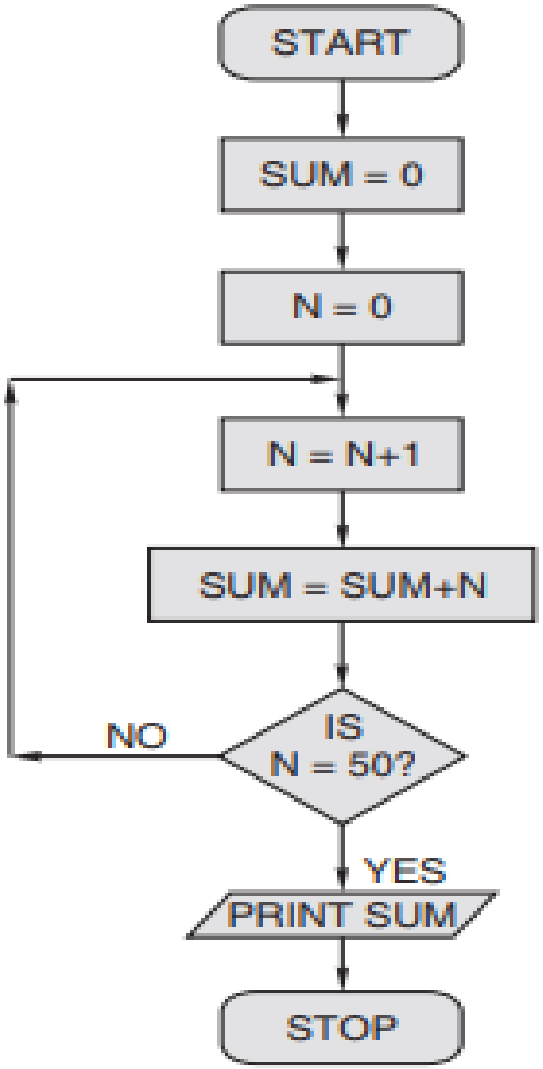
ALGORITHM – PSUEDOCODE - FLOWCHART

PREPARING A FLOWCHART – EXAMPLE 1

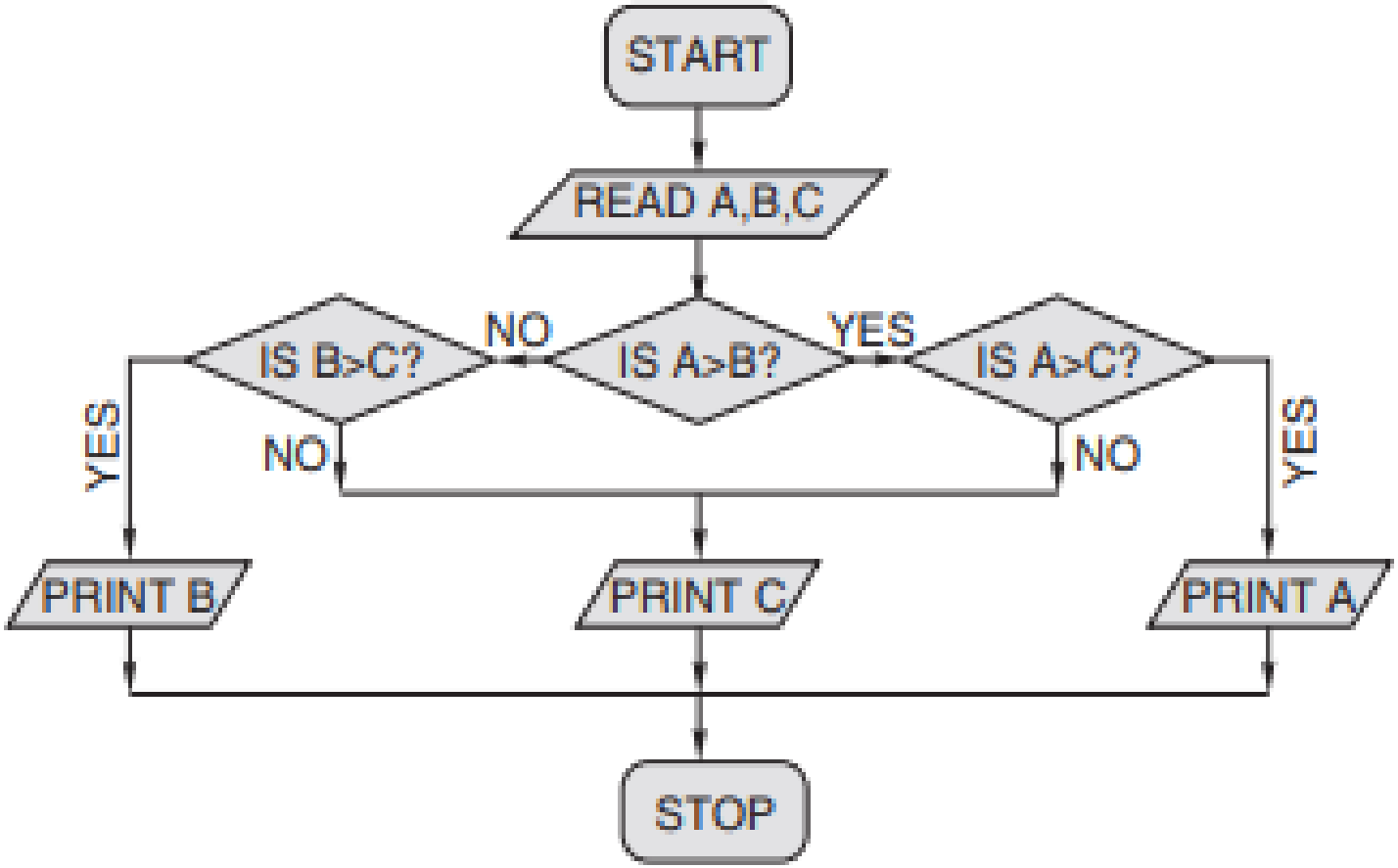
- Draw a flowchart to find the sum of the first 50 natural numbers;



ALGORITHM – PSUEDOCODE - FLOWCHART

PREPARING A FLOWCHART – EXAMPLE 2

- Draw a flowchart to find the largest of three numbers A, B and C.



ALGORITHM – PSUEDOCODE - FLOWCHART

TRY

- Write algorithm & flowchart for area of circle
  (Area = 3.14 * r * r).

- Write an algorithm and flowchart to find the greater number between two numbers.

- Write algorithm and flowchart to calculate simple interest using the formula: SI = (P * T * R)/100.