Excitation Table for SR flip flop

Truth table.

S	R	P.S Q_n	N.S Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	Undefined
1	1	1	

Excitation table.

P.S Q_n	N.S Q_{n+1}	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

(00) 0 0 / 0 1 } 0 X

(01) 1 0

(10) 0 1

(11) 0 0 / 1 0 } X 0

Excitation table for D flip flop.

Truth table.

D	Q_n	Q_{n+1}
0	0	0
0	1	0
1	0	1
1	1	1

Excitation table.

Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

0 0 → 0

0 1 → 1

1 0 → 0

1 1 → 1

Excitation Table & JK flip flop.

Truth table.

J	K	Q(n)	Qn+1
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Excitation table.

Qn	Qn+1	J	K
0	0	0	x
0	1	1	x
1	0	x	1
1	1	x	0

(00) 0 0 } 0x (10) 0 1 } x1
0 1 1 x

(01) 1 0 } 1x (11) 0 0 } x0
1 1 1 x

Excitation table for T flip flop.

Truth table.

T	Qn	Qn+1
0	0	0
0	1	1
1	0	1
1	1	0

Excitation table.

Qn	Qn+1	T
0	0	0
0	1	1
1	0	1
1	1	0

00 → 0
01 → 1
10 → 1
11 → 0

Flip flop Conversion

Steps:

- Consider truth table for destination flipflop & extend it as excitation table & source flip flop.
- Draw K-map for source flip flop input variables, it will provide expression for conversion.
- Draw the circuit according to K-map expression

Conversions: SR → D, JK → T, T → D, SR → JK, JK → D, D → T, SR → T

S-R to D flip flop Conversion

Truth table & excitation table.

Truth table of D (i)

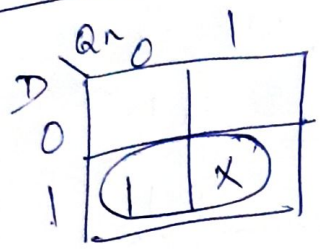
D	Q_n	Q_{n+1}
0	x	0
1	x	1

Excitation table for SR.

Q_n	Q_{n+1}	SR
0	0	0x
0	1	10
1	0	01
1	1	x0

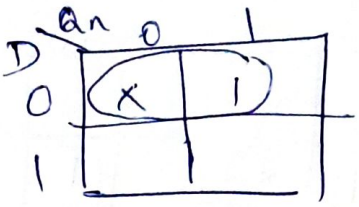
D	Q_n	Q_{n+1}	S	R
0	0	0	0	x
0	1	0	0	1
1	0	1	1	0
1	1	1	x	0

(ii) K-map for S



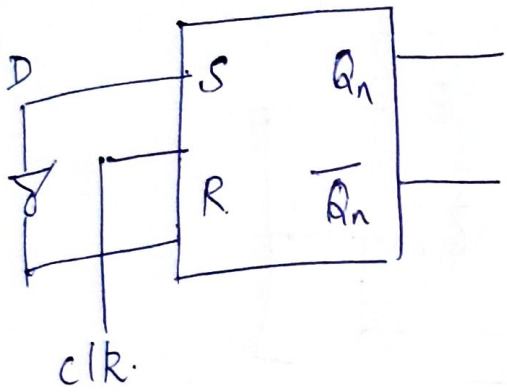
$S = D$

K-map for R.



$R = \overline{D}$

(iii)



S-R to J-K flip flop Conversion

Truth table of J-K.

J	K	Q_n	Q_{n+1}
0	0	X	Q_n
0	1	X	0
1	0	X	1
1	1	X	$\overline{Q_n}$

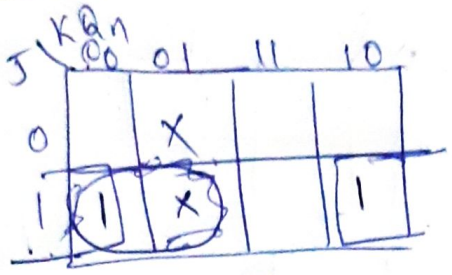
E.T of S R.

Q_n	Q_{n+1}	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

(i)

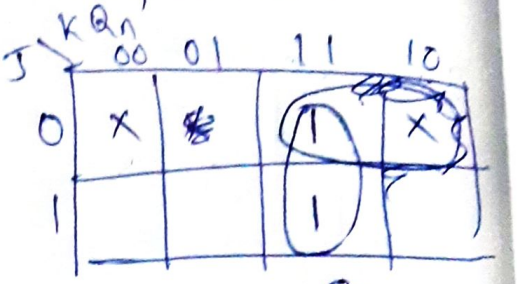
Truth table of JK.				Excitation table of SR.	
J	K	Q_n	Q_{n+1}	S	R
0	0	0	0	0	X
0	0	1	1	X	0
0	1	0	0	0	X
0	1	1	0	0	1
1	0	0	1	1	0
1	0	1	1	X	0
1	1	0	1	1	0
1	1	1	0	0	1

ii) K-map for S



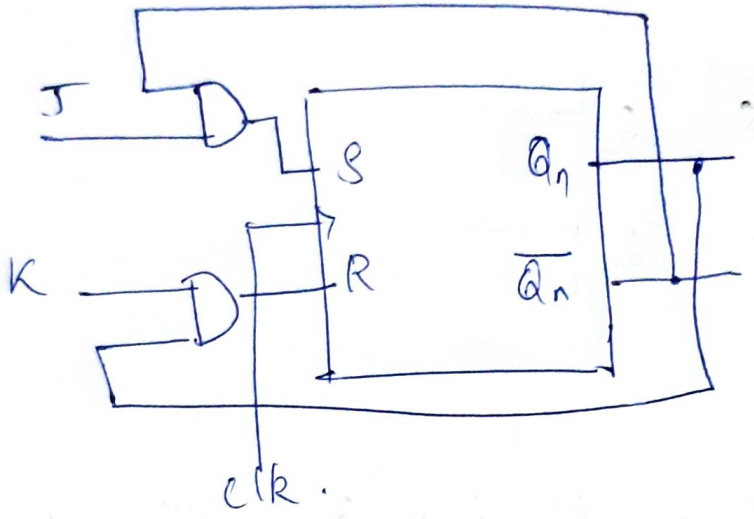
$S = J\bar{Q}_n$

K-map for R



$R = KQ_n$

(iii)



SR flip flop to T flip flop Conversion

T-T & T-F-F

T	Qn	Qn+1
0	0	0
0	1	1
1	0	1
1	1	0

E-T & SR-F-F

Qn	Qn+1	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

(i)

T-T & T		F-T & SR	
T	Qn	Qn+1	S R
0	0	0	0 X
0	1	1	X 0
1	0	1	1 0
1	1	0	0 1

ii) K-map for S

T \ Qn	0	1
0		X
1	1	X

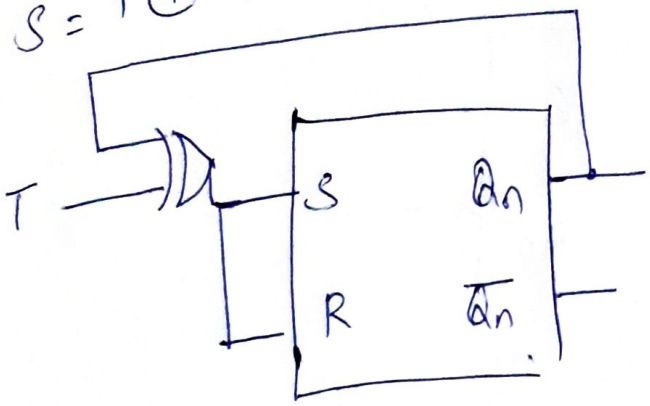
$S = T \oplus Q_n$

K-map for R.

T \ Qn	0	1
0	X	
1		1

$R = T \oplus Q_n$.

iii)



J-K to T flip flop Conversion

T-T & T-F.F — E.T & J.K F.F.

T.T & T.F.F

T	Qn	Qn+1
0	0	0
0	1	1
1	0	1
1	1	0

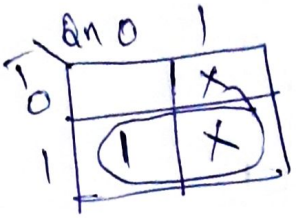
E.T & J.K FF.

Qn	Qn+1	J K
0	0	0 X
0	1	1 X
1	0	X 1
1	1	X 0

ii)

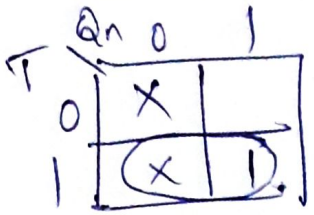
T	Qn	Qn+1	J	K
0	0	0	0	X
0	1	1	X	0
1	0	1	1	X
1	1	0	X	1

(ii) K-map for J:



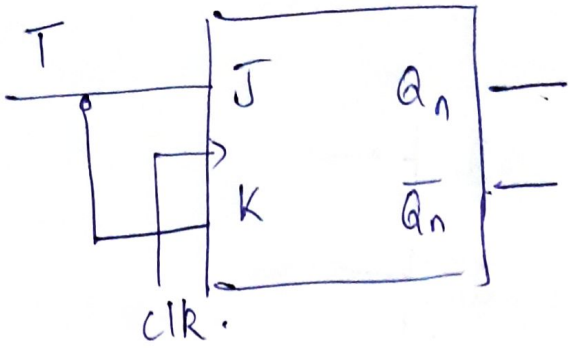
$J = T$

K-map for K



$K = T$

(iii)



J-K to D flip flop Conversion

T.T & D F.F

T	Qn	Qn+1
0	0	0
0	1	0
1	0	1
1	1	1

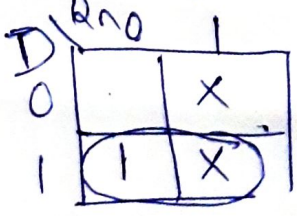
E.T & J.K.

Qn	Qn+1	J K
0	0	0 X
0	1	1 X
1	0	X 1
1	1	X 0

i) T.T & D F.F — E.T & J K F.F

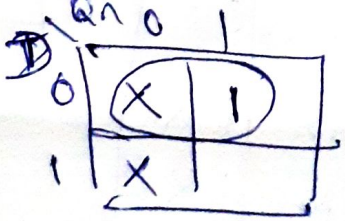
D	Qn	Qn+1	J K
0	0	0	0 X
0	1	0	X 0
1	0	1	1 X
1	1	1	X 0

ii) K-map of J



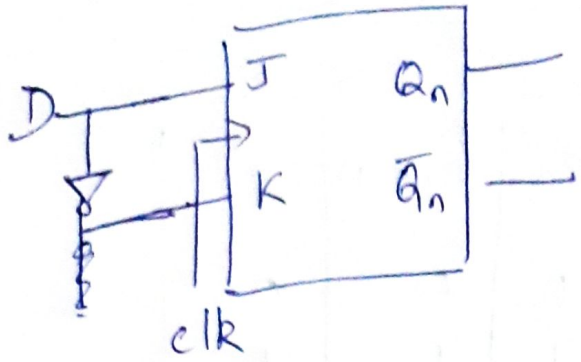
$J = D$

K-map of K



$K = \overline{D}$

iii)



T to D flip flop Conversion

T.T & D.F.F

D	Qn	Qn+1
0	0	0
0	1	0
1	0	1
1	1	1

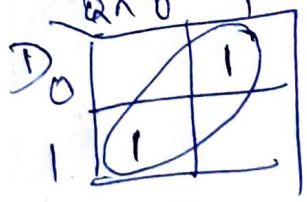
(i) T.T & D.F.F — E.T & T F.F

D	Qn	Qn+1	T
0	0	0	0
0	1	0	1
1	0	1	1
1	1	1	0

E.T & T.F.F

Qn	Qn+1	T
0	0	0
0	1	1
1	0	1
1	1	0

(ii) K-map & T

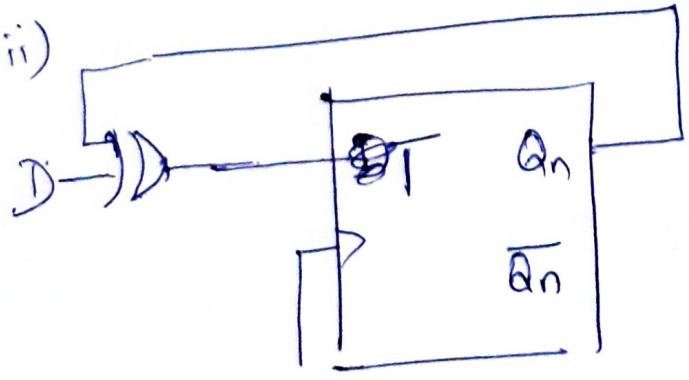


$T = D \oplus Q_n$

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

D Qn T
0 0 → 0 → 0
0 1 → 1 → 0
1 0 → 1 → 1
1 1 → 0 → 1

(iii)



D to T flip flop conversion

T-T & T.

T	Q_n	Q_{n+1}
0	0	0
0	1	1
1	0	1
1	1	0

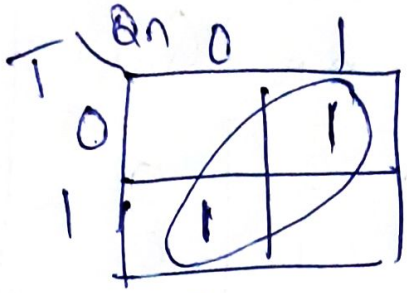
E-T & D F-F.

Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

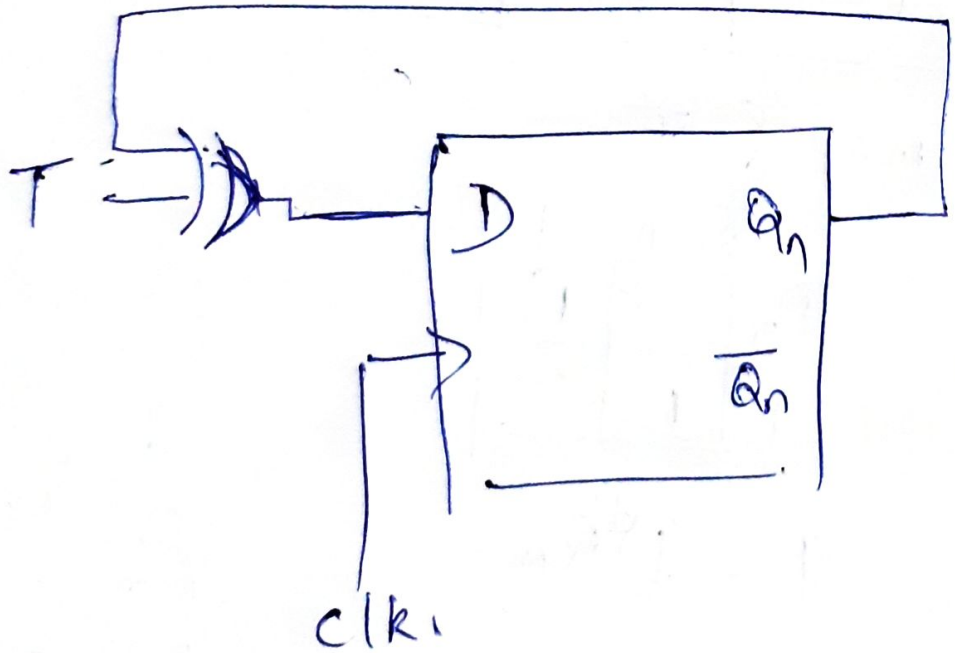
ii)

T	Q_n	Q_{n+1}	D
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

ii) K-map for D



$D = T \oplus Q_n$



T	Q_n	D
0	0 →	0 → 0
0	1 →	1 → 1
1	0 →	1 → 1
1	1 →	0 → 0