Solution Tutorial 7

Ans 1

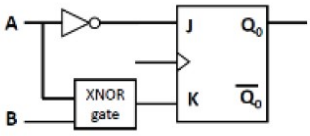
Characteristics Table of AB FF				Excitation Table of JK FF	
A	B	Qn	Qn+1	J	K
0	0	0	1	1	X
0	0	1	0	X	1
0	1	0	1	1	X
0	1	1	1	X	0
1	0	0	0	0	X
1	0	1	1	X	0
1	1	0	0	0	X
1	1	1	0	X	1

K-map for J

A \ BQ_n	00	01	11	10
0	1	X	X	1
1		X	X	

K-map for K

A \ BQ_n	00	01	11	10
0	X	1		X
1	X		1	X



J = A'

K = A'B' + ABRequired AB- FF using JK FF

Ans 2

D Flip Flop to J-K Flip Flop

Conversion Table

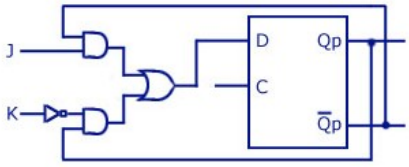
J-K Input J	K	Outputs Qp	Qp+1	D Input
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

K-map

J \ KQp	00	01	11	10
1	0 (0)	1 (1)	0 (3)	0 (2)
1	1 (4)	1 (5)	0 (7)	1 (6)

$D = J\overline{Q}p + \overline{K}Qp$

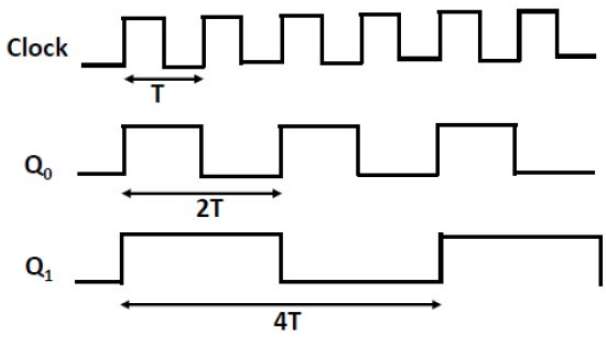
Logic Diagram



Ans 3

Assuming initial outputs (Q_o, Q_1) are logic low (0). Since the FF's are working in toggle mode, therefore, the output waveforms of each flip flop are shown below.

Output frequency = 12 kHz/4 = 3 kHz.



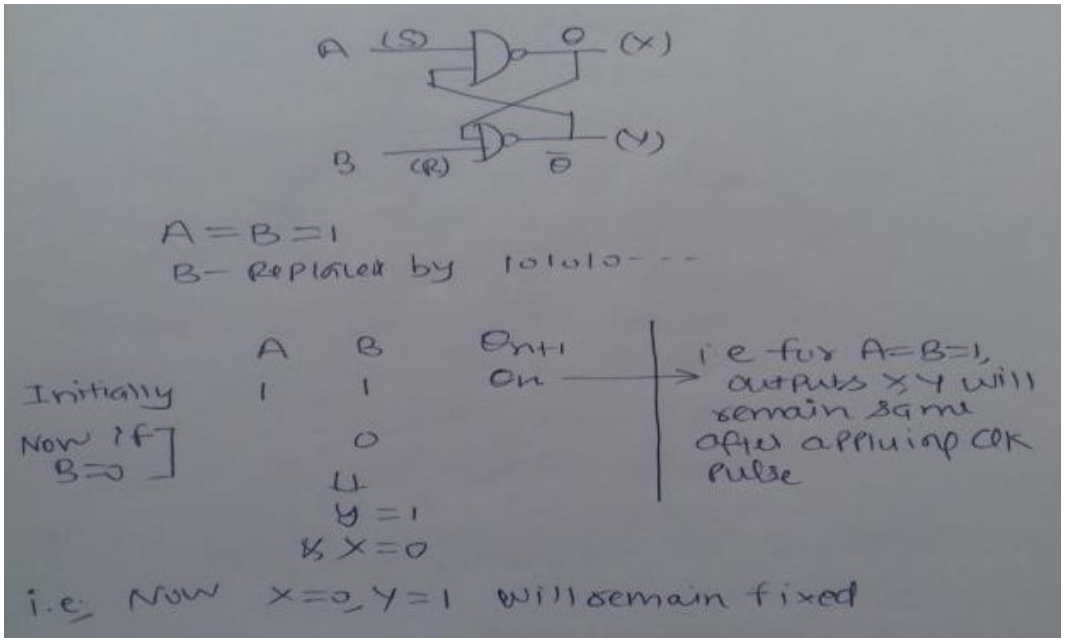
Ans 4

T	$D = T \oplus Q$	$Q+$	
0	Q	Q	Toggle action.
1	$\bar{Q}$	$\bar{Q}$	

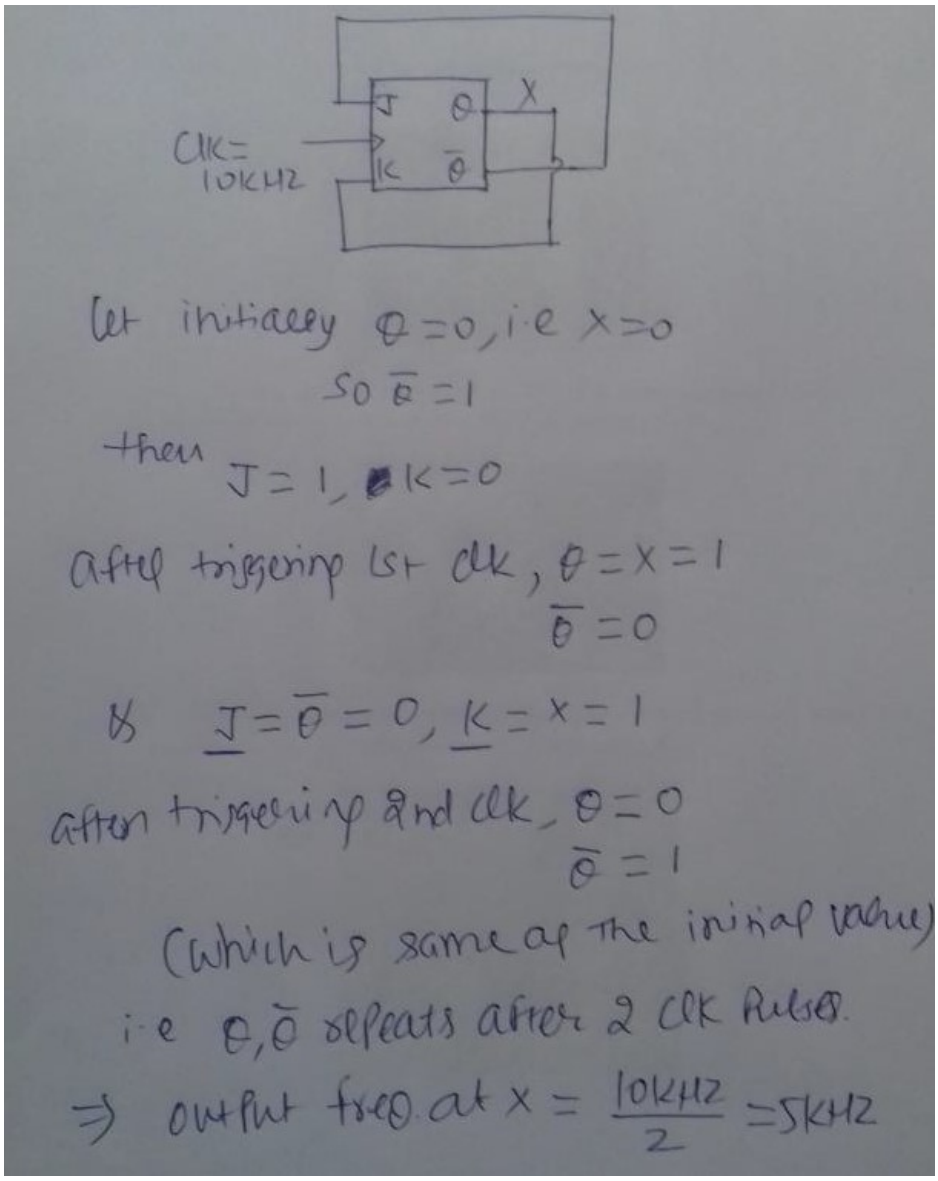
Ans 5

Q	$J = \bar{Q}$	K	$Q+$	
0	1	1	1	After 1st pulse
1	0	1	0	After 2nd pulse
0	1	1	1	After 3rd pulse
1	0	1	0	After 4th pulse
0	1	1	1	After 5th pulse
1	0	1	0	After 6th pulse.

Ans 6



Ans 7



Let initially $Q=0$, i.e $X=0$

So $\bar{Q}=1$

then $J=1$, $K=0$

After triggering 1st clk, $Q=X=1$

$\bar{Q}=0$

& $\underline{J}=\bar{Q}=0$, $\underline{K}=X=1$

after triggering 2nd clk, $Q=0$

$\bar{Q}=1$

(Which is same as the initial value)

i.e $Q, \bar{Q}$ repeats after 2 CLK Pulses.

$\Rightarrow$ output freq. at $X = \frac{10KHz}{2} = 5KHz$