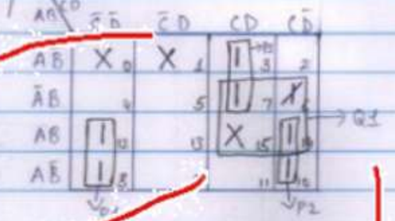
Section-C

# Question No: 3 (a)

$Y = \Sigma_m (3,6,7,8,10,12,14) + d(0,1,6,15)$

The given expression is in SOP form.

To reduce the expression we shall use K-map.




There are 3 pairs & 1 Quad

$P_1 = A\bar{C}\bar{D}$

$P_2 = AC\bar{D}$

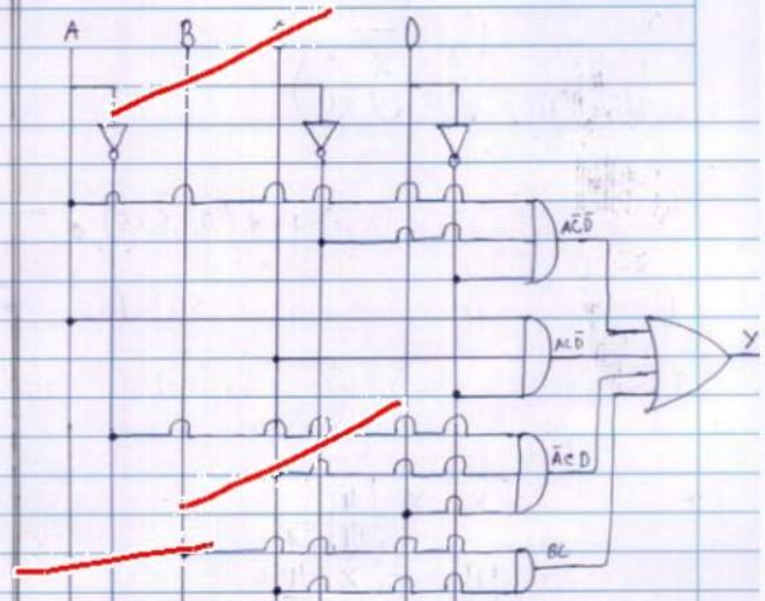
$P_3 = \bar{A}CD$

$Q_1 = BC$

$\therefore Y = A\bar{C}\bar{D} + AC\bar{D} + \bar{A}CD + BC$

Logic Diagram

$Y = A\bar{C}\bar{D} + AC\bar{D} + \bar{A}CD + BC$



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# Section-C

## Question No: 4(b)

### 2 Bit Magnitude Comparator

In Comparator we compare the bits. There would be 3 cases.

when:

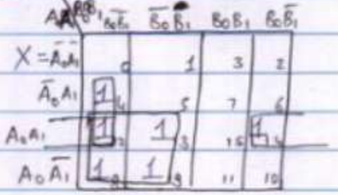
* A > B  A = B  A < B.

In this we are comparing 2 bit Magnitude Comparator.

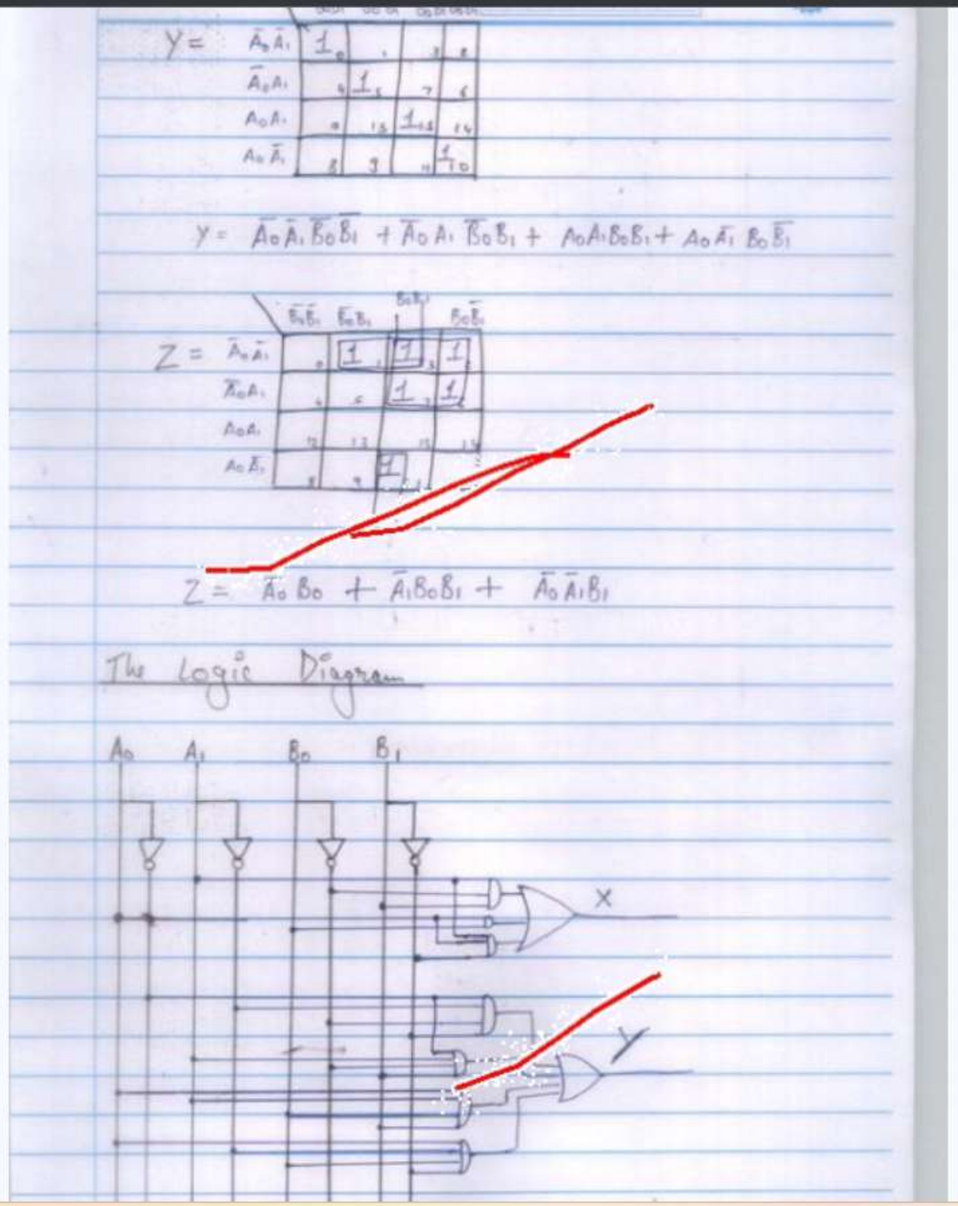
There would be $A_0$ $A_1$ $B_0$ $B_1$

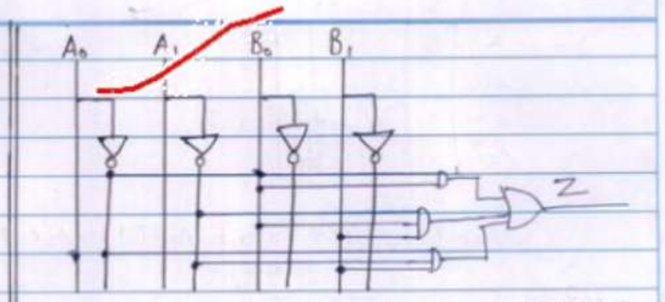
| Inputs | | | | Comparator | | |
|---|---|---|---|---|---|---|
| $A_1$ | $A_0$ | $B_0$ | $B_1$ | X= A>B | Y= A=B | Z= A<B |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 |

So the expressions for Variable X, Y, Z are :-



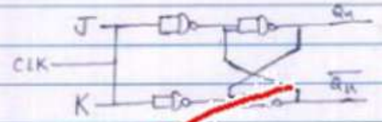

$$X = A_1\bar{B}_0B_1 + A_0B_0 + A_0A_1\bar{B}_1$$






Section C

Question No: 5 (b)




Block Diagram of JK Flip Flop

## Truth Table of JK

| P.S. | I/P | | N.S | |
|---|---|---|---|---|
| $Q_n$ | J | K | $Q_{n+1}$ | |
| 0 | x | x | $Q_n$ | Previous state |
| 1 | 0 | 0 | $Q_n$ | Previous state |
| 1 | 0 | 1 | 0 | Reset |
| 1 | 1 | 0 | 1 | Set |
| 1 | 1 | 1 | $\overline{Q_n}$ | |

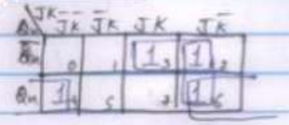
### Characteristic Table

| I/P | | | Y= N.S |
|---|---|---|---|
| $Q_n$ | J | K | $Q_{n+1}$ |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

### Excitation Table

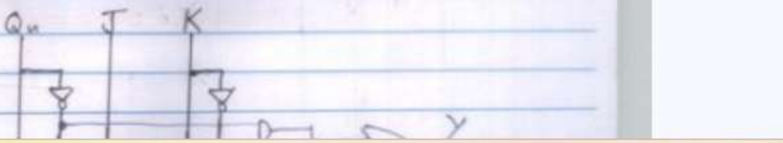
| $Q_n$ | $Q_{n+1}$ | J | K |
|---|---|---|---|
| 0 | 0 | 0 | x |
| 0 | 1 | 1 | x |
| 1 | 0 | x | 1 |
| 1 | 1 | x | 0 |

Expression for Y=




3 pairs ⇒ $Y = \overline{Q_n}J + Q_n\overline{K} + J\overline{K}$

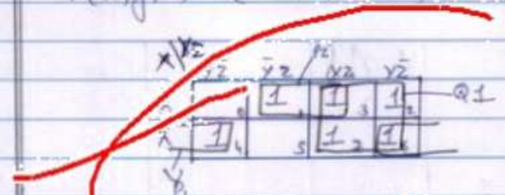
Logic Diagram



# Section-B

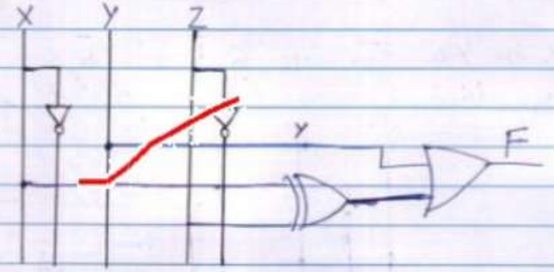
## Question No: 2(a)

$F(x,y,z) = (1,2,3,4,6,7)$




In the above K-map there is 2 pair & 1 quad.

Q1 ⇒ $Y$
P1 ⇒ $X\bar{Z}$ ⇒ $F = Y + X\bar{Z} + \bar{X}Z$
P2 ⇒ $\bar{X}Z$ $= Y + X \oplus Z$



# Section-B

## Question No: 2 (c)

* TT of SR

| P.S | S | R | N.S | |
|---|---|---|---|---|
| 0 | x | x | $Q_n$ | Previous state |
| 1 | 0 | 0 | $Q_n$ | Previous state |
| 1 | 0 | 1 | 0 | Reset |
| 1 | 1 | 0 | 1 | Set |
| 1 | 1 | 1 | X | Invalid |

Characteristic Table

| $Q_n$ | S | R | $Q_{n+1}$ |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | X |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | X |

Excitation Table

| $Q_n$ | $Q_{n+1}$ | S | R |
|---|---|---|---|
| 0 | 0 | 0 | x |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | x | 0 |

~~Truth Table of D~~
~~Excitation Table~~

TT of D

| | |
|---|---|
| 0 | 0 |
| 1 | 1 |

⇒ Characteristic / ~~Equation~~ Excitation Table

| $Q_n$ | D | $Q_{n+1}$ |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | x |
| 1 | 0 | x |
| 1 | 1 | 1 |

* Truth Table of JK

| P.S. | I/P | N.S |
|---|---|---|
| $Q_n$ | J K | $Q_{n+1}$ |
| 0 | x x | $Q_n$ |
| 1 | 0 0 | $Q_n$ |
| 1 | 0 1 | 0 |
| 1 | 1 0 | 1 |
| 1 | 1 1 | $\bar{Q}_n$ |

Previous state
Previous state

Characteristic Table

| $Q_n$ | J | K | $Q_{n+1}$ |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

Excitation Table

| $Q_n$ | $Q_{n+1}$ | J | K |
|---|---|---|---|
| 0 | 0 | 0 | x |
| 0 | 1 | 1 | x |
| 1 | 0 | x | 1 |
| 1 | 1 | x | 0 |

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Truth Table of T

| T | |
|---|---|
| 0 | $Q_n$ |
| 1 | $\overline{Q_n}$ |

Characteristic / Excitation Table

| $Q_n$ | T | $Q_{n+1}$ |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | X |
| 1 | 0 | X |
| 1 | 1 | 0 |

Section-B

Question No: 2(b)

## Section-A

1 (a) (i) $(1011)_2$ ... Gray code ⇒

(ii) (1...) ⇒ ... code ⇒ $(1110)_2 = E$

1 (b) $(1011)_2 - (1...01)_2$

⇒ 0010

1 (c) Serial Adder ⇒ In this the circuit is linear in serial form.

Parallel Adder ⇒ In this the circuit is added parallely.

1 (d) 16 multiplexer

1 (e) Characteristic Table: Characteristic Table is formed from Truth table.

Excitation Table: Excitation Table is formed from Characteristic Table.

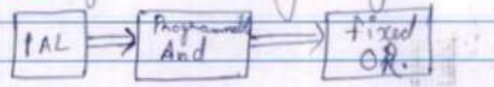
1 (f) Combination circuits: In Combinational the ckt can be both Serial & Parallel.

Sequential circuits: In Sequential ckt it can be only Serial.

(g) $2^{1K}$

(h) Propagation delay are occured in Hazards circuits and the paths divisions.

(i) PAL ⇒ Programmable Array Logic




PLA ⇒ Programmable Logic Array