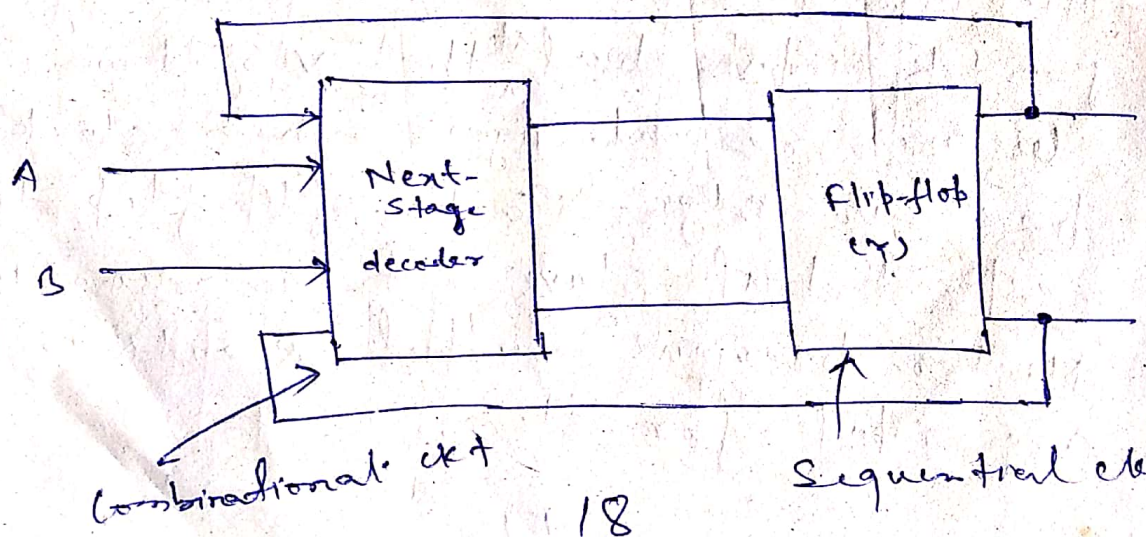
Realisation of One-flip-flop Using another flip-flop.

It is possible to implement a flip-flop using another flip-flop. A basic block diagram for such a realisation is shown in fig. a below —



Working Rule for implementation :-

i) Find Present-state Next state table of the flip-flop (X) that is to be realized or implemented.

ii) Find excitation table of given flip-flop (Y)

iii) Using K-map simplify the logic expression for excitation table.

Realization of D-flip-flop Using S-R flip-flop.

Step:- I PS-NS table for D-flip-flop.

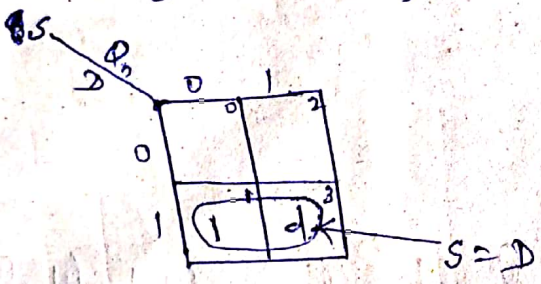
Q_n	D	Q_{n+1}
0	0	0
0	1	1
1	0	0
1	1	1

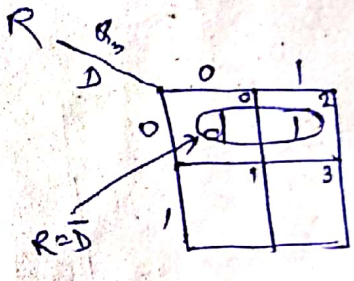
$Q_{n+1} = D$ ← characteristic equation.

Step-II: Excitation table on the basis of PS-NS table of D-flip-flop —

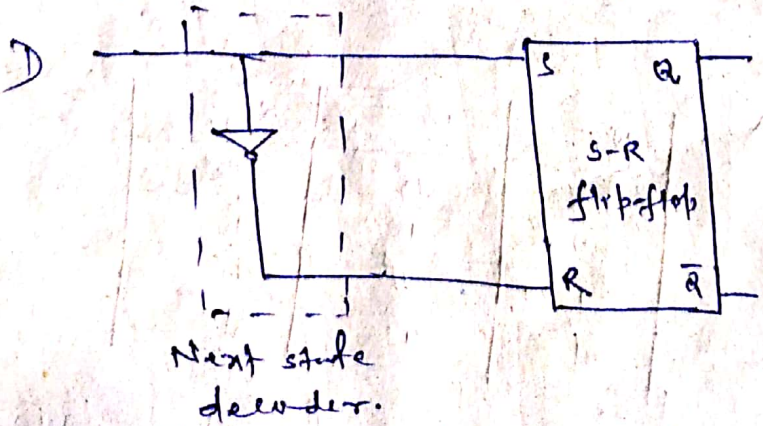
Q_n	D	Q_{n+1}	Excitation table S	R
0	0	0	0	d(0,1)
0	1	1	1	0
1	0	0	0	1
1	1	1	d(0,1)	0

Step-III K-map simplification for S-input —





From above K-map simplification, we can realize D-flip-flop by S-R flip-flop as below —



Realisation of J-K flip-flop by using S-R flip-flop.

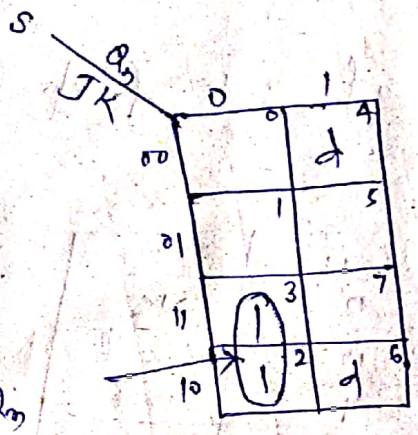
Step:- I. PS-NS table of J-K flip-flop.

Q_n	J	K	Q_{n+1}	Action
0	0	0	0	NC
0	0	1	0	Reset
0	1	0	1	set
0	1	1	1	Toggle
1	0	0	1	NC
1	0	1	0	Reset
1	1	0	1	set
1	1	1	0	Toggle

Step – II. Excitation table of S-R flip-flop corresponding to PS-NS of J-K flip-flop.

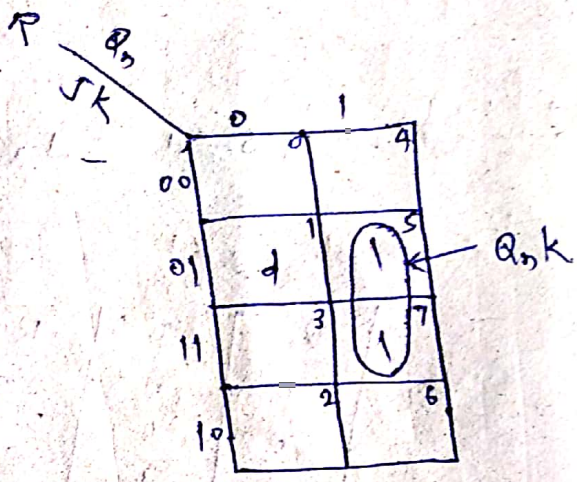
Q_n	J	K	Q_{n+1}	Excitation inputs S	Excitation inputs R
0	0	0	0	0	d(0,1)
0	0	1	0	0	d(0,1)
0	1	0	1	1	0
0	1	1	1	1	0
1	0	0	1	d(0,1)	0
1	0	1	0	0	1
1	1	0	1	d(0,1)	0
1	1	1	0	0	1

Step - III. Simplification of boolean expression by using K-map —

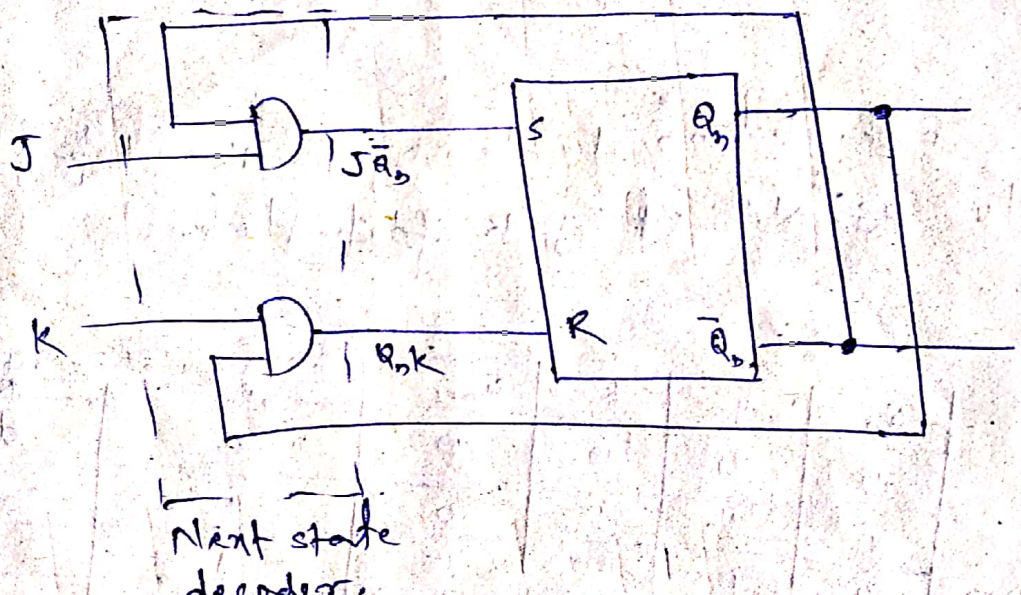


$J\bar{Q}_3$

$S = J\bar{Q}_3$, $R = Q_3K$



Implementation —



Realisation T-flip-flop by using S-R flip-flop

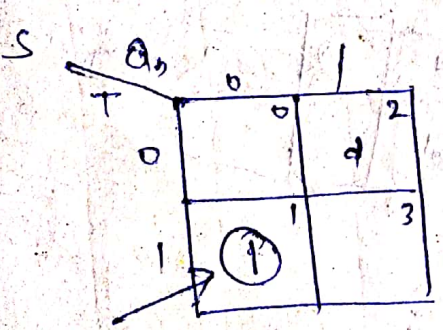
Step-I : PS-NS of T-flip-flop —

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

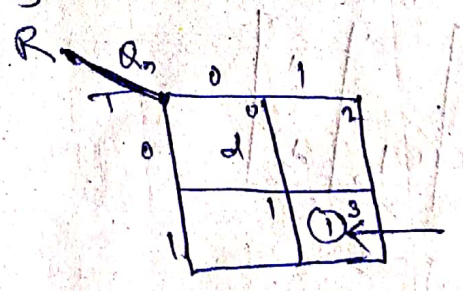
Step-II Excitation table of S-R corresponding to PS-NS table of T-flip-flop.

Q_n	T	Q_{n+1}	Excitation input S	R
0	0	0	0	d(0,1)
0	1	1	1	0
1	0	1	d(0,1)	0
1	1	0	0	1

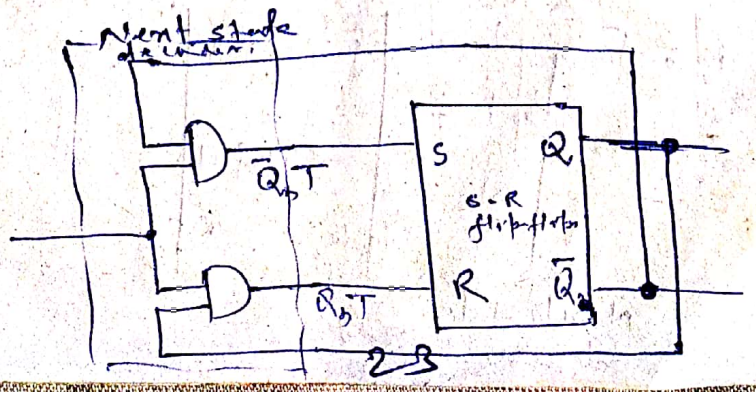
Step-III : Simplification by K-map —



$S = \bar{Q}_n T$



$R = Q_n T$



Realisation of D-flip-flop using J-K flip-flop

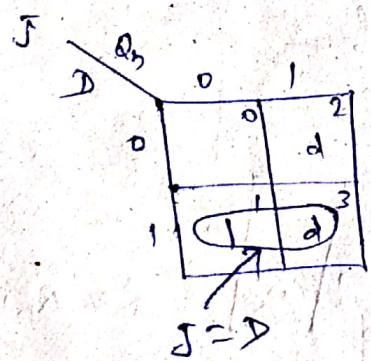
Step-I. PS-NS of D-flip-flop —

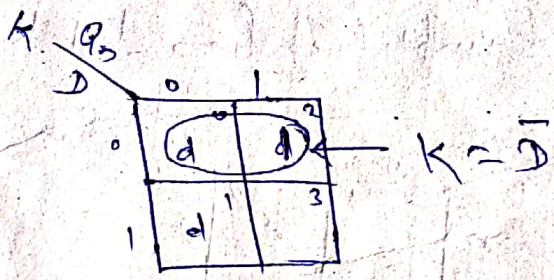
Q_n	D	Q_{n+1}
0	0	0
0	1	1
1	0	0
1	1	1

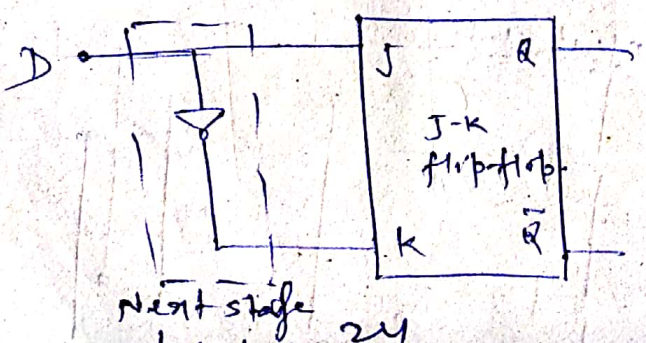
Step-II. Excitation table —

Q_n	D	Q_{n+1}	Excitation inputs J	K
0	0	0	0	d(0,0)
0	1	1	1	d(0,1)
1	0	0	d(1,0)	1
1	1	1	d(1,1)	0

Step-III Simplification —







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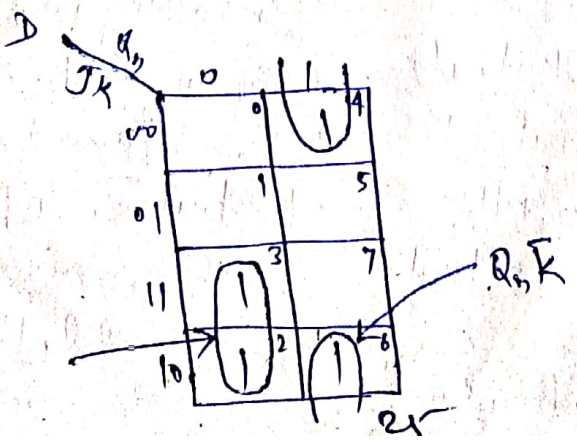
Realisation of J-K flip-flop by using D-flip-flop.

Step-I PS-NS of J-K flip-flop —

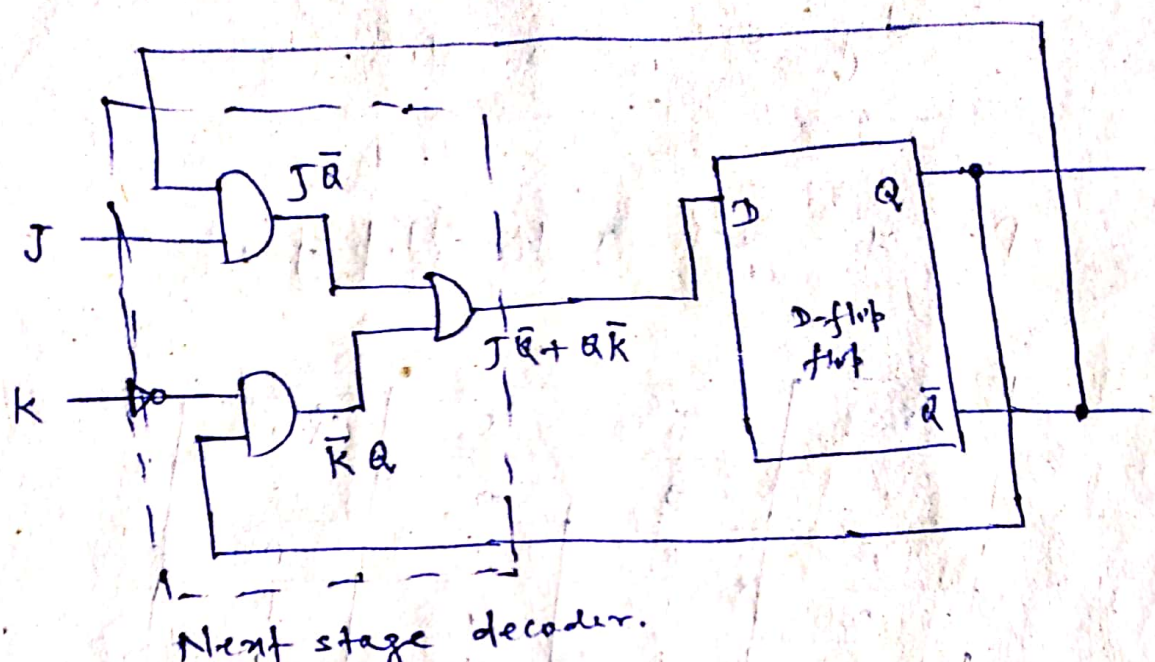
Q_n	J	K	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

Step-II. Excitation table for D-flip-flop.

Q_n	J	K	Q_{n+1}	Excitation inp. D
0	0	0	0	0
0	0	1	0	0
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	0	0
1	1	0	1	1
1	1	1	0	0



$D = J\bar{Q}_n + Q_n\bar{K}$.



Application of flip-flops.

i> Used as Logic unit of memory element

ii> Parallel data storage

iii> Used for frequency division.

iv> Used to construct counter and Register