

PART A: 15 OBJECTIVE QUESTIONS [Total mark 15 points]

1. =A= =B= =C= =D=
2. =A= =B= =C= =D=
3. =A= =B= =C= =D=
4. =A= =B= =C= =D=
5. =A= =B= =C= =D=
6. =A= =B= =C= =D=
7. =A= =B= =C= =D=
8. =A= =B= =C= =D=
9. =A= =B= =C= =D=
10. =A= =B= =C= =D=
11. =A= =B= =C= =D=
12. =A= =B= =C= =D=
13. =A= =B= =C= =D=
14. =A= =B= =C= =D=
15. =A= =B= =C= =D=

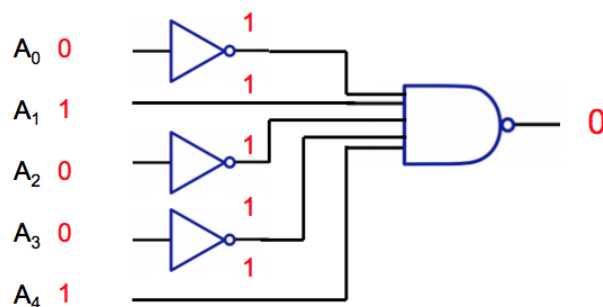
PART B: 4 SUBJECTIVE QUESTIONS [Total mark 85 points]

Question 1 [15 Marks]

(a)

Pin Label (i)	Input		Carry Out	Sum
	A_i	B_i	C_i	S_i
1	1	0	0	1
2	1	1	1	0
3	0	1	1	0
4	0	0	0	1

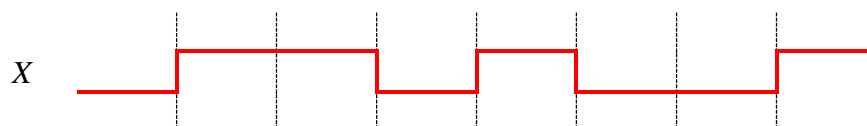
(b)



(c)

BCD Input				Segment Output							Display
A	B	C	D	a	b	c	d	e	f	g	
0	1	0	0	0	1	1	0	0	1	0	4
0	1	1	1	1	1	1	0	0	0	0	7
1	0	0	1	1	1	1	1	0	1	1	9

(d)



Question 2 [15 Marks]

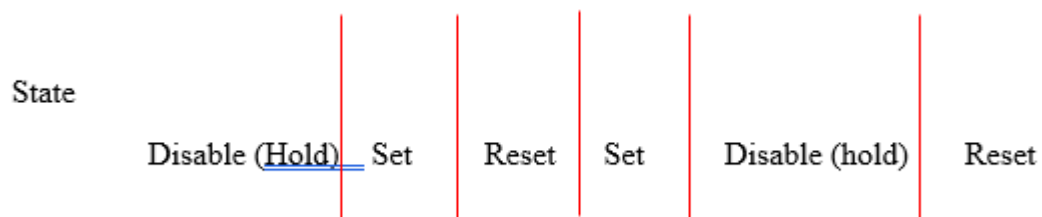
(a)

(i)

Input		Output		State
A	B	Q	\bar{Q}	
0	0	NC	NC	No change
0	1	0	1	Latch RESET
1	0	1	0	Latch SET
1	1	0	0	Invalid

(ii) SR Latch, Active High SR Latch

(b)



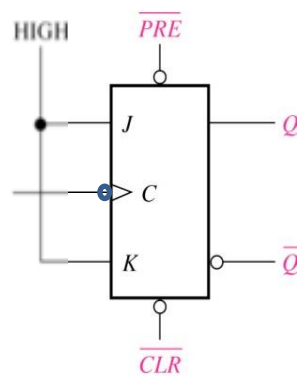
(c) (i)



(ii)

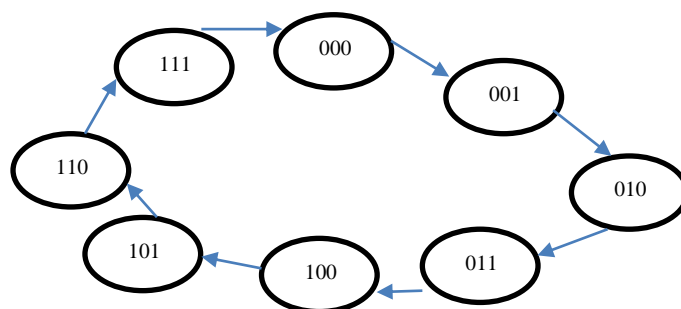
PRE, CLR
CLK
JK

(d)

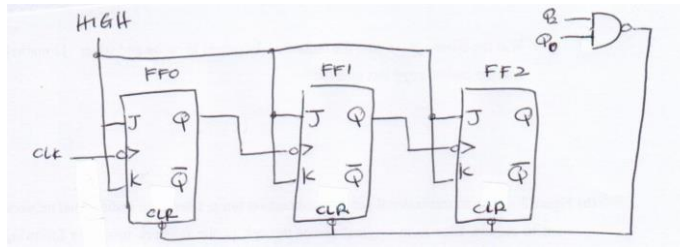


Question 3 [40 Marks]

(a)



(b)



(c) (i)

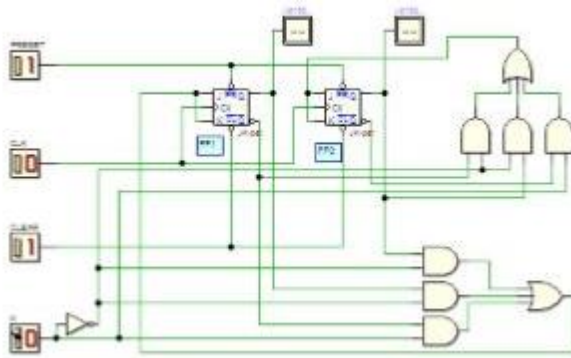
m	Present State		Next State		FF1	FF0
	Q1	Q0	Q1	Q0		
0	0	0	0	1	0	1
0	0	1	1	0	1	1
0	1	0	0	0	1	0
0	1	1	0	0	1	1
1	0	0	1	1	1	1
1	0	1	1	1	1	0
1	1	0	1	1	0	1
1	1	1	1	1	0	0

$$T1 = m'.Q0 + m'.Q1 + m.Q1'$$

$$T0 = m'.Q1' + m.Q0' + m'.Q0$$

(ii)

(iii)



(d) (i)

$$Q1_+ = D1 = \text{Cnt XOR } Q1$$

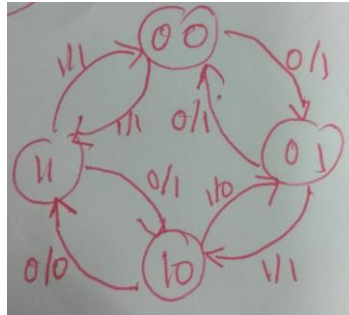
$$Q0_+ = D0 = (\overline{Q0})$$

$$Y = Q0 + \overline{Q1}$$

(ii)

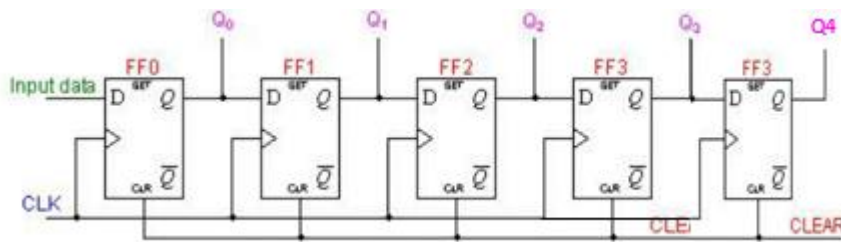
Input, Cnt	Present State		Next State		Output, Y
	Q1	Q0	Q1 ₊ = D1	Q0 ₊ = D0	
0	0	0	0	1	1
0	0	1	0	0	1
0	1	0	1	1	0
0	1	1	1	0	1
1	0	0	1	1	1
1	0	1	1	0	1
1	1	0	0	1	0
1	1	1	0	0	1

(iii)



Question 4 [15 Marks]

(a) (i)

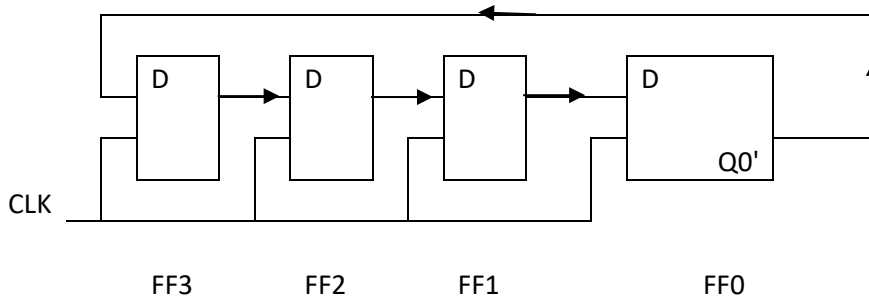


(ii)



(iii) After 5 clock cycle data can be read at the output. 10011

(b) (i)



(ii)

	Q3	Q2	Q1	Q0	Q0'
Clock, t	FF3	FF2	FF1	FF0	Q0'
Initial	0	0	0	0	1
1	1	0	0	0	1
2	1	1	0	0	1
3	1	1	1	0	1
4	1	1	1	1	0
5	0	1	1	1	0
6	0	0	1	1	0
7	0	0	0	1	0
8	0	0	0	0	1