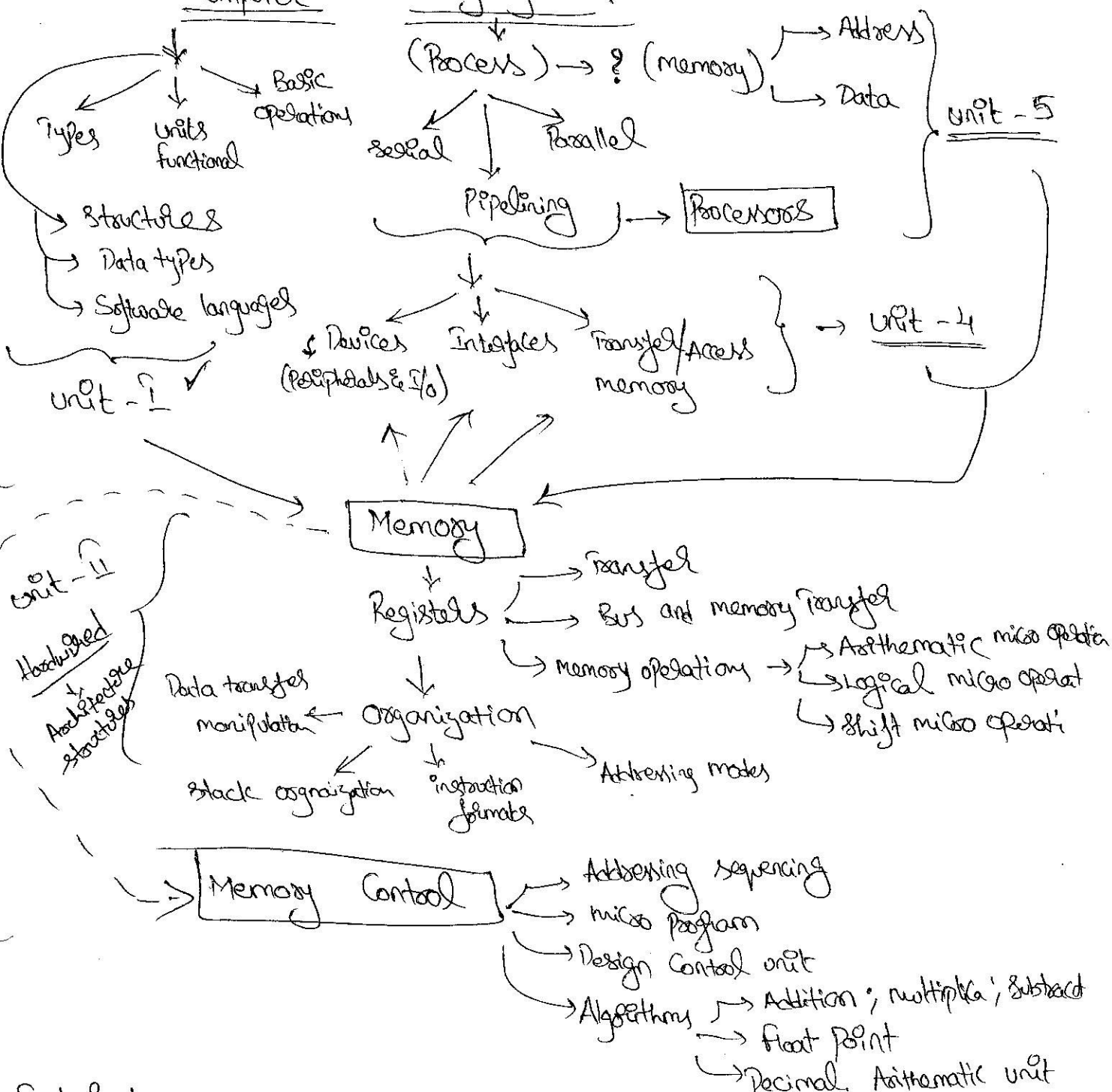
CO - frame:-



Text Books:-

1. Carl Hamacher
2. M. Morris Mano (3rd edition) (CSA)
3. William Stallings (CO & Program)

Computer Organization:-

1) Introduction to Computing:-

Computer:- Come from Compute = { widely used for Communicating
numbers ←

Any Computer system Contains
- Processing → Processor (memory ; I/O)
  - memory → store numbers
  - I/O → external
- Processing → number

Organization:-	Architecture
→ Study units (& Cal derived)	→ Study of designers (Cal mechanic)
&:- Multiplier	→ Implemented
Programmer	→ Designer
Software	→ Hardware

Def:- A Computer is a device that can be instructed to carry out an arbitrary set of arithmetic (or) logical operations
- arithmetic → numerals
- logical operations → symbols.

logically.

→ The ability of Computer to follow a sequence of operations called a program, make computer very flexible and useful.

(or)

Def:- Computer is an electronic ~~device~~ data processing device which accepts and stores data inputs, processes the data input, and generate the output in a required format.

C - Commonly
O - operating
M - machine
P - Particularly
U - used for
T - Technical and
E - Educational
R - Research

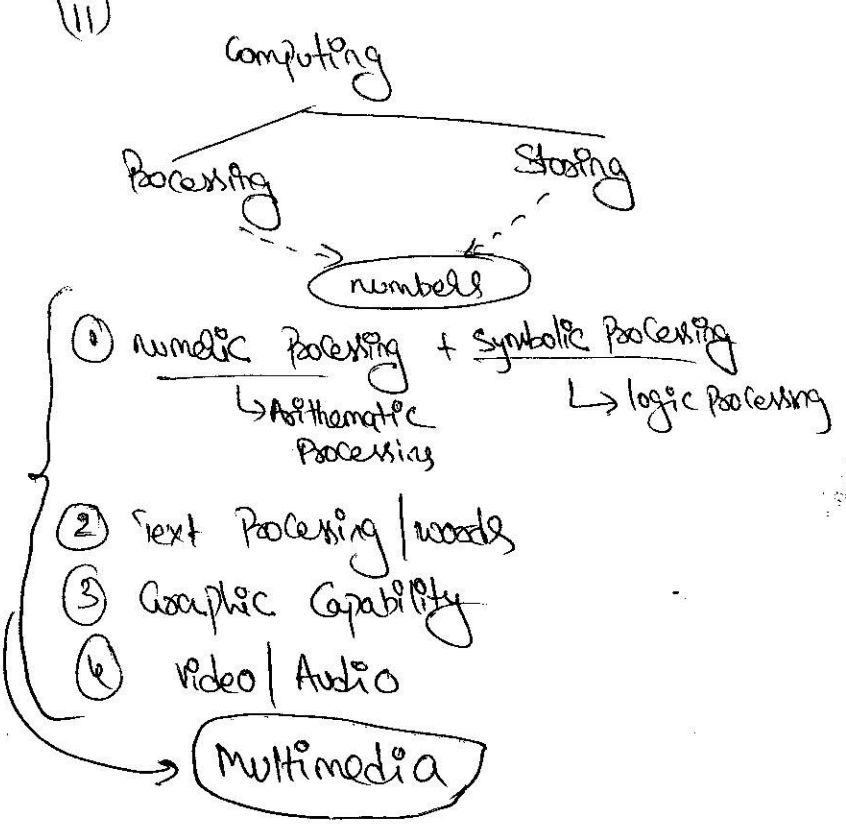
COMPUTER

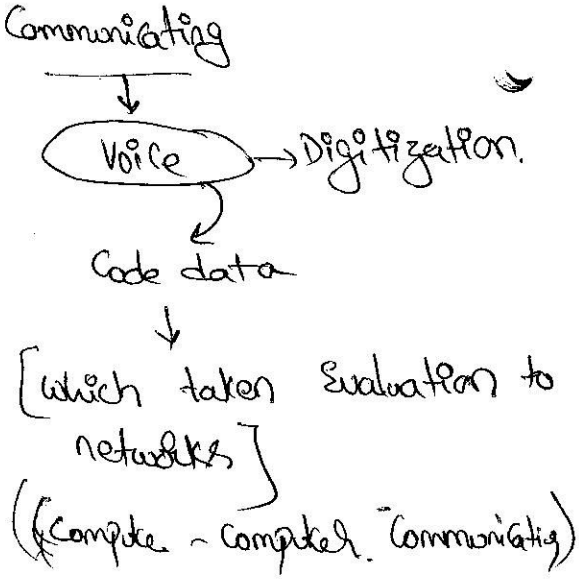
②) History of Computer Development :-

(i) Generation of Computer development :-

Generation	Years	Circuitry	Characterized by
a) First	1950's	Vaccum tubes	Difficult to Program used only machine language
b) Second	Early 1960's	Transistors	Eased to Program (high level language) could work with business tabulating machine; cheaper.
c) Third	mid 1960-1970	Integrated circuits	Time sharing, mini Computer (SSI, MSI, LSI).
d) fourth	mid 1970 to Present	VLSI and the micro Processor	Personal Computer; graphical user; user interface; LAN; Internet.

(00)
(11)





Sno	Year	Scientists	Introduced	Implemented.
1.	1860's	Charles Babbage	Analytical Engine	Essential mechanical Calculator (Add, Sub, Mul, divi)
2.	Dec-1941	Konrad Zuse (German Engineer) (Z-3)	Z-3 Calculator first general Purpose Calculator which uses Program Controlled.	→ Z-3 is electro mechanical uses telephone relay iron cords and wires coles, → It acts as electro mechanical Relay Switch in memory and Computation. → Z-3 uses Binary systems of ones (1's) & (0's) zeros → Z-3 internal operation is based on boolean logic which contain True (or) false ; AND ; OR ; NOT
3.	1942	John Atanasoff	ABC (Atanasoff Berry Computer)	→ ABC filled with capacitor and memory ↳ (electronic components hold electrical charges) whole vaccum tubes are used as switches that can represent numbers (on & off) → ABC is not Easy to Program.
4.	1944 (Aug-7)		Automatic Sequence Controlled Calculator (ASCC) by (IBM).	→ first Programmable Calculator developed by united States in (Harvard university). → known as (Mark-1 Harvard) which is 51-feet long ; 8-feet high ; 17,468 vaccum Tubes were used. → Mainly used in solving military Problem like firing Tables ; and Automatic bombs Calculations.

S.No	Year	Scientist	Introduced	Implanented.
5.	-	Grace Hopper	Mask - 2 & 3	→ she was pioned in Computed Programming.
6.	1943	John P. Arcedaus & John Mauckless	ENIAC Electronic Numerical Integrator Analizer Computer.	→ It was super Calculator (if it was not a Computer) → It Can Perform 5000 Additions and 360 Multiplication Per Second. → ENIAC filled by 30×50 feet and weight nearly 30 tones it was Programed using switches and Plugs. boards.
7.	1944	John Von-Neumann	EDVAC Electronic Discrete Variable Automatic Computer.	→ It utilized 3600 VacCom tubes and → It is first stored Program Computer (i.e Program stored in memory). → first Program was runned on June 21 (1948)
8.	1947	J. Lyons & Co. Ltd (British)	EDSAC : 99 Electronic delay Storage Automatic Computer.	→ In 1950 M.V. Wilkes and Wheeler used EDSAC to solve a differential Equation relating to gene frequencies in a paper. → To represent the sequences (0 - 99).
9.	1949	Eckert & Mauchly	BINAC Binary Automatic Computer	→ the first stored Program Computer but its not General Purpose Computer it was designed for Military use. → used for Aircrafts.

S.NO	Year	Scientist	Introduced	Implemented.
16.	1964		IBM introduced System-360 Computer	→ The System-360 was family of 9-Processors and 44-phelipheral devices.
17	1968		IBM installed 14000 systems of system-360's	
18.	1958	Jack Kilby working @ Texas	first Ic Computer for Airforces	→ It has 10 ounces and 15 pounds transistor Computers.
19.	1965		Ic (or) chip used in Comerical Computers	→ Came from FAIRCHILD (SemiConductor) → Robert Noyce found in designing & manufacture Ics through out 1960 Ic were used in missile.
20	1947	Marcian.E "Ted" off. Jr.	first Comercially available MP 4004 Intell Co-operation.	

Computer Types :-

(i) Digital Computer (or) Simply Computer :-

It is a fast Electric calculating machine that accepts digitized input information, Processes it according to a list of internally stored instructions and Produces the resulting output.

(ii) Personal (or) Desktop Computers :-

Desktop Computer have Processing and storage unit, visual display and audio o/p units and keyboards that can all be located easily on a home (or) office desk.

(iii) Portable Network Computers :-

Portable Computers are Compact versions of Personal Computer with all those Components packed in to a single unit the size an thin of brief case.

(iv) Enterprise systems (or) Mainframes :-

Mainframes used in bussiness data processing in medium to large corporations that require much more computing Power and storage Capacity than workstations.

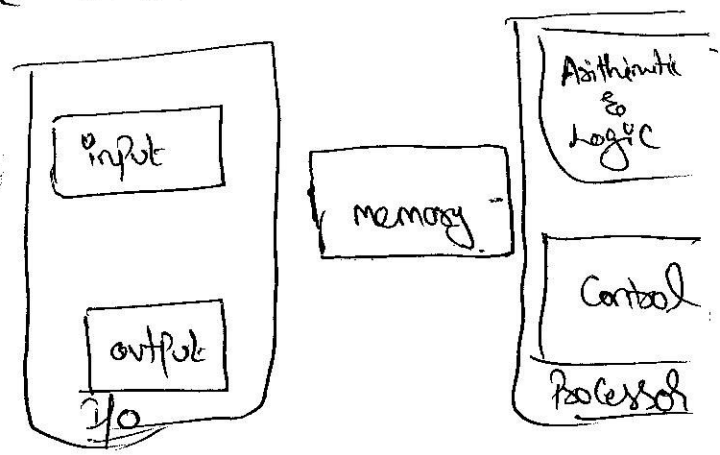
(v) Servers :-

Servers are widely accessible to the Education, bussiness, and Personal user Communities.

(vi) Super Computer :- Super Computers are used for large scale numerical Calculations required in applications such as weather forecasting, air Craft design and simulation..

4) Functional units :-

(i) Input
(ii) Memory
(iii) Asithematic and logic
(iv) output
(v) Control units.



~~I/O~~ - i/p Accepts Coded information from human operators, the electromechanical devices such as keyboards, (or) from other digital communication lines.

→ The information received either stored in Computer memory for later reference (or) immediately used by arithmetic and logic circuitry to perform desired operations.

→ The processing steps are determined by a program stored in memory.

→ Finally the results are sent back to the outside world through the output unit.

→ All these actions are co-ordinated by the control unit.

→ The list of instructions that perform a task is called Program.

→ Usually Programs is stored in memory

→ The Program fetches instructions that make up the Program from the memory one after another and perform the desire operation.

(i) Input Unit :- Computer accepts Code information through i/p unit which reads the data whenever a key is pressed, the corresponding letter (or) digit is automatically translated into its corresponding binary code, and transmitted over cable to either the memory (or) Processor.

→ Devices like → Joysticks, trackballs, microphones.

(ii) Memory unit :- used to store Program and data

There are two types of storage Classes

(a) Primary storage (b) Secondary storage

(a) Primary storage :- Stores Programs and data

~~Secondary storage~~ :- It is fast memory operates at electronic speed. Programs must be stored in memory while they are being executed.

→ The memory contain large no. of semiconductor storage cells.

→ Each cell store 1-bit of information.

→ The memory contain large no. of group of fixed size called words.

→ To provide easy access to memory to any word, a distinct address is needed.

→ The no:- of bits in each word is called length.

→ The word length ranges from 16 to 64 bits

3-types of memory → RAM (Random Access memory)
→ Cache memory
→ main memory

RAM:- memory in which any location can be reached in short and fixed amount of time after specifying the address is called RAM.

→ Time required to access 1 word is called memory Access.

Cache memory:- The small, fast, RAM units are called Cache. They are tightly coupled with Processor to achieve high performance.

Main memory:- The biggest and slowest unit is called main memory.

~~(iii) ALU (Arithmetic & logical unit) :-~~

~~Arithmetic → Numericals~~
~~Logical → Symbols~~

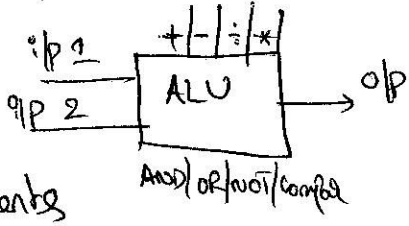
(b) Secondary storage:- is used when large amount of data and many programs have to be stored, particularly for information that is accessed infrequently.

Eg:- Magnetic disks and tapes & optical disks (CD-ROM).

(iii) Arithmetic and Logic Unit :- (ALU)

↳ Numerical ↳ Symbols

→ Any operations of Arithmetic and logic operations of input numbers(or) data is initiated by bringing the required operands into Processor where the operation is performed by ALU.



→ when operands are brought into Processor they are stored in high speed storage elements called registers.

→ Each register can store one word of data. Access times to registers are somewhat faster than access time to fast cache unit in memory hierarchy.

→ The Control and arithmetic and logic units are many times faster than other devices connected to Computer systems.

→ This enables single Processor to Control a number of external devices such as keyboards, displays, magnetic and optical disks, sensors and mechanical controllers.

(iv) **Output unit** :- It is a Control part of input unit.
→ function is to send Processed results to outside world.
Eg:- Printer, ink jet streams, mechanical impact heads.
→ Some units, such as graphic displays, Provide both an o/p function and an i/p function (I/O).

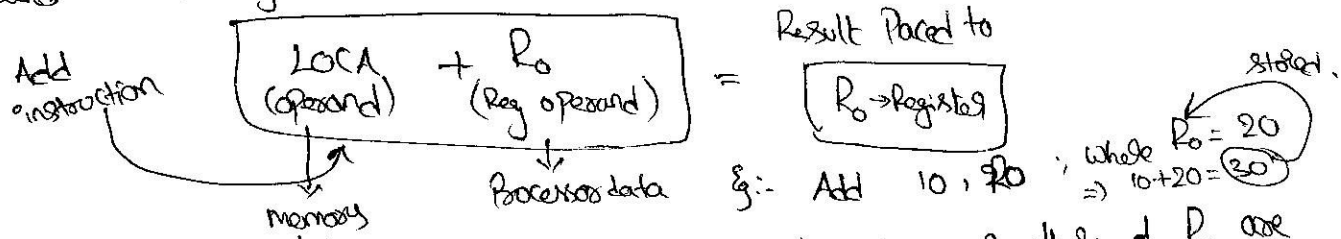
(v) **Control unit** :-
→ The Control unit is effectively the nerve Center that sends Control signals to other units and sense their states.
→ I/o transfers are controlled by instructions of I/o Programs, that identifies the devices involved and information is to be transferred.
→ The actual timing signals that govern the transfers are generated by Control ~~units~~ circuits.
→ Timing signal are signals that determine when a given action is to take place.
→ Data transfer b/w Processor and memory are also controlled by Control unit through timing signals.
→ The operation of Computer Can be summarized as follows :-
(*) The Computer accepts information in the form of Programs and data through an i/p unit and stores it in the memory
(*) Information stored in the memory is fetched, under Program Control, into an arithmetic and logic unit, where it is Processed.
(*) Processed information leaves the Computer through an o/p unit.
(*) All activities inside the machine are directed by the Control unit.

5) Basic operational Concepts:-

→ the activity of Computer is governed by instructions.
→ To Perform an given task, an appropriate Program Consisting of a list of instructions is stored in the memory.
→ Individual instructions are brought from memory in to Processor, which executes specified operation.
→ Data to be used as operands are also stored in the memory.

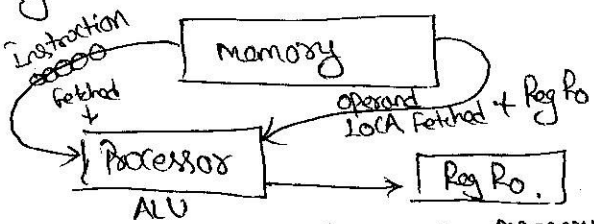
Type 1:- Eg:- Add LOCA, R_0 ⟶ Register.
Addition ← instruction
LOCA → Location

the instruction adds the operand at memory location LOCA to the operand in a register in the Processor, R_0 and places the sum in to Reg(R_0).



→ The original Content of location LOCA are preserved, whereas those of R_0 are over written.

Instruction operation:- first instruction is fetched from memory into the Processor, Next the operand at LOCA is fetched and added to the Contents of R_0.
Finally resulting sum is stored in register R_0.



The Preceding Add instruction Combines a memory access operation with an ALU operation. //.

Type 2:- Instruction sequence → { Load LOCA, R_1 ; Add R_2, R_0

R_1, R_2 → are Processor Registers
LOCA → operand at memory location.

→ the first instruction transfer the Contents of memory location LOCA into Processor Register R_1 and second instruction add the Contents of Register R_1 and R_0 and Places the sum into R_0.
→ this destroy the Content of Register R_1 and as well as those of R_0.

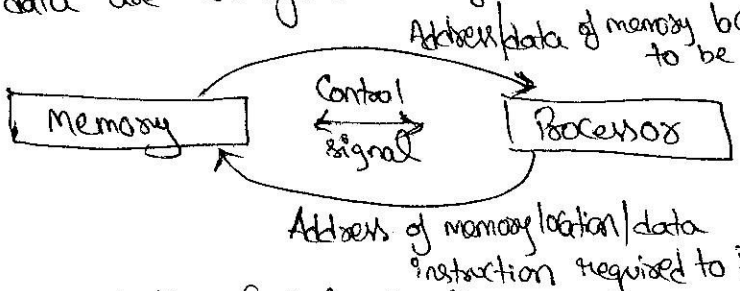
```
Load   LOCA , R1
Add    R1 , R0
       (+) → Added.
```

Eg:-
```
Load   (10) , R1
Add    R1 , R0
```
let R0 =
now R1 =

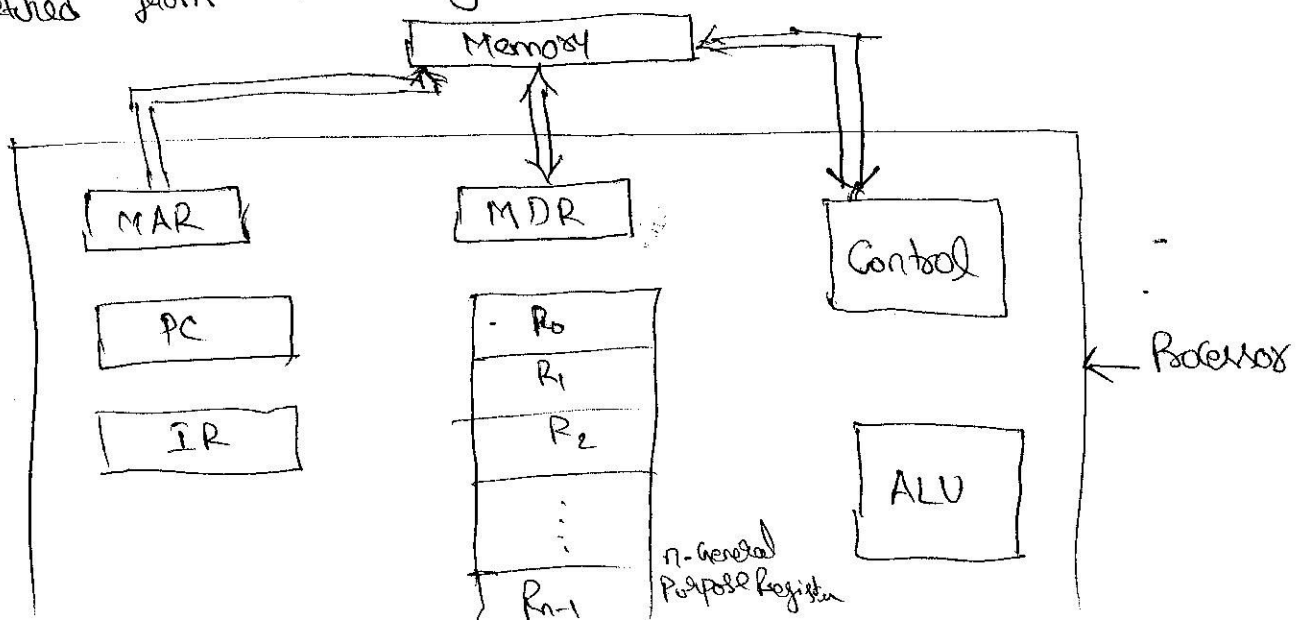
∴ ∴ [Res] = 10 + 10 = 80.
→ Stored in R0 → Register.

Operation between memory and Processor :-

Transfer " " " " are started by sending the address of memory location to be accessed to the memory unit and issuing the appropriate control signals.
→ The data are transfered to (or) from the memory.



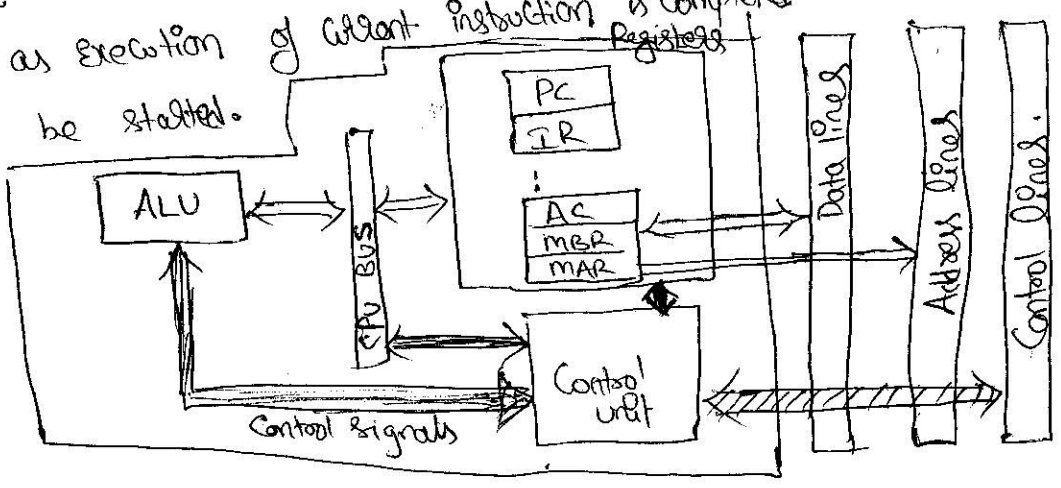
→ The ALU and the control circuitry the Processor contain a number of registers used for several different purpose.
→ the Instruction Register (IR) holds the instruction that currently being executed.
→ the op available on control signals, which generate timing signals, which control the various Processing Elements, involved in executing the instruction.
→ the Program Counter is a specialized register, which keep track of execution of a Program, contain memory address of next instruction to be fetched and executed.
→ During the execution of an instruction the contents of PC are updated to correspond to address of next instruction to be executed.
→ the Program Counter Points the next instruction that is to be fetched from the memory.

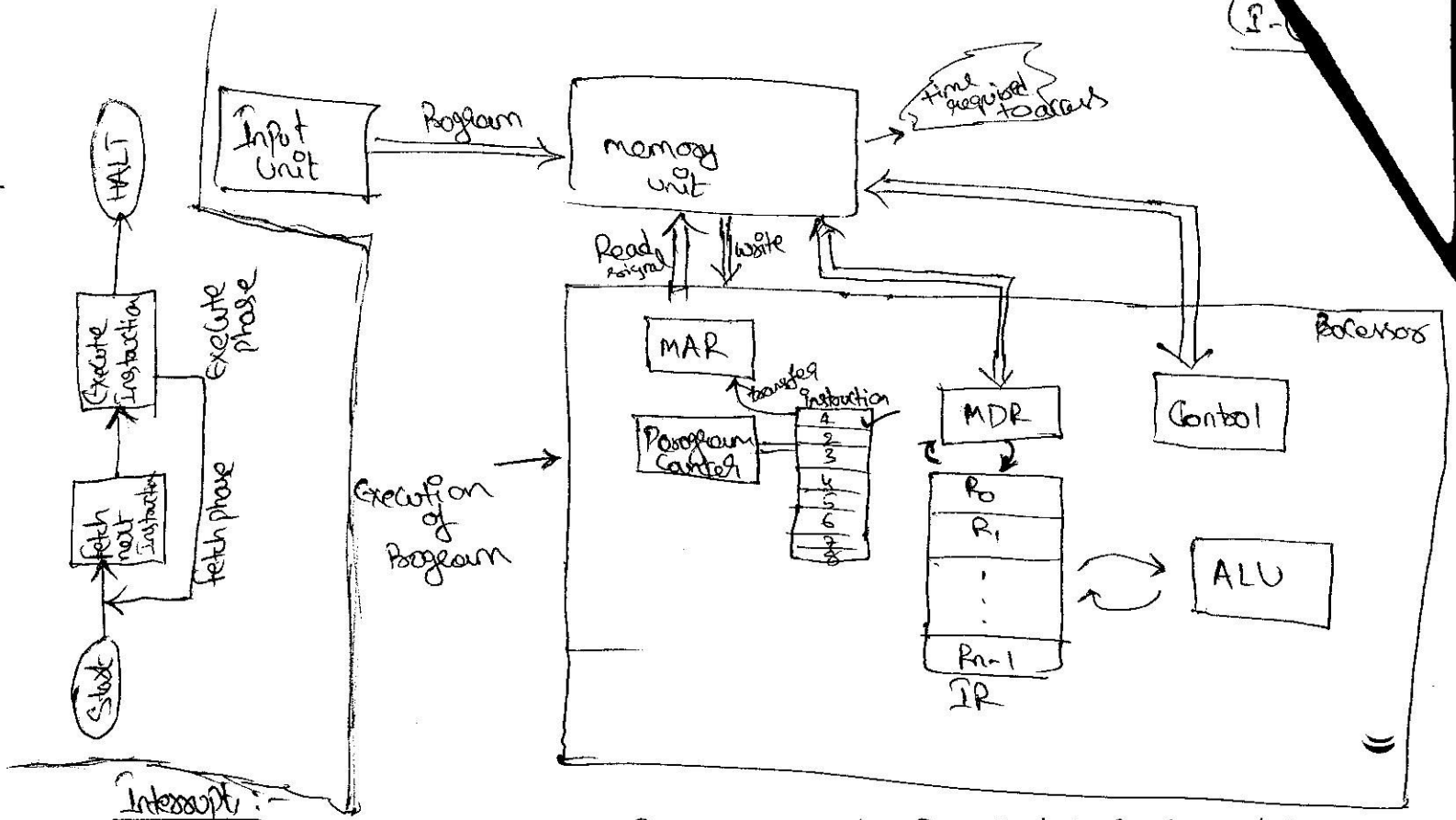


Trainally two Registers facilitate Communication with the memory they are
① Memory Address Register (MAR) → holds address of location
② Memory Data Register (MDR) → Can Read/write in (or) out to address location.

Program Operation:-

→ Programs reside in the memory and usually get there through the input unit.
→ Execution of Program starts when Pc is set to point to first instruction of Program.
→ The Content of Pc transfed to MAR and a Read Control signal is sent to the memory.
→ After time required to access the memory elapses, the addressed word is read out of memory and loaded in to the MDR.
→ next the Content of MDR are transferred to IR. at this point, the instruction is ready to be decoded and executed.
→ If instruction involves an operation to be Performed by ALU, it is necessary to obtain the required operands.
→ If an operand resides in the memory it has to be fetched by sending its address to MAR and initiating a Read cycle.
→ when operand has been read from the memory into the MDR, it is transferred from MDR to the ALU.
→ If the result of this operation is to be stored in the memory, then the result is sent to MDR.
→ the address of the location where the result is to be stored is sent to the MAR, and write cycle is initiated.
→ At some Point during execution of Current instruction the Contents of Pc are incremented so Pc Points to next instruction to be executed.
→ As soon as execution of Current instruction is completed a new instruction fetch may be started.





Interrupt :-

Normal Execution of the Program may be pre-Empted if some device requires urgent servicing.

Eg:- Monitoring device in a Computer Controlled industrial Process may detect a dangerous Condition.

→ In order to deal with the situation immediatly the normal execution of Current Program may be interrupted and the device raises an interrupt signal. the Processor Provides the requested service Called Interrupt service Routine (ISR).

→ ISR save the internal state of Processor. when ISR is completed, the state of the Processor is restored and interrupted Program may Continue its Execution.

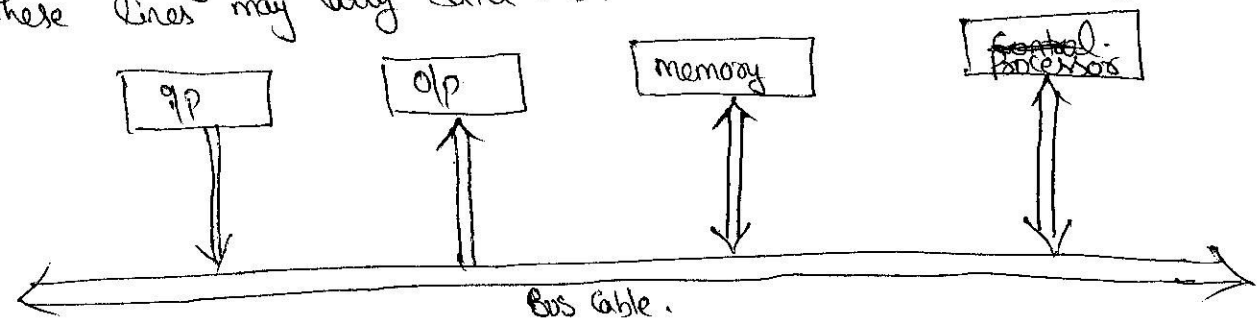
6) BUS STRUCTURES :-

Bus (is a set of signal lines)

→ The group of lines that serves a Connection Path to several devices is Called a Bus.

→ A Bus may be a lines (or) wires (or) one bit Per line.

→ these lines may Carry data (or) Address (or) Control signal.



are 2-types of Bus structures:-
① Single Bus structure
② Multiple Bus structure.

① Single Bus structure:-
* It allows only one transfer at a time
* It costs low
* It is flexible for attaching peripheral devices.

② Multiple Bus structures:-
* It allows two (or) more transfer at a time
* It costs high
* It provides concurrency in operation. It performance is high.

What defines a Bus:- / Specifications of Bus:-
① Transaction Protocol (fast/slow)
② Timing and signaling specification
③ Bunch of wires
④ Electrical specifications
⑤ Physical/mechanical characteristics of connectors.

Sections:
① DATA transfer → Read/write/I/O response/memory (fetching instruction & processing)
② Priority Arbitration → Interrupt [if n-devices if 2-devices are transfer the data bus and other device indicate ready the priority look in devices gives wait].
③ Initialization
[Check power; system clock; reset signal; special signals].

Types of Bus:-
① Processor - memory Bus → (short; fast Bus;
② I/O Bus → (long Bus; slow
③ Back-plane Bus → on pc-board it has set of signal buses.

Requirement:-
Bus latency → minimized in time (when ever request is enable so bus must be available with least possible delay).
Bus bandwidth → increased by [buffering and block of data (storing on before transmission)]

- Software:-

In order for a user to enter and run an application program, the computer must already contain some system software in its memory.

→ System software is a collection of programs that are executed as needed to perform functions. as

1. Receiving and interpreting user commands
2. Entering and editing application programs and storing them as files in secondary storage devices.
3. Managing the storage and retrival of files in secondary storage devices.
4. Running standard application programs such as word processors, spread sheets, (or) games; with data supplied by the user.
5. Controlling I/o units to receive i/p information and produce o/p result.
6. Translating programs from source form prepared by the user into object form consisting of machine instructions.
7. Linking and running user-written application programs with existing standard library routines, such as numerical computation packages.

→ Application programs are usually written in high level programming language such as C; C++, Java (or) fortran, in which programmer specifies mathematical (or) text processing operations.

→ A programmer using high level languages need not know the details of machine program instructions.

→ A system software program called a compiler translates the high level language program in to suitable machine language.

⇒ All programmer use is a text editor. which is used for entering and editing application programs.

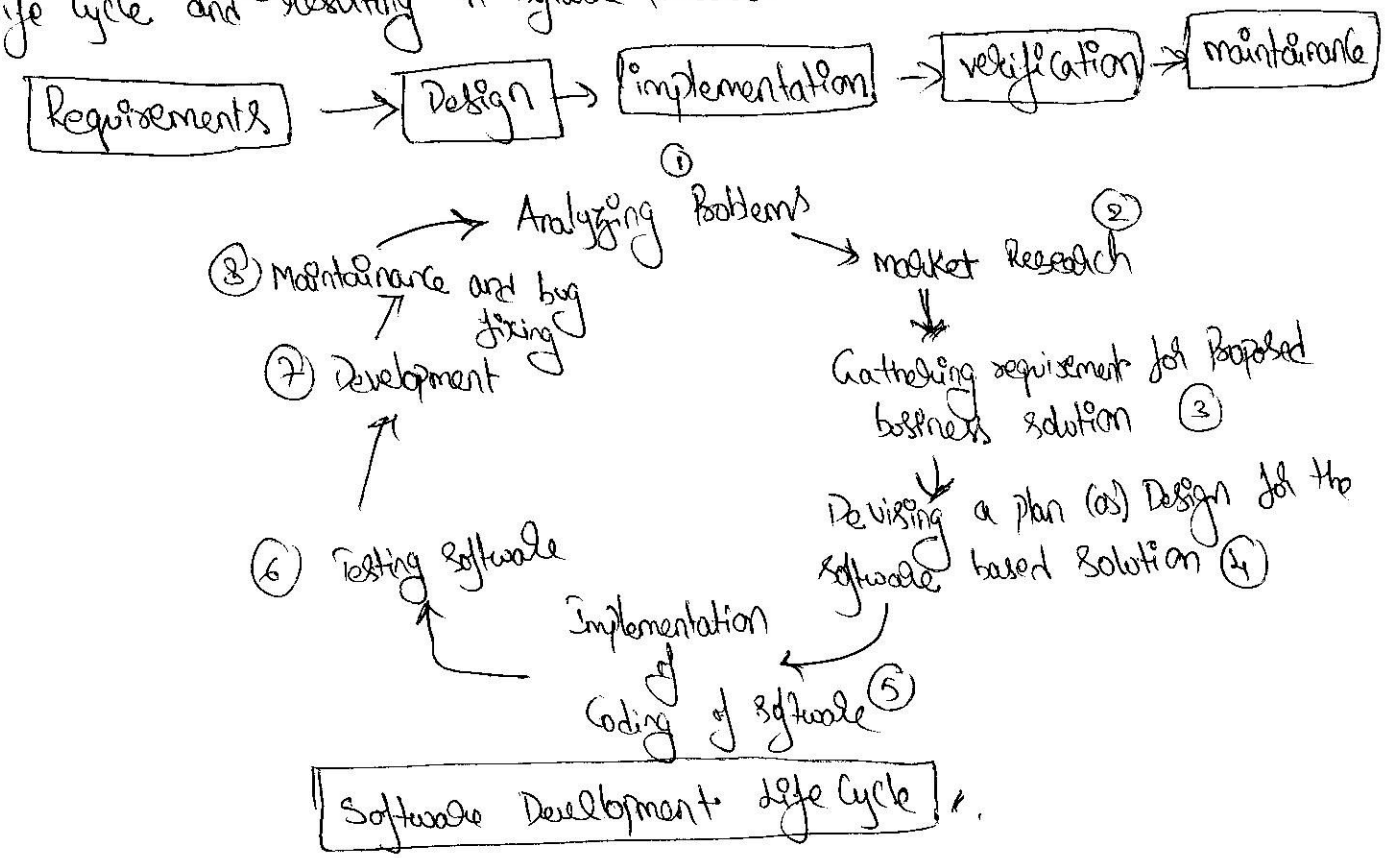
→ The user of this program interactively executes commands that allow statements of source program entered at a keyboard to be accumulated in a file.

→ A file is simply a sequence of alphanumeric characters (or) binary data that is stored in memory (or) in secondary storage.

Software
- → Operating system (windows ; mac os ; Linux) (Programs that run the computer)
- → Application (word of wayfast ; ms office ; chrome ; photoshop) (Program that the end user works to get something done)

Software development :-

→ The Computer Programming ; documenting ; testing involved in creating and maintaining applications and framework involved in a software release life cycle and resulting in software product.



ADDIE model

Analysis → Design → Development → implementation → Evaluation.

Computer Programming :-

→ the process of creating software, to solve a problem is known as Coding

Types of Programming language :-

Low level refers close to binary code language refers (0 & 1)

Low level → Assembly (or) &
High level → Java (or) Python ; Fortran ; C ; Pascal ; C++ ; COBOL ;

Translators:- A Computer language translator is a Program that translates a set of code written in one Programming language into a functional equivalent of the code in another programming language.

→ the different types of Computer translators are interpreters, source to source Compilers.

→ Standard Compilers de-compilers ; assemblers and dis-assemblers, interpreters translate a high level Programming language into an intermediate code that is immediately executed.

→ Source - to - source Compilers translate a high level Computer language into another high level Computer language.

→ Standard Compilers translate a high level language into low level language.

→ De Compilers translate machine code to a source code readable by a Programming language.

→ Assembler translate assembly language to machine code.

→ De Assembler " machine code into an assembly language.

(i) **Compiler:-**

→ Translates a high level language Program into a sequence of machine instructions.

→ To reduce an N- no of instructions we need to have a suitable machine instruction set and a Compiler that makes good use of it.

→ An optimizing compiler takes advantages of various features of the target Processor to reduce the Product N×S.

S → avg no of basic step need to execute instructions.

where N×S is a total number of clock cycles needed to execute Program.

Let machine Code language → L_0
Program Code " → L_1

$L_0 \longrightarrow L_1$ conversion/execution } is translation. (Each instruction)

$L_1 \longrightarrow L_0$ " } is interpretation (Complete Program execution in one time).

Computer Language :- (CMMSCCQ)

May refer Programming language, a formal language designed to communicate instructions to a machine particularly a computer.

① Command language :- a language used to control the task of computers itself such as starting other programs

② Machine language :- (or) machine code :- a set of instructions executed directly by a computer's CPU.

③ Markup language :- a grammar for annotating a document in a way that is syntactically distinguishable from text.

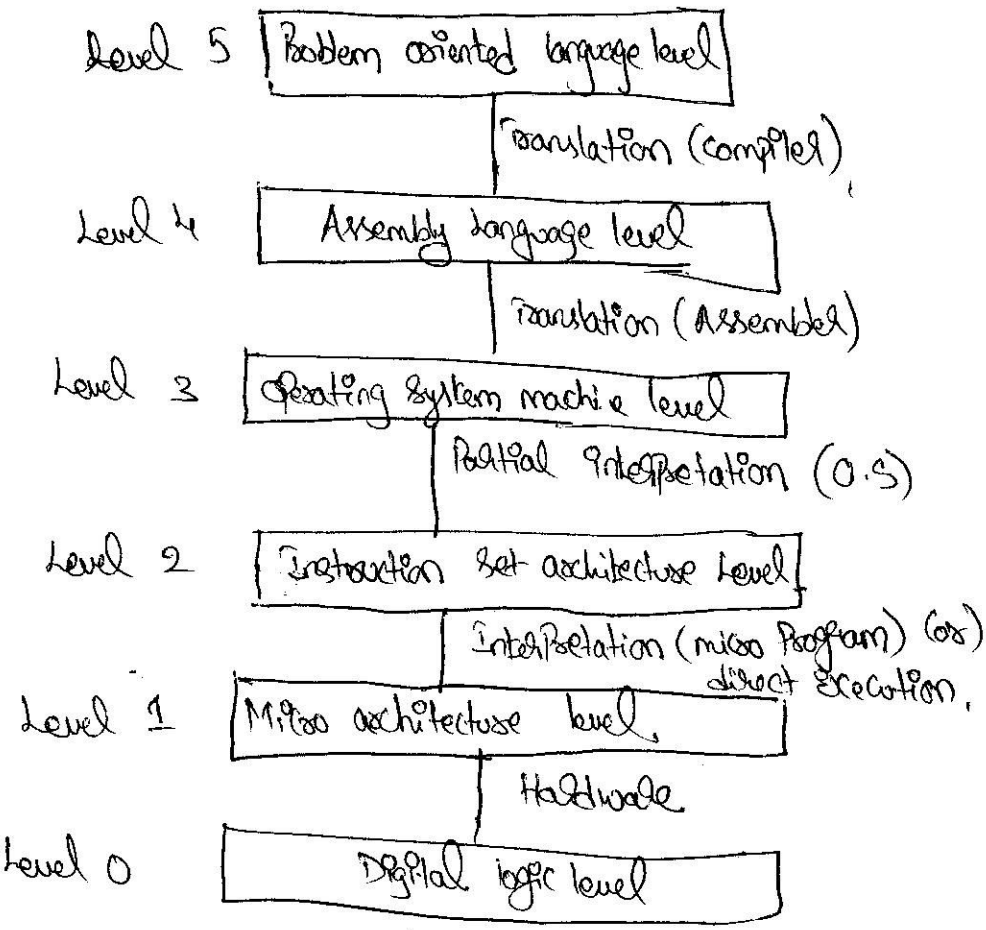
④ Style Sheet language :- a computer language that represents the presentation of structured documents

⑤ Configuration language :- used to write configuration files.

⑥ Construction language :- a general category that includes configuration languages, toolkit languages, and programming languages.

⑦ Query language :- formal language used to express information (or) knowledge often for use of computer system design.

(or) ~~Languages levels~~ :-



Level 0 :- Discuss digital logic level (0 & 1).

Although built from analog components such as transistors, gate can be accurately modeled as digital devices.

Level 1 :- Micro architecture level :-

→ In this level, we see 8 – 32 registers that form a local memory and a circuit called ALU (Arithmatic Logic Unit).

→ The registers are connected to ALU to form datapath. over which data flow.

→ The basic operation of datapath consisting of selecting one (or) two registers.

→ In some machines operation of datapath is controlled by Program called Micro Program.

Level 2 :- Instruction set Architecture level (ISA) referred as "Machine language Reference Manual" to understand the Computer Architecture level by Manufacture "guide

Level 3 :- Operating System machine level :-

(hybrid level of level 2 & level 3)

to overcome interrupts by micro Program.

Level 4 :- Assembler :-

This is symbolic form of one underlying languages. In this Programs are translated to level 1, 2, 3 and then interpreted to appropriate virtual (or) Actual machine.

Level 5 :- High level languages :- (C, C++, Java, LISP) etc.,

These high level languages designed to be used by application Programmer with problem to solve.

→ In this translators known as Compilers.