

# Answer key

CT1 - 18ECE206J - Advanced digital system design.

Set-D

## PART-A (5x1 = 5 marks) (Answer all)

1. (a) SOP, Karnaugh map.
2. (a)  $\bar{A}\bar{B} + AC + B\bar{C}$
3. (b)  $n: n+1$
4. (a) Decomposition theorem.
5. (a) Clocked flip-flops

## PART-B (2x10 = 20 marks) (Answer any two)

(1) i)

$$\begin{aligned} F(A, B, C, D) &= \bar{A}BD + BCD + A\bar{B}\bar{C}\bar{D} \\ &= (1 \oplus A)BD \oplus BCD \oplus A(1 \oplus B)C(1 \oplus D) \\ &= BD \oplus ABD \oplus BCD \oplus (A \oplus AB)(C \oplus CD) \\ &= BD \oplus ABD \oplus BCD \oplus AC \oplus ACD \oplus ABC \oplus ABCD \\ &\quad \oplus ABCD \end{aligned}$$

logic diagram (2m) (3m)

(6) (i)  $F(x, y, z) = \bar{x}\bar{y}\bar{z} + \bar{x}\bar{y}z + \bar{x}yz + x\bar{y}\bar{z} + x\bar{y}z$

$$= \bar{x}(\bar{y}\bar{z} + \bar{y}z + yz) + x(\bar{y}\bar{z} + \bar{y}z)$$

$$= \bar{x}(\bar{y}\bar{z} + (\bar{y}+y)z) + x(\bar{y}(\bar{z}+z))$$

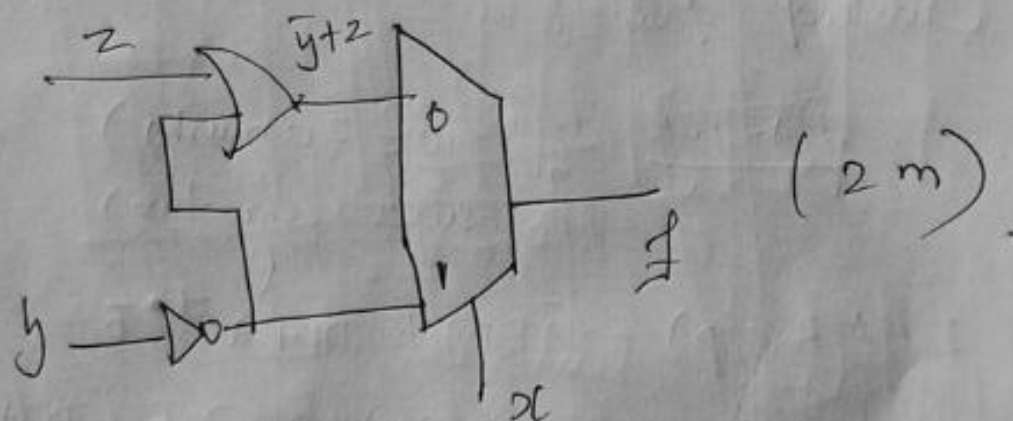
$\downarrow$                        $\downarrow$

$$= \bar{x}(\bar{y}\bar{z} + z) + x(\bar{y})$$

$$= \bar{x}(\bar{y}+z)(z+\bar{z}) + x(\bar{y})$$

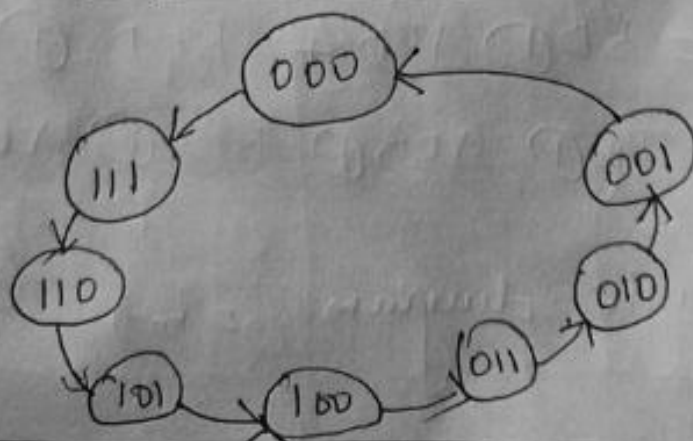
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$$= \bar{x}(\bar{y}+z) + x\bar{y} \quad (3 \text{ mark})$$



(7) 3-bit down counter (1 m)

Step 1:



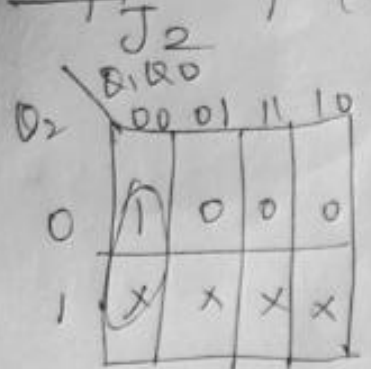
## Step 2 State table (1m)

Present state	Next state
0 0 0	1 1 1
1 1 1	1 1 0
1 1 0	1 0 1
1 0 1	1 0 0
1 0 0	0 1 1
0 1 1	0 1 0
0 1 0	0 0 1
0 0 1	0 0 0

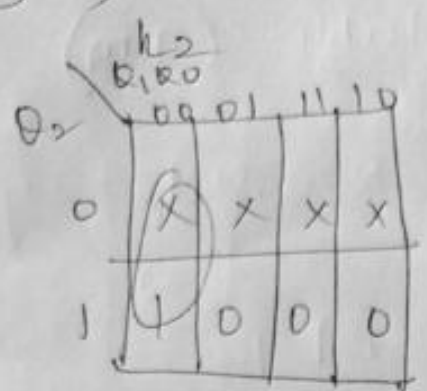
## Step 3 (3m)

PS			NS			Flip flop inputs					
$Q_2$	$Q_1$	$Q_0$	$Q_2^*$	$Q_1^*$	$Q_0^*$	$J_2$	$k_2$	$J_1$	$k_1$	$J_0$	$k_0$
0	0	0	0	1	1	1	x	1	x	1	x
1	1	1	1	1	0	x	0	x	0	x	1
2	1	1	1	0	1	x	0	x	1	1	x
3	1	0	1	0	0	x	0	0	x	x	1
4	1	0	0	1	1	x	1	1	x	1	x
5	0	1	1	0	0	0	x	x	0	x	1
6	0	1	0	0	1	0	x	x	1	1	x
7	0	0	1	0	0	0	x	0	x	1	x
8	0	0	0	0	0	0	x	0	x	x	1

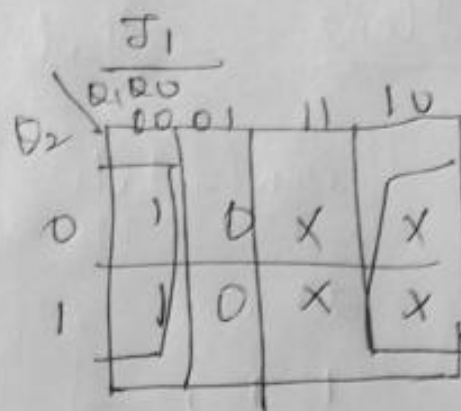
## Steph map (3m)



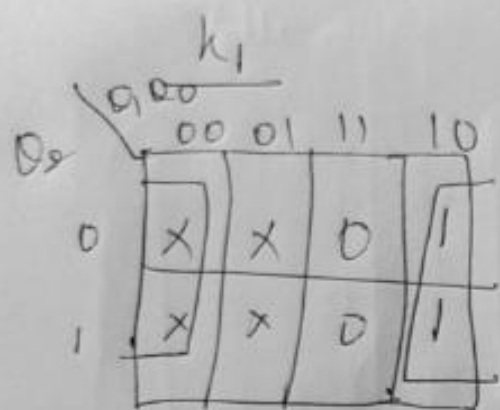
$$J_2 = \bar{Q}_1 \bar{Q}_0$$



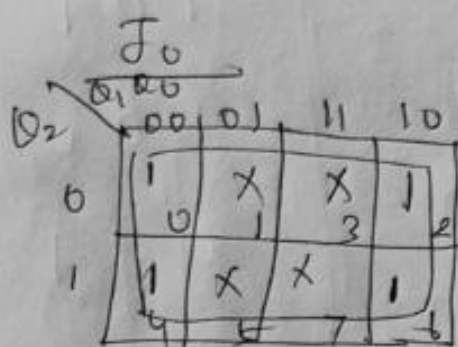
$$K_2 = \bar{Q}_1 \bar{Q}_0$$



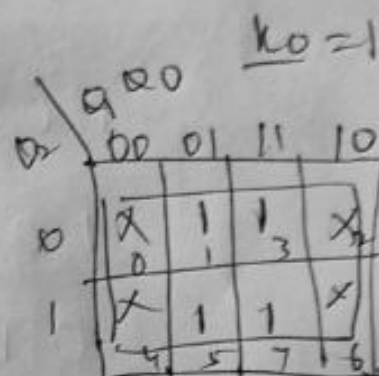
$$J_1 = \bar{Q}_0$$



$$K_1 = \bar{Q}_1$$

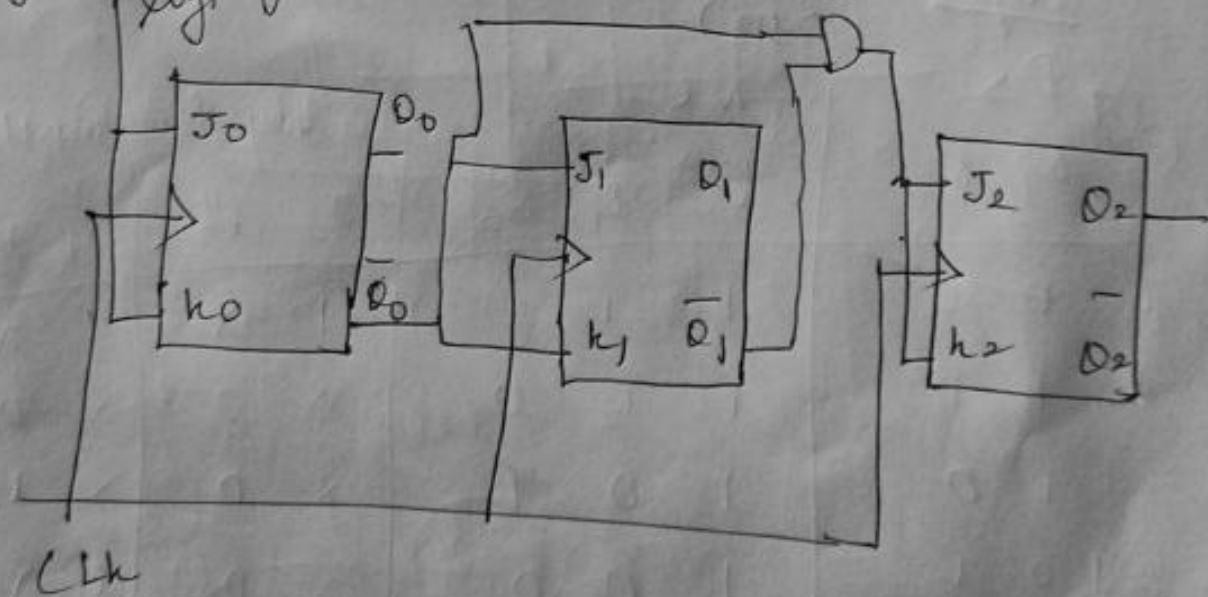


$$J_0 = 1$$



$$K_0 = 1$$

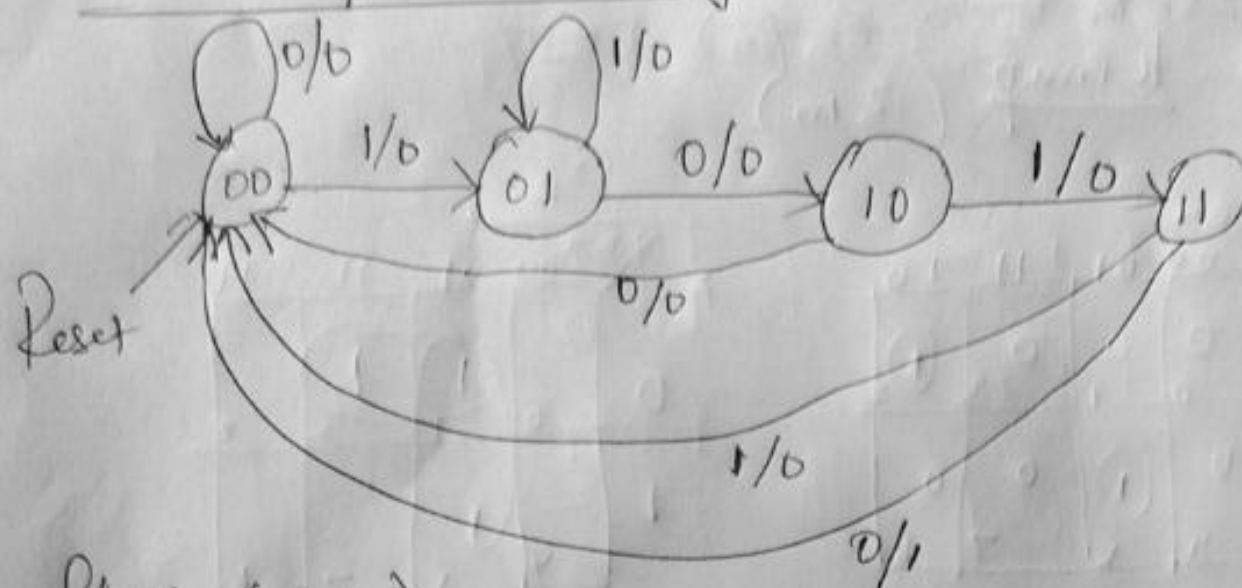
## Logic diagram (2m)





(3)

1010 non overlapping (2 mark)

Step 2 (3m)

Present state		Input	Next state		Flipflop F/P		O/P
A	B	X	A <sub>(t+1)</sub>	B <sub>(t+1)</sub>	D <sub>A</sub>	D <sub>B</sub>	Y
0	0	0	0	0	0	0	0
1	0	1	0	1	0	1	0
2	0	0	1	0	1	0	0
3	0	1	0	1	0	1	0
4	1	0	0	0	0	0	0
5	1	1	1	1	1	1	0
6	1	0	0	0	0	0	1
7	1	1	0	0	0	0	0

### Step 3 kmap (3m)

$D_A$

	$Bx$			
	00	01	11	10
A				
0	0	0	0	1
1	0	1	0	0
	4	5	7	6

$$D_A = \bar{A}B\bar{x} + AB\bar{x}$$

$D_B$

	$Bx$			
	00	01	11	10
A				
0		1	1	
1				
	4	5	7	6

$$D_B = \bar{A}x + \bar{B}x$$

	$y$			
	00	01	11	10
A				
0	0	0	0	0
1	0	0	0	1
	4	5	7	6

$$y = ABx$$

logic diagram (2m)