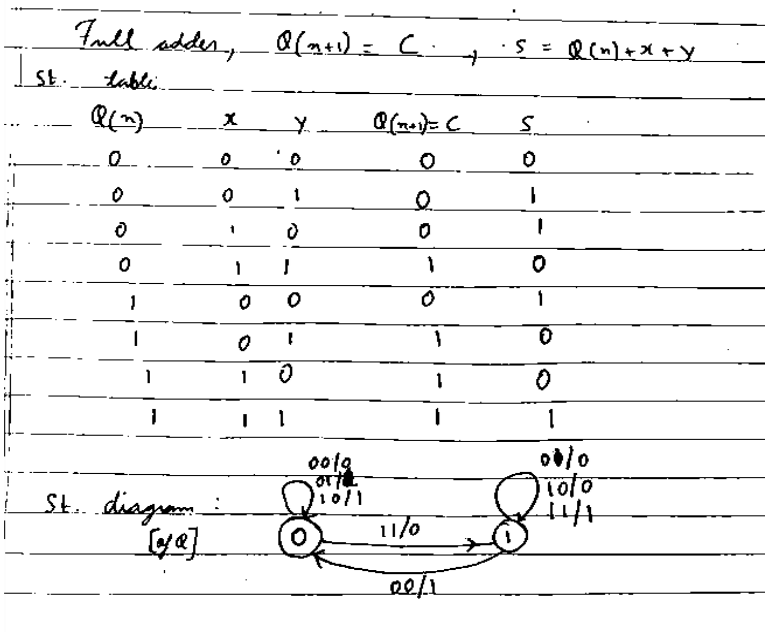
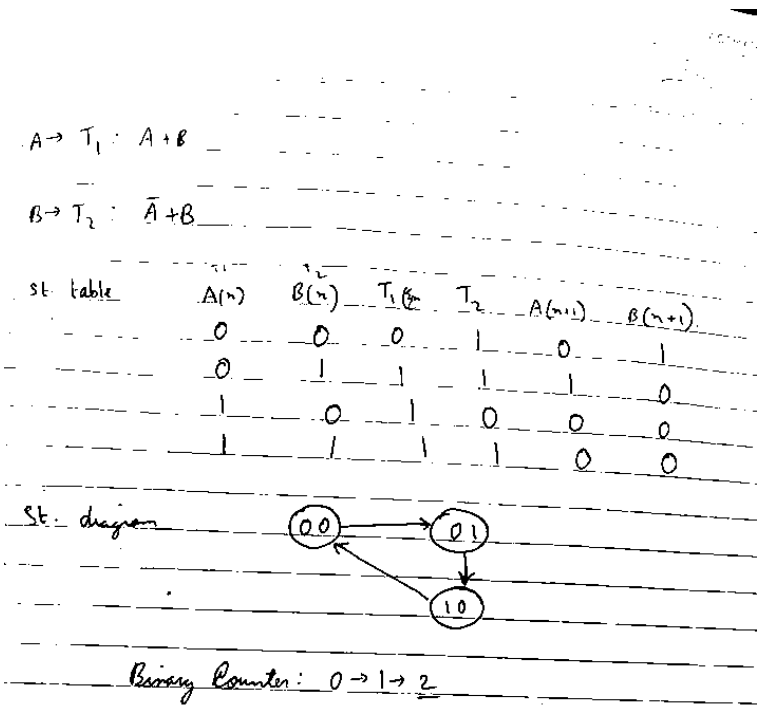
# Practice sheet 3 solutions

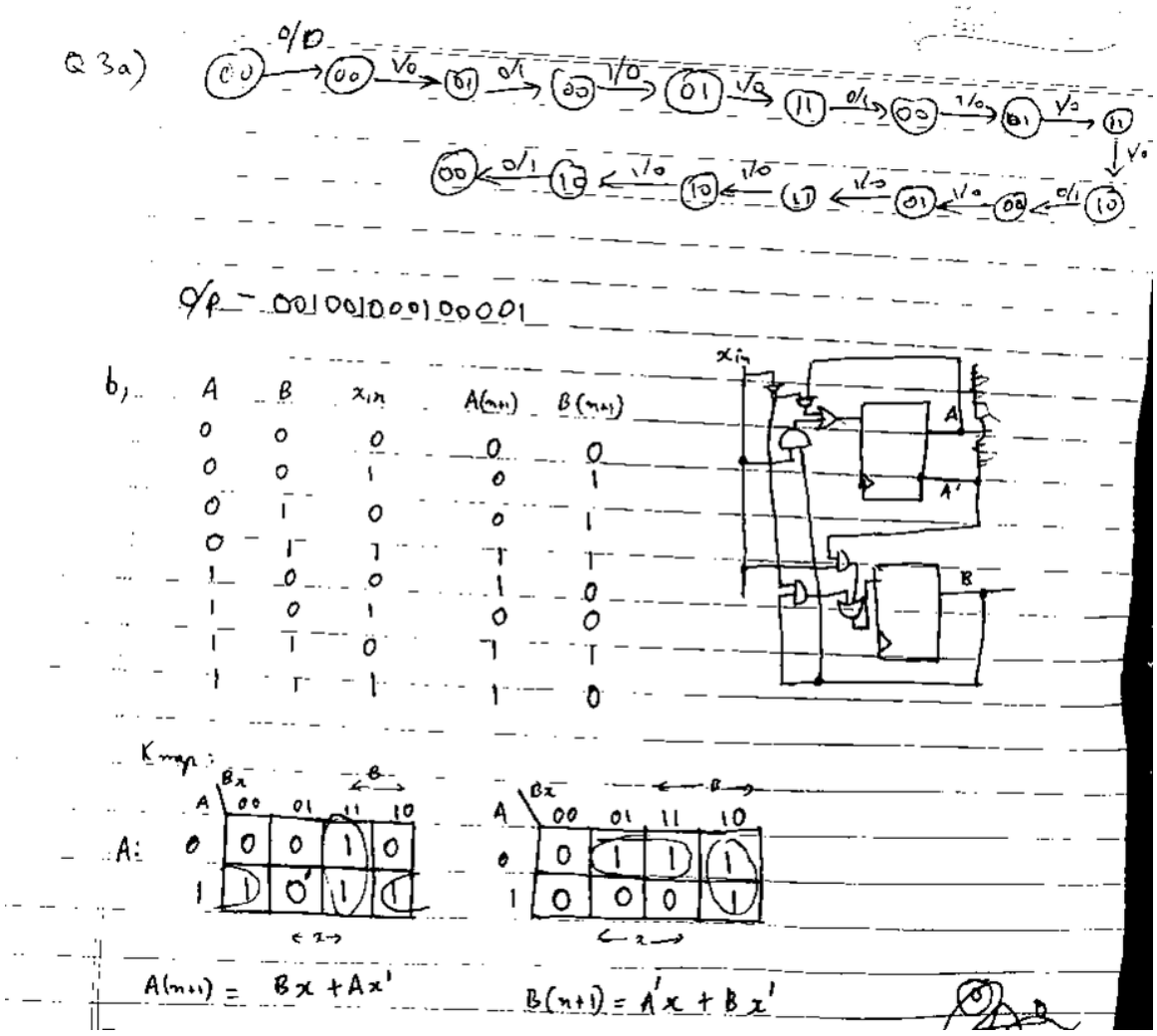
## Q1.




## Q2.



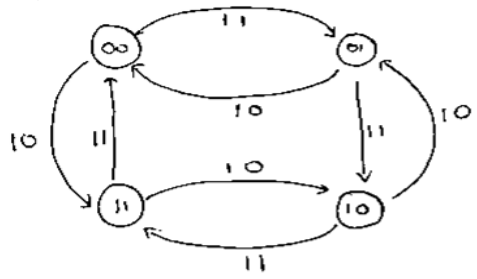
**Q3.**


Q 3a)
0/0
00
01
11
10
O/p - 001001001100001
b)
A B $x_{in}$ A(n+1) B(n+1)
0 0 0 0 0
0 0 1 0 1
0 1 0 0 1
0 1 1 1 1
1 0 0 1 0
1 0 1 0 0
1 1 0 1 1
1 1 1 1 0
$x_{in}$
A
A'
B
Kmap :
A:
Bx
00 01 11 10
$A(n+1) = Bx + Ax'$
$B(n+1) = A'x + Bx'$

**4.**

4)

State diagram




State table

| Present State | | Input | | | Next Stage | | Flipflop Inputs | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| A | B | E | x | | A | B | $J_A$ | $K_A$ | $J_B$ | $K_B$ |
| 0 | 0 | 0 | 0 | | 0 | 0 | 0 | x | 0 | x |
| 0 | 0 | 0 | 1 | | 0 | 0 | 0 | x | 0 | x |
| 0 | 0 | 1 | 0 | | 1 | 1 | 1 | x | 1 | x |
| 0 | 0 | 1 | 1 | | 0 | 1 | 0 | x | 1 | x |
| 0 | 1 | 0 | 0 | | 0 | 1 | 0 | x | x | 0 |
| 0 | 1 | 0 | 1 | | 0 | 1 | 0 | x | x | 0 |
| 0 | 1 | 1 | 0 | | 0 | 0 | 0 | x | x | 1 |
| 0 | 1 | 1 | 1 | | 1 | 0 | 1 | x | x | 1 |
| 1 | 0 | 0 | 0 | | 1 | 0 | x | 0 | 0 | x |
| 1 | 0 | 0 | 1 | | 1 | 0 | x | 0 | 0 | x |
| 1 | 0 | 1 | 0 | | 0 | 1 | x | 1 | 1 | x |
| 1 | 0 | 1 | 1 | | 1 | 1 | x | 0 | 1 | x |
| 1 | 1 | 0 | 0 | | 1 | 1 | x | 0 | x | 0 |
| 1 | 1 | 0 | 1 | | 1 | 1 | x | 0 | x | 0 |
| 1 | 1 | 1 | 0 | | 1 | 0 | x | 0 | x | 1 |
| 1 | 1 | 1 | 1 | | 0 | 0 | x | 1 | x | 1 |

__/__/____

| AB \ EX | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 0 | 1 |
| 01 | 0 | 0 | 1 | 0 |
| 11 | X | X | X | X |
| 10 | X | X | X | X |

$J_A = BEX + E\bar{X}B'$

| AB \ EX | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 1 | 1 |
| 01 | X | X | X | X |
| 11 | X | X | X | X |
| 10 | 0 | 0 | 1 | 1 |

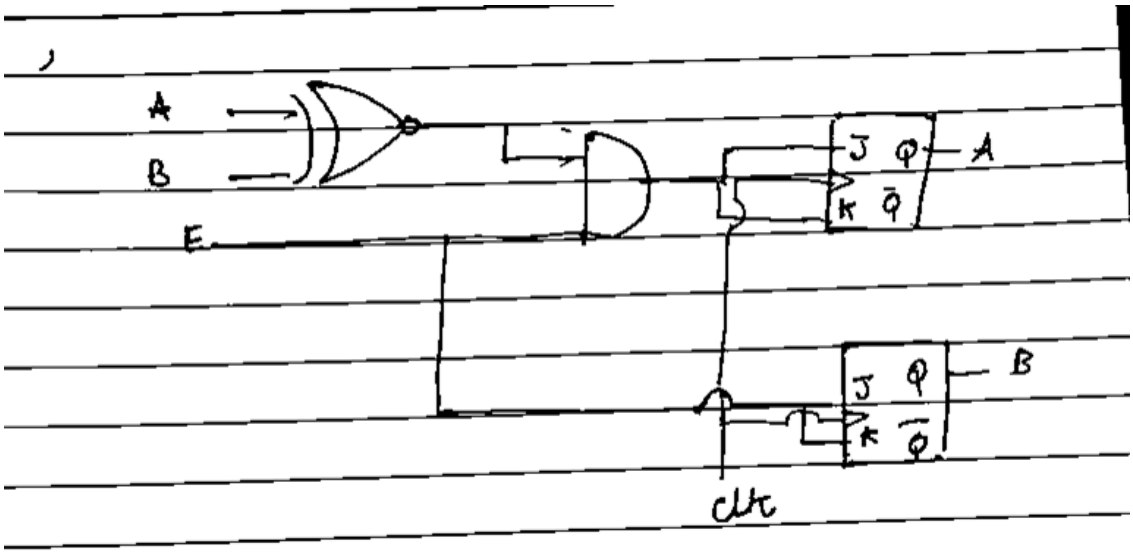
$J_B = \bar{E}$

| AB \ EX | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | X | X | X | X |
| 01 | X | X | X | X |
| 11 | 0 | 0 | 1 | 0 |
| 10 | 0 | 0 | 0 | 1 |

$K_A = BEX + B'EX'$

| AB \ EX | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | X | X | X | X |
| 01 | 0 | 0 | 1 | 1 |
| 11 | 0 | 0 | 1 | 1 |
| 10 | X | X | X | X |

$K_B = \bar{E}$



5.

→

| Present state | | | input | Next State | | | output |
|---|---|---|---|---|---|---|---|
| A | B | C | x | A*(next) | B*(next) | C*(next) | y |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |

we use don't care condition, i.e $d(A, B, C, x) = \sum(10, 11, 12, 13, 15)$

$A^* = A'B'x$

| AB \ Cx | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 1 | 1 | 0 |
| 01 | 0 | 0 | 0 | 0 |
| 11 | x | x | x | x |
| 10 | 0 | 0 | x | x |

$B^* = A + C'x' + BCx$

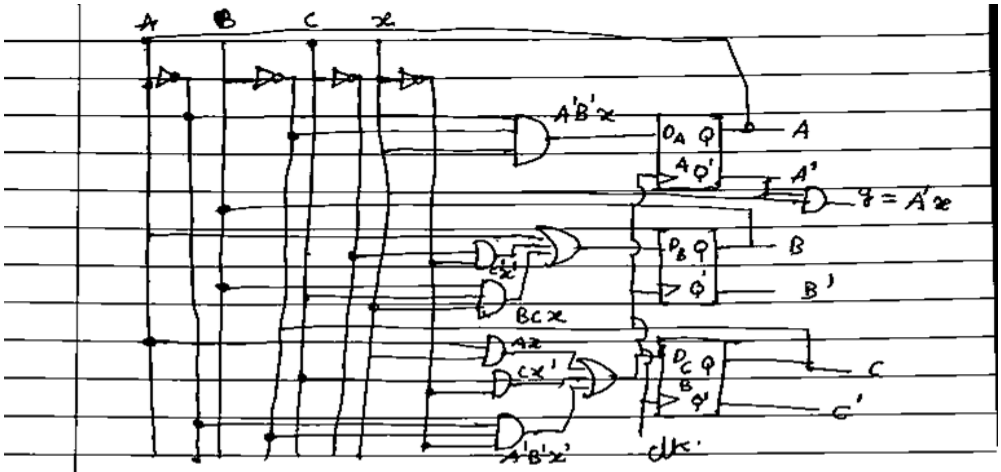
| AB \ Cx | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | | |
| 01 | 1 | | 1 | |
| 11 | x | x | x | x |
| 10 | 1 | 1 | x | x |

$C^* = Ax + Cx' + A'B'x'$

| AB \ Cx | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | | 1 |
| 01 | | | | 1 |
| 11 | x | x | x | x |
| 10 | | 1 | x | x |

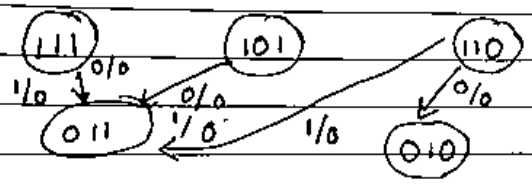
$y = A'x$

| AB \ Cx | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | 1 | 1 | |
| 01 | | 1 | 1 | |
| 11 | x | x | x | x |
| 10 | | | x | x |




For don't care for unused state

| Present State | | | input | Next State | | | output |
|---|---|---|---|---|---|---|---|
| A | B | C | x | $A^*$ | $B^*$ | $C^*$ | y |
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |




The machine is transitioning from unused states to known states.