Q1 (a):-

1 1101
0110

0001 0011 0110

1011
0110
1 0001

1001
0001
1010
1 0110
0001 0000

0001 0000 0001
0001 0011 0110

0010 0011 0111

b):-

0	0	0	0	0	1	1	0	0	0
0	0	0	0	1	1	1	0	1	1
0	0	0	1	0	1	1	1	0	0
0	0	0	1	1	1	1	1	0	1
0	0	1	0	0	1	1	1	1	0
0	0	1	0	1	1	1	1	1	1
0	0	1	1	0					
0	0	1	1	1					
0	1	0	0	0					
0	1	0	0	1					
0	1	0	1	0					
0	1	0	1	1					
0	1	1	0	0					
0	1	1	0	1					
0	1	1	1	0					
0	1	1	1	1					
1	0	0	0	0					
1	0	0	0	1					
1	0	0	1	0					
1	0	0	1	1					
1	0	1	0	0					
1	0	1	0	1					
1	0	1	1	0					
1	0	1	1	1					
1	1	0	0	0					
1	1	0	0	1					

1 1 0 0 0

1 1 0 1 1

1 1 1 0 0

1 1 1 0 1

1 1 1 1 0

1 1 1 1 1

1 1 0 1 1

↓

1 0 1 1 0

1 1 1 0 0

↓

1 0 0 1 0

1 1 1 0 1

↓

1 0 0 1 1

1 1 1 1 0

↓

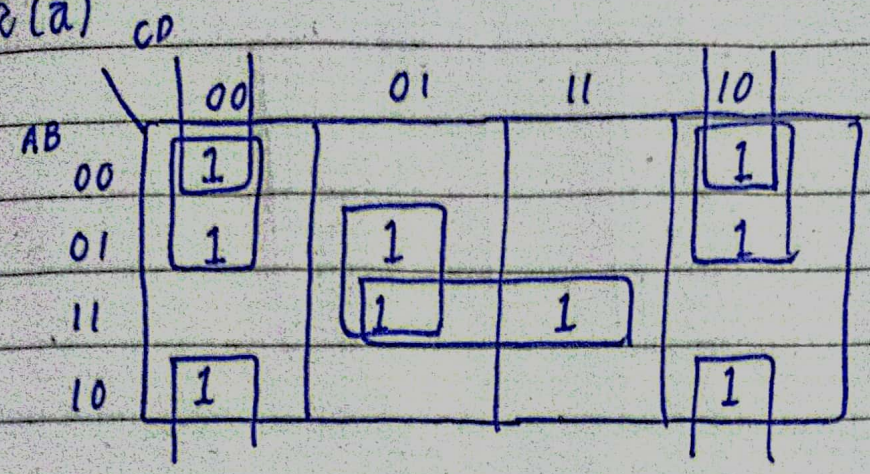
1 0 0 0 1

1 1 1 1 1

↓

1 0 0 0 0 0

2(a)



$$\bar{B}\bar{C}\bar{D} + \bar{A}\bar{C}\bar{D} + B\bar{C}D + ABD + \bar{B}C\bar{D} + \bar{A}C\bar{D}$$

b):-

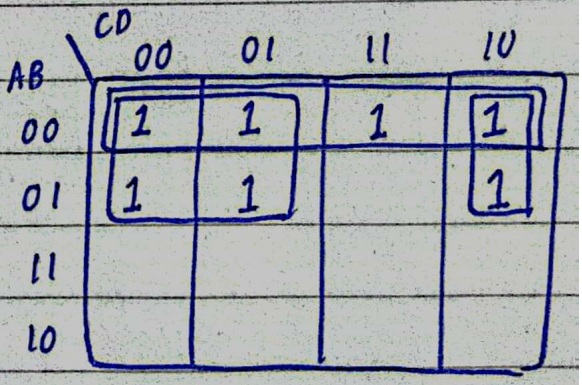
c):-

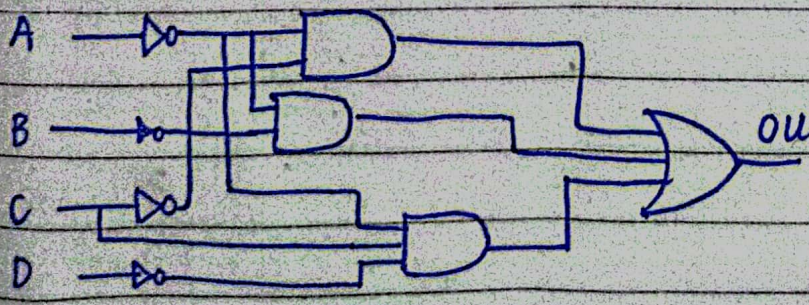
i):-

Assuming

A B C D

MSB ← LSB





$$\bar{A}\bar{C} + \bar{A}\bar{B} + \bar{A}C\bar{D}$$

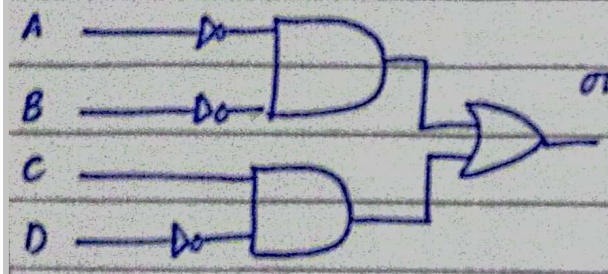
ii):-

assuming

A B C D

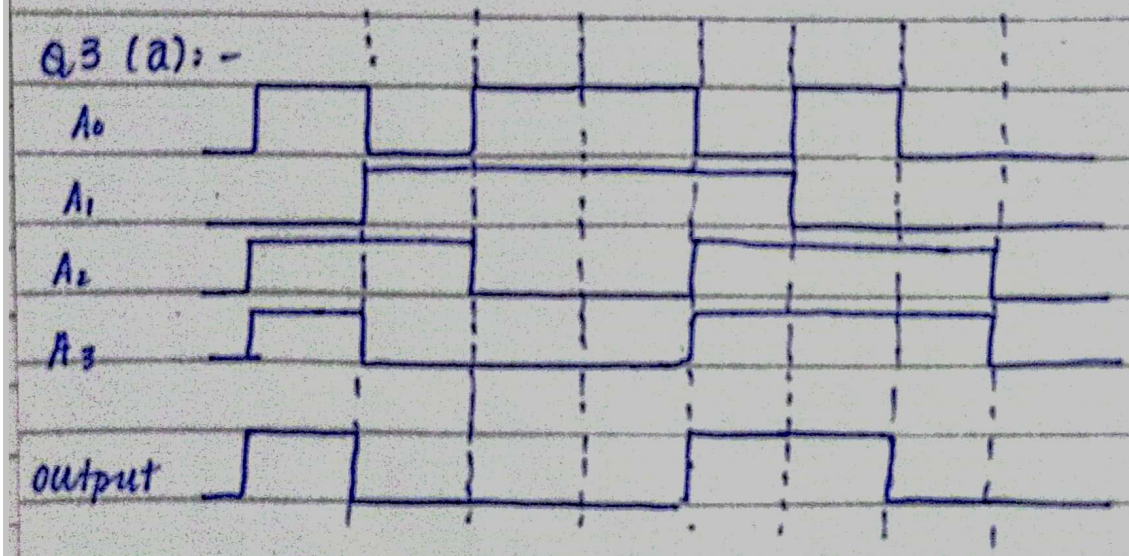
MSB ← LSB

AB \ CD	00	01	11	10
00	1			1
01	1			1
11	1			1
10	1			1

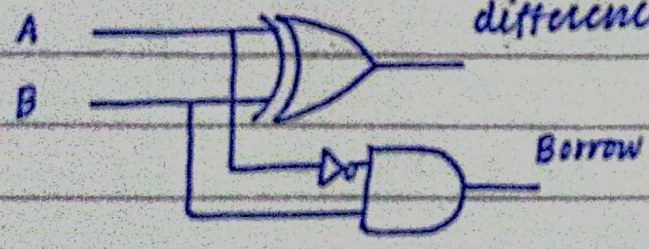


$\bar{A}\bar{B} + C\bar{D}$

Q3 (a):-



b):-



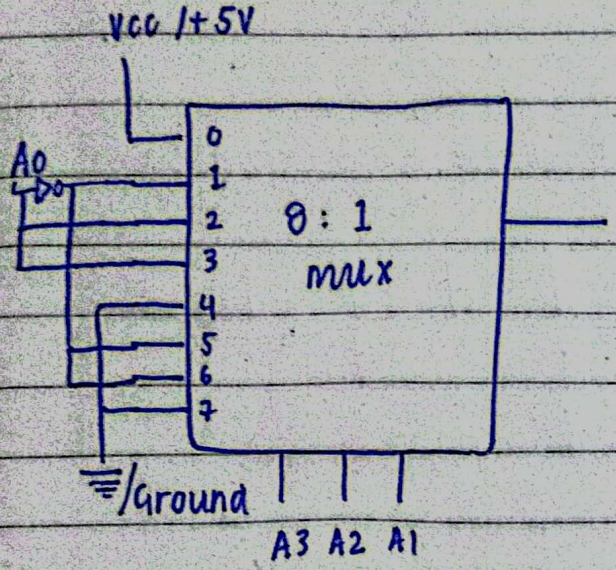
c):-

$X(A3, A2, A1, A0) = \Sigma(0, 1, 2, 5, 7, 10, 12)$

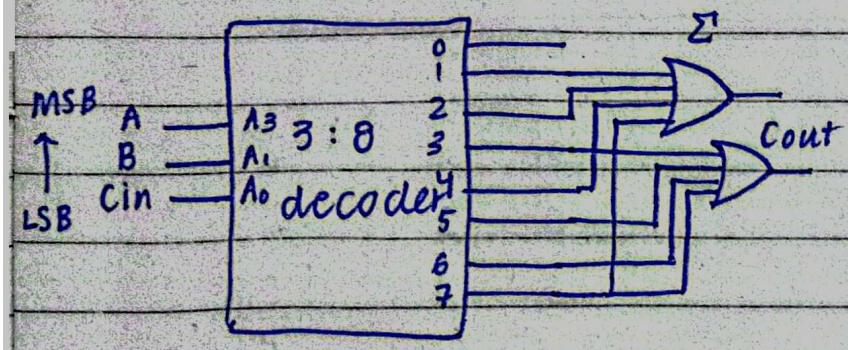
A3A2 \ A1A0	00	01	11	10
00	1	1		1
01		1	1	
11	1			
10				1

Analysis of A0 with respect to A3, A2, A1

A3	A2	A1	output
0	0	0	1 always
0	0	1	A0
0	1	0	A0
0	1	1	A0
1	0	0	0
1	0	1	$\overline{A0}$
1	1	0	$\overline{A0}$
1	1	1	0



d):-

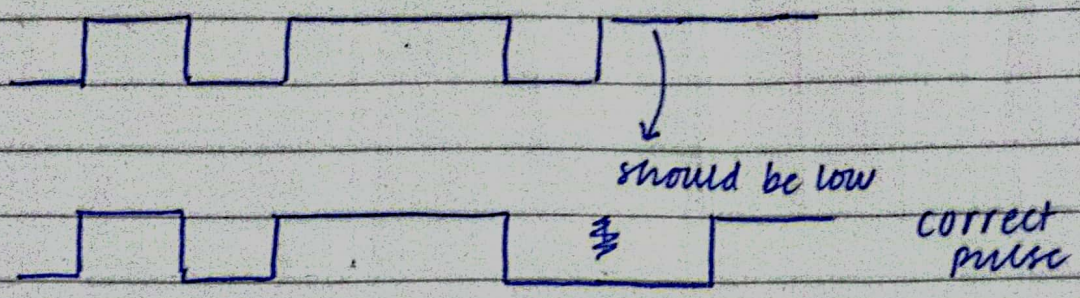


A	B	Cin	Σ	Co
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	
1	0	0	1	
1	0	1	0	
1	1	0	0	
1	1	1	1	

Q4

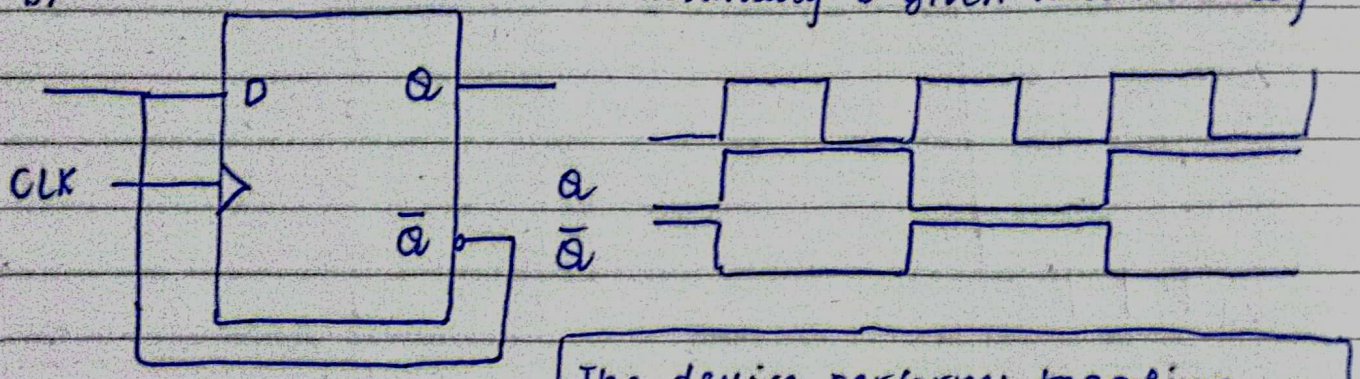
a):-

output corresponding to the sixth clock pulse is faulty



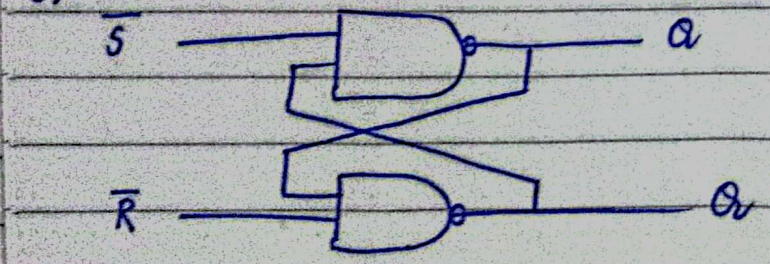
b):-

Assuming D given zero initially



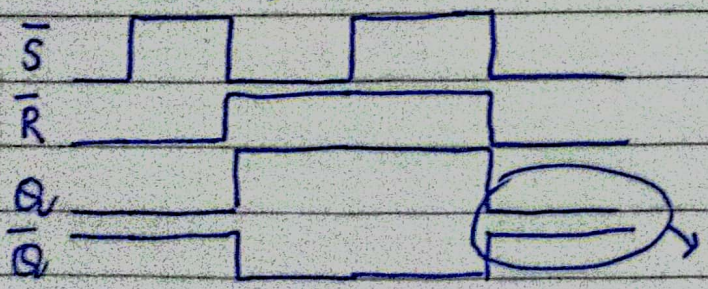
The device performs toggling at positive edges of clock pulses

c):-



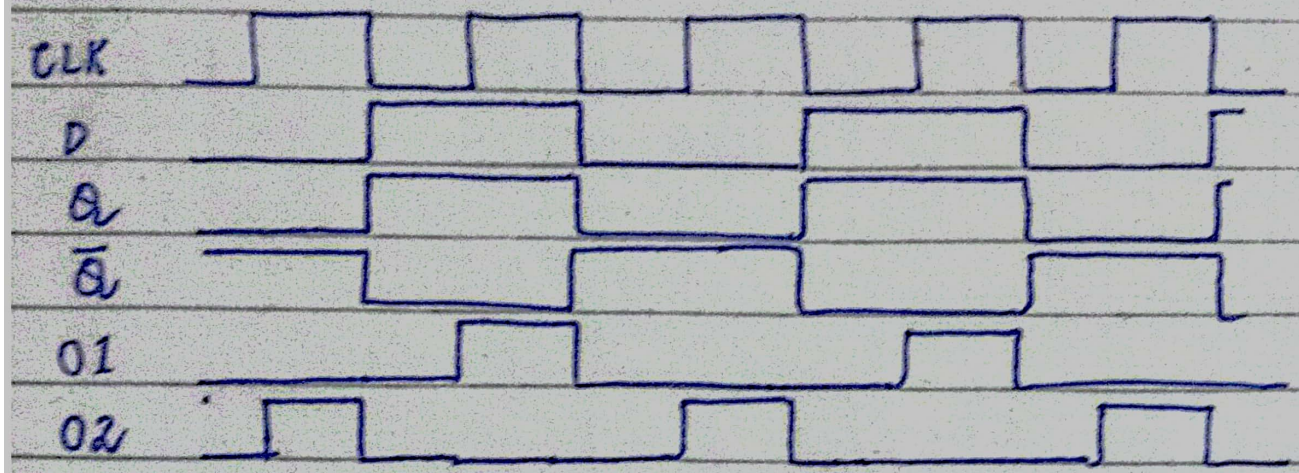
$\bar{S}$	$\bar{R}$	Q	$\bar{Q}$
0	1	1	0
1	0	0	1
1	1	Q	$\bar{Q}$
0	0	invalid	

Assuming Q to be low initially



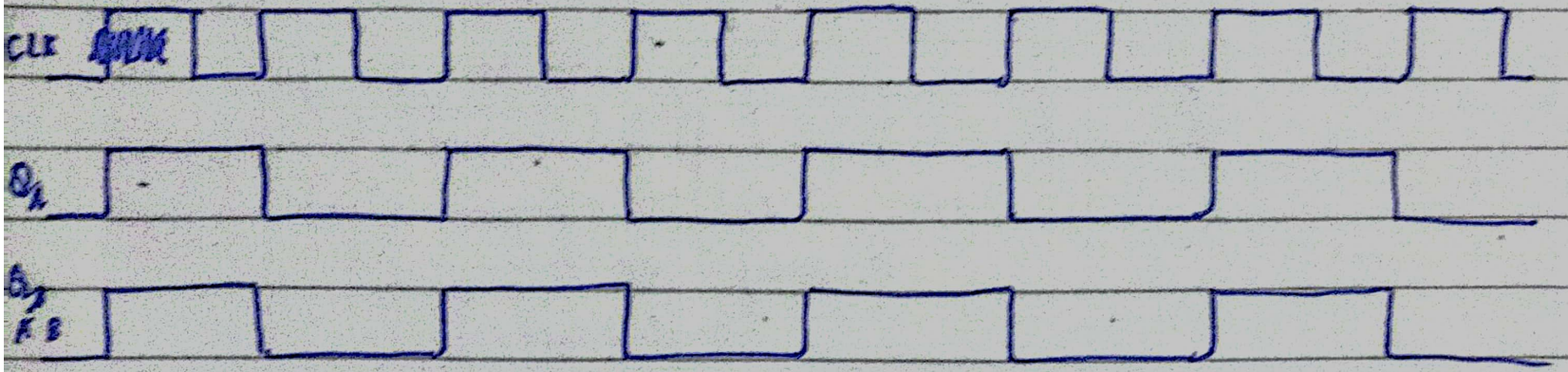
hold state / no change

Q4 (d)



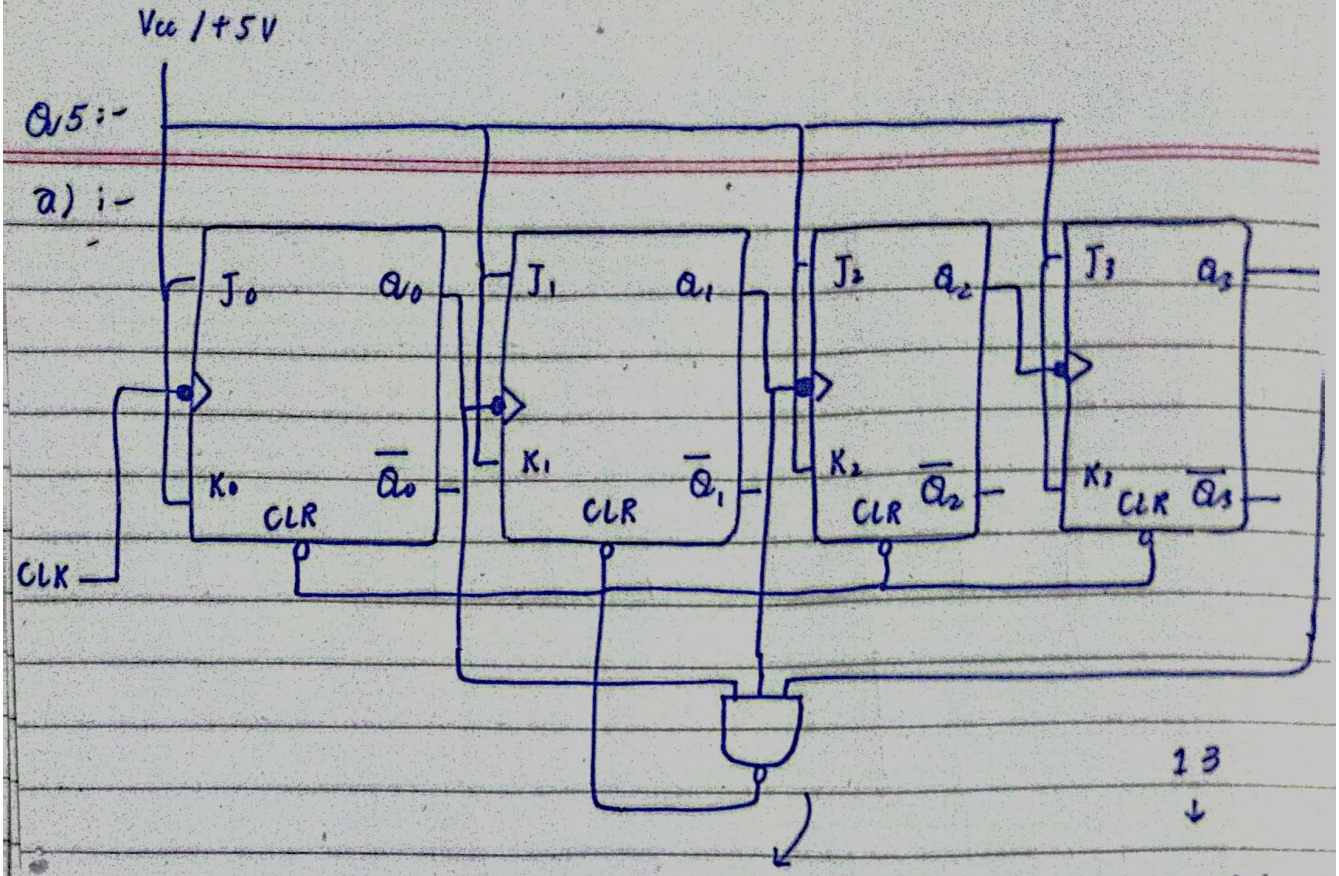
no space for explain

(e)



Q5:-

a) i-



13

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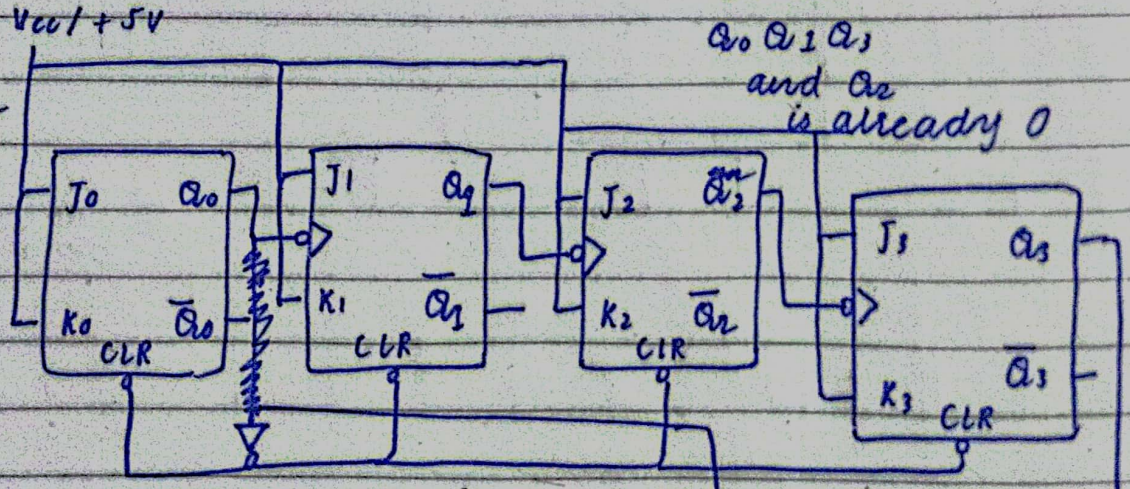
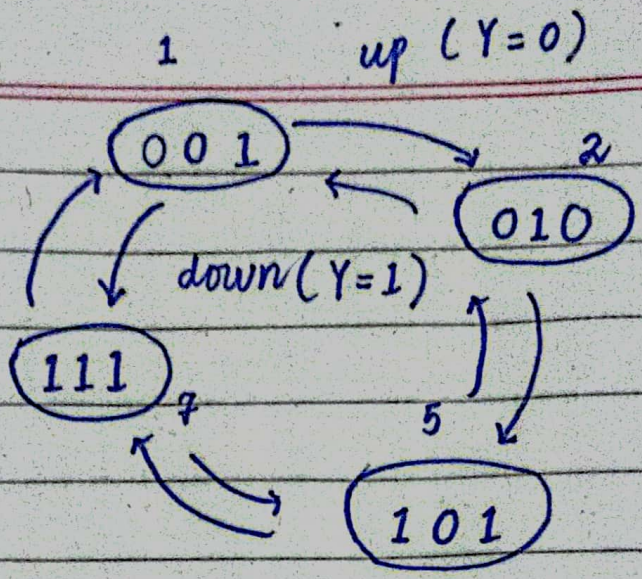
1101

since no other state has 1's on $Q_0 Q_1 Q_3$ and Q_2 is already 0

(ii):-



since Q_{13} is only 1 on 8 and others are already 0



J-K 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

Circuit Excitation Table

Y	Q_3	Q_2	Q_1	Q_3^*	Q_2^*	Q_1^*	J_3	J_2	J_1	K_3	K_2	K_1
0	0	0	1	0	1	0	0	1	X	X	X	1
0	0	1	0	1	0	1	1	X	1	X	1	X
0	1	0	1	1	1	1	X	1	X	0	X	0
0	1	1	1	0	0	1	X	X	X	1	1	0
1	0	0	1	1	1	1	1	1	X	X	X	0
1	0	1	0	0	0	1	0	X	1	X	1	X
1	1	0	1	0	1	0	X	1	X	1	X	1
1	1	1	1	1	0	1	X	X	X	0	1	0

YQ_3 \ Q_2Q_1	00	01	11	10
00	X	0	X	1
01	X	X	X	X
11	X	X	X	X
10	X	1	X	0

J_3

YQ_3 \ Q_2Q_1	00	01	11	10
00	X	1	X	X
01	X	1	X	X
11	X	1	X	X
10	X	1	X	X

J_2

YQ_3 \ Q_2Q_1	00	01	11	10
00	X	X	X	1
01	X	X	X	X
11	X	X	X	X
10	X	X	X	1

J_1

YQ_3 \ Q_2Q_1	00	01	11	10
00	X	X	X	X
01	X	0	1	X
11	X	1	0	X
10	X	X	X	X

K_3

YQ_3 \ Q_0Q_1	00	01	11	10
00	X	X	X	1
01	X	X	1	X
11	X	X	1	X
10	X	X	X	1

K_2

YQ_3 \ Q_2Q_1	00	01	11	10
00	X	1	X	X
01	X	0	0	X
11	X	1	0	X
10	X	0	X	X

K_1

$J_3 = \overline{Q_2} + Q_1$ $\quad K_3 = \overline{Q_2} + Q_1$

$J_2 = 1$ $\quad K_2 = 1$

$J_1 = 1$ $\quad K_1 = \overline{Y}\,\overline{Q_3} + Y Q_3 \overline{Q_2}$