ASSIGNMENT No. 1 Computer Organisation

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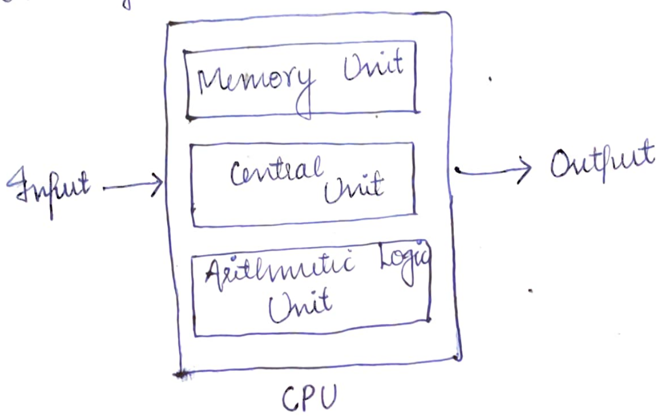
① The basic and main components of computers are :-
→ Input Unit.
→ Output Unit.
→ Memory Unit.
→ Central Unit.
→ Arithmetic Logic Unit.



② •) First generation of computers (1940-1956) :- Used vacuum tubes for circuitory and magnetic drums for main memory and they were enormous. This generation computers were relied on machine language, the lowest level programming language understood by computers to perform operations.

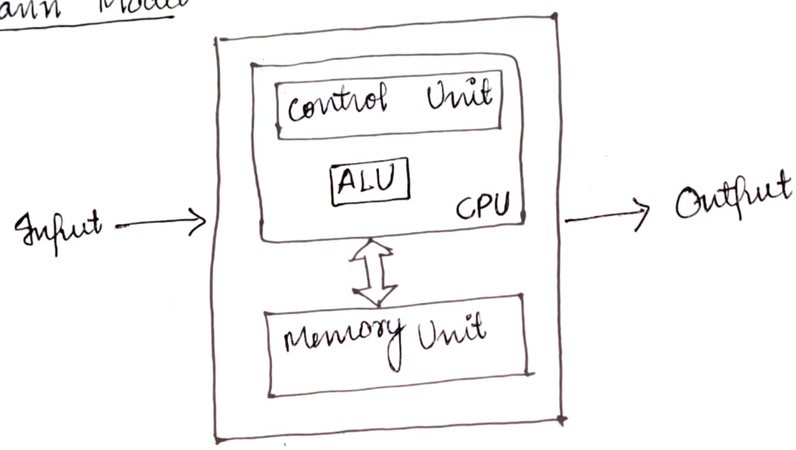
•) Second Generation (1956 - 1963) :- Vacuum tubes were replaced by transistors. This generation includes hardware advances like magnetic core memory, magnetic tape and the magnetic disc. High level programming language were also developed at this time, such as early version of COBOL & FORTRAN.

•) Third Generation (1964 - 1971) :- The development of the integrated circuiterious the hallmark of the circuit of third generation of computers transistors were minimized and placed on silicon chips, called semi-conductors which increased the speed and efficiency of computers.

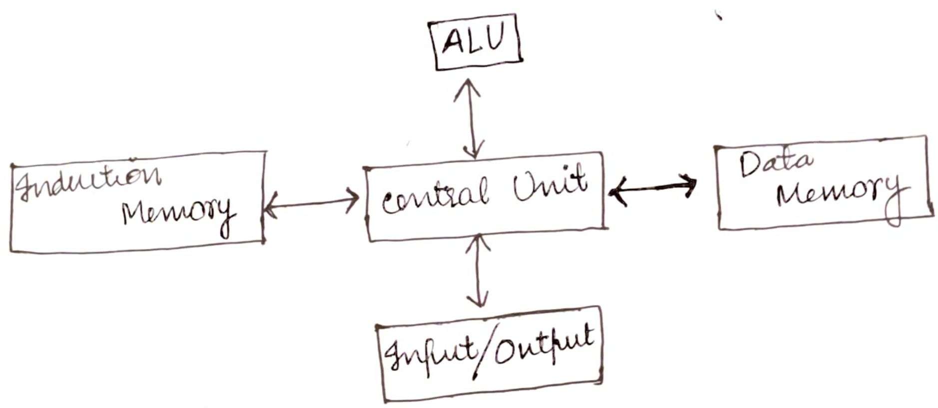
·) <u>Fourth Generation – (1971 - present)</u> :- Generation of microprocessors introduced in this generation as thousands of integrated circuits were built into a single silicon chip. Also IBM introduced its first personal computers for the home user and Apple introduced the Macintosh. Also we have the development of GUIs and handled the

·) <u>Fifth Generation (Present to beyond)</u> :- This generation is based on artificial intelligence (AI), the use of parallel recognition and superconductors is helping to make artificial intelligence a reality.

(3) <u>Von Neumann Model</u>



<u>Non- Von Neumann Model</u>



The von-neumann is a limitation on throughput caused by the standard personal computer architecture.

*) <u>Solution to overcome Von Neumann Bottleneck</u> :-

- Caching.
- Prefetching.
- Multi-threading.
- Processing in memory.
- RAMBUS.

14 (8 bits)

In unsigned bits - 00001110

In unsigned bits - 10001110

1's compliment - 00001101
+1

2's compliment - 00001110

(2) 25 (16 bits)

UB = 0000000000110001

SB = 0000000000110001

1's compliment - 1111111111001110
+1

2's compliment - 1111111111001111

(3) 35 (16 bits)

UB - 0000000000100011

SB - 1000000000100011

1's compliment - 0000000000100010

2's compliment - 0000000000100011

(5) 26 (8 bits)

UB - 00011010

SB - 10011010

1's compliment - 00011001

2's compliment - 00011010

(5) (a) $(0.1)_{10}$ in 32 bit IEEE floating point :-

$(0.1)_{10} = (0.00011\ldots\ldots)_2$

$\Rightarrow 0.00011 \times 2^0$

Exponent = 0 + 127
= 127

Sign bit = 01111111 Mantissa

Ans = $0 \underbrace{01111111}_{\text{8 bit exponent}} 01000100\ldots\ldots$

(b) $-(-40.52)_{10}$

$(40.52)_{10} = (101000.100001\ldots)_2$

$= 1.01000100001\ldots \times 2^5$

Exponent $= 5 + 127$

$= 132$

$= 10000100$ mantissa

Ans = $\overset{1B}{1}\ \underbrace{10000100}_{\text{8 bit exponent}}\ 01000100$

(6) (i) 13×7

M = 13, Q = 7

N	A	Q	Q-1	operation
5	00000	00111	0	Initial
4	01101	00111	0	A = A-M
3	00110	10011	1	ARS
2	00011	01001	1	ARS
	10100	10100	1	ARS
1	10100	01010	0	A = A+M
0	11101	00101	0	ARS

Ans = $(1110100101)_2$

$= (-91)$

(iii) 14×-10

M = 14, Q = -10

N	A	Q	Q-1	operation
5	00000	10110		
4	00000	01011	0	Initial
3	10010	01011	0	ARS
	11001	00101	0	A = A-M
2	11100	10010	1	ARS
	01010			ARS
1	00101	10010	1	
0	10111	01001	0	A = A+M
	11011	01001	0	ARS
		10100	1	A = A-M

Ans- $(01110100)_2 = (-140)_{10}$

$4 \longrightarrow 8$

N	A	Q	Q-1	Operation
				Initial
4	0000	0100	0	ARS
3	0000	0010	0	ARS
2	0000	0001	0	A = A-M
		0 001	0	ARS
1	1011			
	1101	1000	1	A = A+M
		1000	1	ARS
0	0010			
	0001	0100	0	

⑦ (i) 42.6875 + 0.375 in IEEE

$42.6875 = 101010.101 = 1.01010101 \times 2^5$

$0.375 = 0.011 = 0.011 \times 2^0 = 0.00000011 \times 2^5$

now adding

$$\begin{array}{r} 1.01010101 \times 2^5 \\ 0.00000011 \times 2^5 \\ \hline 1.01011000 \times 2^5 \end{array}$$

exponent $= 5 + 127 = 132$

$= (10000100)_2$

Ans $= \underbrace{0}_{SB}\,\underbrace{10000100}_{\text{exponent}}\ \underbrace{01011000\ldots}_{\text{Mantissa}}$

(ii) 0.2×10^3 and 0.3×10^2

0.2×10^3 also $0.3 \times 10^2 = 0.03 \times 10^3$

$$\begin{array}{r} 0.2 \times 10^3 \\ \times\ 0.03 \times 10^3 \\ \hline 0.006 \times 10^6 \end{array}$$

(8) Q ← 22/3 → M using Restoring Algo.

N	M	A	Q	Operation
				Initial
5	000011	000000	10110	
		000001	0110?	SLAQ
				A = A-M
4		111110	0110?	Q[0] = 0
		000001	01100	
		000010	1100?	SLAQ
				A = A-M
3		111111	1100?	
		000010	11000	Q[0] = 0, Restore A
		000101	1000?	SLAQ
		000010	1000?	A = A-M
		000010	10001	Q[0] = 1
		000101	0001?	SLAQ
		000010	0001?	A = A-M
1		000010	00011	Q[0] = 1
		000100	0011?	SLAQ
0		000001	0011?	A = A-M
		000001	00111	Q[0] = 1

now $Q = (00111)_2 = (7)_{10}$

$R = (000001) = (1)_{10}$

(9) Signed Magnitude – In this magnitude system, no. consists of magnitude and symbol which indicates that the number is positive or negative

eg $4 = 0100$ (0 for positive number)

$-4 = 1100$ (1 for negative number)

1's compliment – To get one's compliment of no, subtract each bit of binary number from 1 or simply invert all the bits 1 to 0 and 0 to 1

2's compliment – Adding 1 to one's compliment we get 2's compliment of a no. by performing 2's compliment we get -ive number for positive number and we get pos. for -ive number.

) 11010 - 10000

= 11010 + 2's comp. of 10000

= 11010 + 10000

= 101010

carry discarding = 01010 Ans.

(ii) 11010 - 1101

= 11010 + 2's comp. of 1101

= 11010 + 0011

= 11101 Ans.

(iii) 100 - 110000

= 100 + 010000

= 010100 Ans.

(iv) 1010100 - 101010

= 1010100 + 010110

= 1101010 Ans.