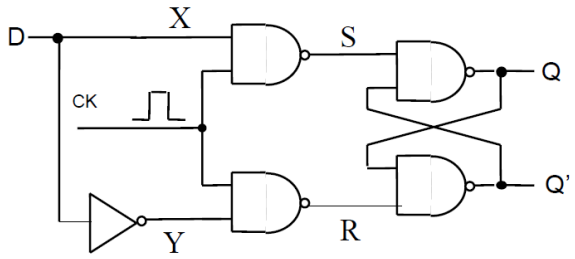
Q_{1A}) Design a D flip flop using truth table and draw the logic circuit. Give two applications of J-K flip flop.



D	C	Q	Q'
0	1	0	1
1	1	1	0
X	0	Q_0	Q_0'

Applications:

1- Counters
2- Data Storage
3- Signal Latching

Q_{1B}) Do as required:

1) Add **$(11101)_2 + (10101)_2$** = **<u>110010</u>**

Subtract **$(11101)_2 – (10101)_2$** = **<u>1000</u>**

2) One's complement of: **$(000001)_2$** = **<u>111110</u>** , **$(11010111)_2$** =**<u>00101000</u>**

3) Hexadecimal to Binary **$(59)_{16}$** = (**<u>0101 1001</u>**$)_2$, **$(5C8)_{16}$** = (**<u>0101 1100 1000</u>**$)_2$

4) Hexadecimal to Decimal **$(91)_{16}$** = (**<u>145</u>**$)_{10}$

5) Write the even parity for **$(11111110)_2$** = **<u>1</u>**

Write the even parity for **$(101011)_2$** = **<u>0</u>**

Q_{2A}) Write a microprocessor program that computes the following formula:

H= (C+C) + (B XOR D)

Given **B**= $(\mathbf{14})_{16}$, **C**= $(\mathbf{1F})_{16}$ **D**= $(\mathbf{C1})_{16}$

Sol:

MVI B,14	;B=14
MVI C,1F	;C=1F
MVI D,C1	;D=C1
MOV A,C	;A=C
ADD C	;A=A+C
MOV L,A	;L=A
MOV A,B	;A=B
XRA D	;A=A XOR D
ADD L	;A=A+L
RST	

Q_{2B}) Fill the blanks with suitable answer:

1. The instruction **MOV A, B** copies the contents of register __**B**__ into register ___**A**_____.

2. The instruction **MVI B, BB** loads register __**B**__ with __**BB**___.

3. The **flags** in 8085 register are _**Carry**_ , _**Zero**_ , _**Parity**_ , _**Sign**_ , and _**Auzilary Carry**_ .

4. The **internal logic design** of the microprocessor is called _**Architecture**_ .

Q_{3A}) Do as required: (**Answer <u>TWO</u> only**)

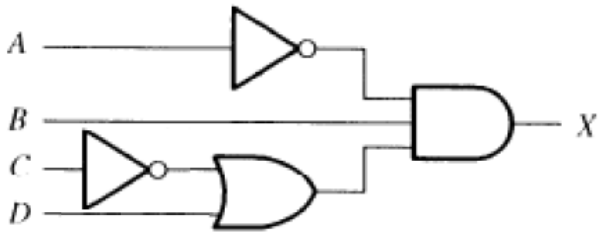
a) Apply DeMorgan's theorems to ($\overline{A} + \overline{B}$) ($\overline{C} + D$)

Sol:

$$\overline{(\overline{A}+\overline{B})(\overline{C}+D)} = \overline{\overline{A}+\overline{B}} + \overline{\overline{C}+D} = AB + C\overline{D}$$

b) Draw the logic circuit for $\overline{A}\ B\ (\overline{C} + D)$

Sol:



c) Write the truth table for ***M = A B + B C***

Sol:

$$X = AB + BC$$

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Q_{3B}) State the **steps** to perform a memory read operation and what is the maximum memory that 8085 microprocessor can address?

Sol:

1- Mp placed 16-bit address on address bus.

2- The address on the bus is decoded by an external logic circuit.

3- The memory location is identified.

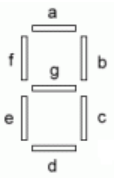
4- The Mp sends a pulse called memory read as control signal.

5- The pulse activates the memory chip.

6- The contents of the memory location (8-bit data) are placed on the data bus.

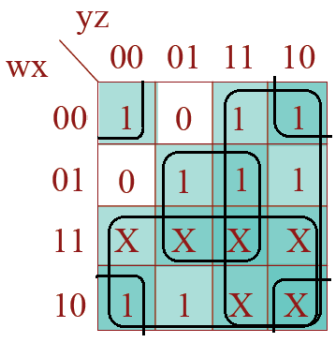
The maximum memory that 8085 microprocessor can address is 2^{16} or 65536 or 64K

Q4A) Design a simplified logic circuit that gives the output for segment **(a)** for the seven segment display shown in figure below:



Sol:

	Inputs				Output
Decimal	**w**	**x**	**y**	**x**	**a**
0	0	0	0	0	1
1	0	0	0	1	0
2	0	0	1	0	1
3	0	0	1	1	1
4	0	1	0	0	0
5	0	1	0	1	1
6	0	1	1	0	1
7	0	1	1	1	1
8	1	0	0	0	1
9	1	0	0	1	1



$$F = y + w + \bar{x}\bar{z} + xz$$

Q4B) Define the internal data operations of 8085 and state them.

Sol:

The internal architecture of the 8085/8080A microprocessor determines how and what operation can be performed with the data. These operations are:-

1- Store 8-bit data.

2- Performed arithmetic and logical operations.

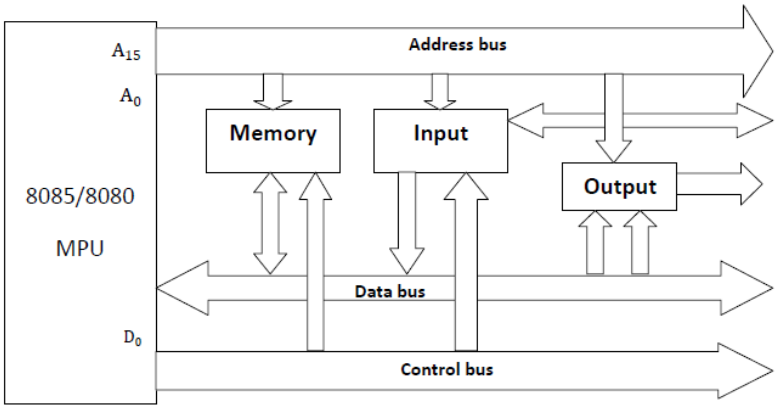
3- Test for conditions.

4- Sequence the execution of instructions.

5- Store data temporarily during execution in the defined R/W memory locations called the stack.

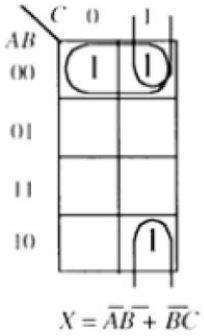
Q_{5A}) Draw a block diagram of the microprocessor 8085 bus structure.

Sol:



Q_{5B}) 1) Simplify using Karnaugh map: $A\ \overline{B}\ C + \overline{A}\ \overline{B}\ \overline{C} + A\ \overline{B}\ C$

Sol:



2) Simplify using Boolean Algebra:

$$\overline{A}\ \overline{B}\ \overline{C} + A\ \overline{B}\ \overline{C} + \overline{A}\ B\ \overline{C} + A\ B\ \overline{C}$$

Sol:

$$= \overline{B}\,\overline{C}\,(\overline{A} + A) + B\overline{C}\,(\overline{A} + A)$$
$$= \overline{B}\,\overline{C} + B\overline{C}$$
$$= \overline{C}\,(\overline{B} + B)$$
$$= \overline{C}$$

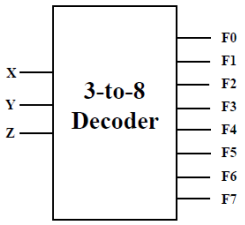
Q_{6A}) Answer <u>ONE</u> only:

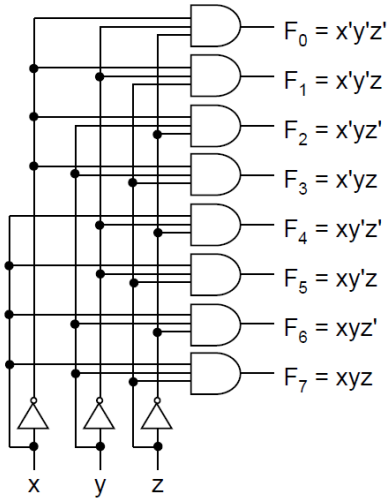
a) Design the logic circuit for (3 to 8) Binary **Decoder** and write the **truth table**.

Sol:

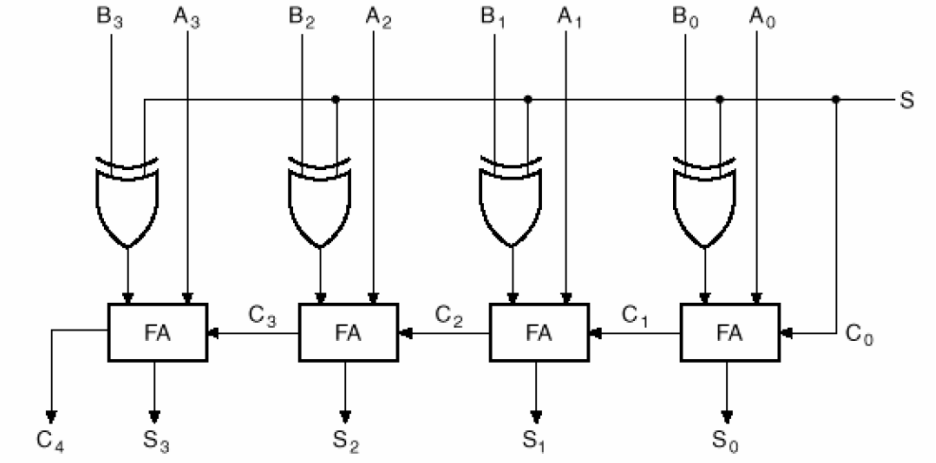
Truth Table:

x	y	z	F_0	F_1	F_2	F_3	F_4	F_5	F_6	F_7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1





b) Design the logic circuit for **4-bit Full Adder/Subtractor** with control signal.



Q_{6B}) Explain the following 8085 instructions (**Choose <u>Five</u> only**):

1- INX D	**5- ADI 11**
2- DCR A	**6- XRA B**
3- JMP 2020	**7- DAD B**
4- SUI 3B	**8- CMP C**

Sol:

1- **INX D:** The contents of the register pair DE are incremented by 1 and the result is stored in the same place.
2- **DCR A:** The contents of the register A is decremented by 1 and the result is stored in the same place.
3- **JMP 2020:** The program sequence is transferred to the memory location 2020.
4- **SUI 3B:** The 8-bit data (3B) is subtracted from the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the subtraction.
5- **ADI 11:** The 8-bit data (11) is added to the contents of the accumulator and the result is stored in the accumulator. All flags are modified to reflect the result of the addition**.**
6- **XRA B:** The contents of the accumulator are Exclusive ORed with the contents of register B, and the result is placed in the accumulator. S, Z, P are modified to reflect the result of the operation**.**
7- **DAD B:** The 16-bit contents of the register pair BC are added to the contents of the HL register and the sum is stored in the HL registers. The contents of the source register pair BC are not altered**.**
8- **CMP C:** The contents of the operand (register or memory) are compared with the contents of the accumulator. Both contents are preserved. The result of the comparison is shown by setting the flags of the PSW as follows:
   if (A) < (reg/mem): carry flag is set
   if (A) = (reg/mem): zero flag is set
   if (A) > (reg/mem): carry and zero flags are reset.