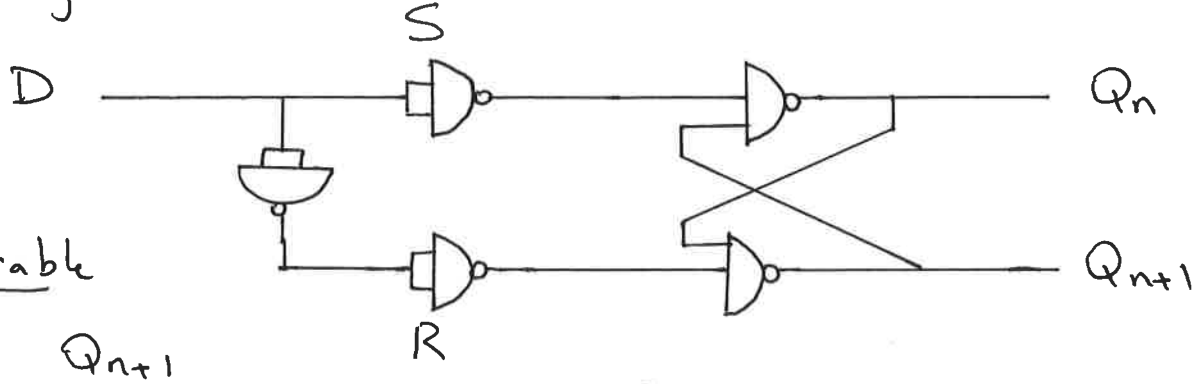
The Logic cct :-



ch/s table

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

Q_n \ D	0	1
0	0	1
1	2	3

$Q_{n+1} = D$ ch/s eq

T Flip_Flop :-

The trigger F.F has one input, T, such that if T=1, the F.F changes state (that is, trigger), and if T=0, the state remains the same.

The truth table of the T/F.F can shown below:-

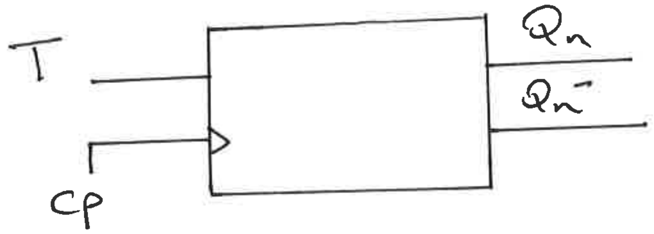
i/p T	present Q_n	next Q_{n+1}
0	0	0
0	1	1
1	0	1
1	1	0

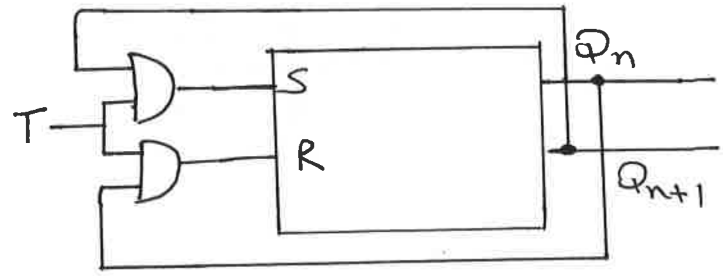
* This means $(Q_{n+1}) = Q_n$ when $T=0$

* $(Q_{n+1}) = \bar{Q_n}$, when $T=1$

$Q_{n+1} = T \oplus Q_n$

The Block Diagram and the cct Diagram of T/F.F is:-





if

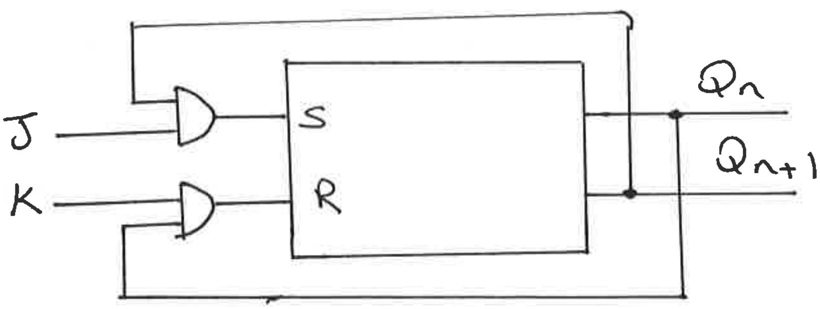
T	Qn	Qn+1
1	0	1

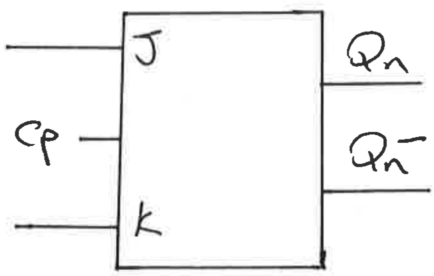
set(1)

T	Qn	Qn+1
1	1	0

J_K Flip_Flip:-

It is the most commonly used type of F.F. it is very similar to SR/F.F except that J.K/F.F allow to used Logic 1 on both inputs J & K, the cct Diagram of J.K/F.F is shown below:-





And the truth table of this type is shown below:-

input J	input K	Present state (Q_n)	Next state (Q_{n+1})	
0	0	0	0	Q_n
0	0	1	1	
0	1	0	0	0
0	1	1	0	
1	0	0	1	1
1	0	1	1	
1	1	0	1	$\bar{Q_n}$
1	1	1	0	

This table can be put in another form such that:-

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

From the cet Diagram, we can conculde that:-

$$S = J\bar{Q_n} \quad , \quad R = K Q_n$$

The ch/s equation of JK/F.F can be:-

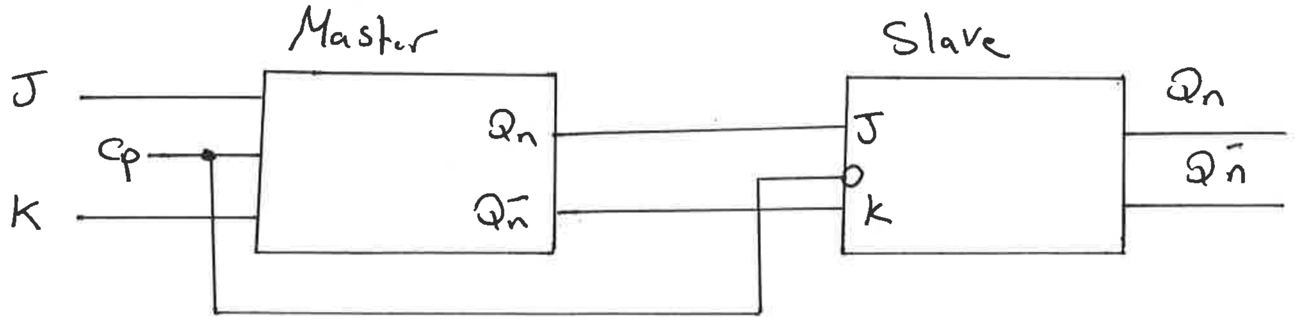
$$Q_{n+1} = J\bar{Q_n} + \bar{K} Q_n$$

Q_n \ JK	00	01	11	10
0			1	1
1	1			1

J-K master-slave F/F :-

A master-slave F.F is a combination of 2 clocked F.F J.K or S-R/F.F.
The first is called "The master" and the second "The slave"
notes that the master is positivly clocked but the slave is negative

The Block Diagram of such Flip-Flop is shown below



Flip-Flop Excitation table:-

The tables of the four standard Flip-Flops can be summeriz as:-

* S-R / F.F

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

* J-K / F.F

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

* D / F.F

D	Q_{n+1}
0	0
1	1

* T / F.F

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

The Excitation table of the same F/F gaves the relation between Q_n and Q_{n+1} as input and the standard i/p as o/p.

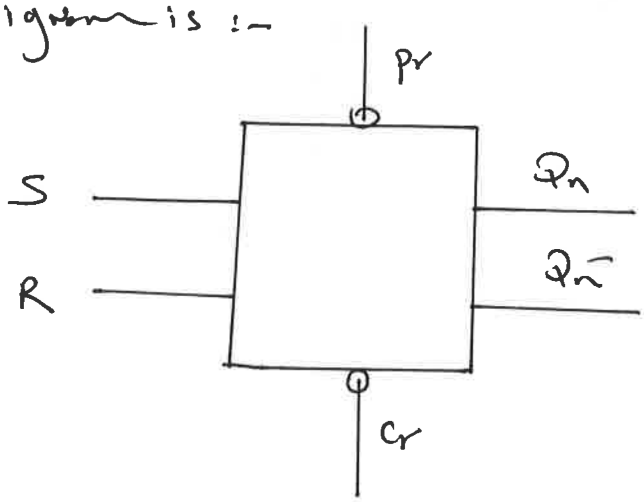
Q_n	Q_{n+1}	S	R	J	K	D	T
0	0	0	d	0	d	0	0
0	1	1	0	1	d	1	1
1	0	0	1	d	1	0	1
1	1	d	0	d	0	1	0

Asynchronous Inputs:-

The S-R inputs or (J-k) are called synchronous i/p's since they only effect the state of the F.F when the clock pulse is present some F.F have either i/ps called preset or set and clear or reset that can be used for setting F.F to logic 1 or reseting to logic zero, by applying the proper signal to the preset and clear inputs.

These inputs can change the state of the F.F regardless of the synchronous i/p of the block

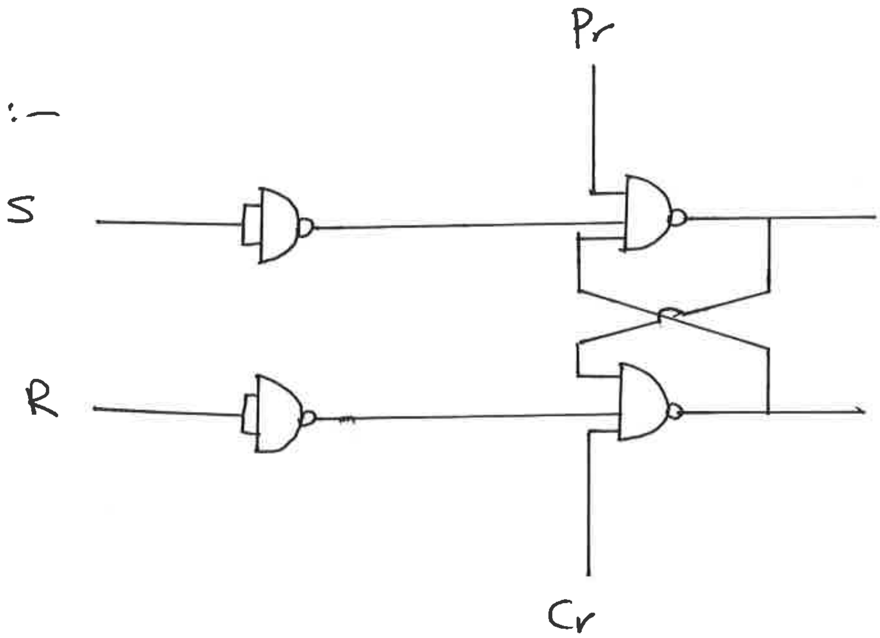
The Block Daigram is :-



The (pr and cr) can be used to determine the primary state of the Flip-Flops o/p or we can setting the F.F at a certain value, regardless of input values of (S, R, J, K), and can put the table as:-

Cr	Pr	Condition (Qn)
0	0	Dont use
0	1	0
1	0	1
1	1	Normal condition

The Logic cct:-



Transformation of Flip-Flops:-

* Transform T/F.F to J-K/F.F

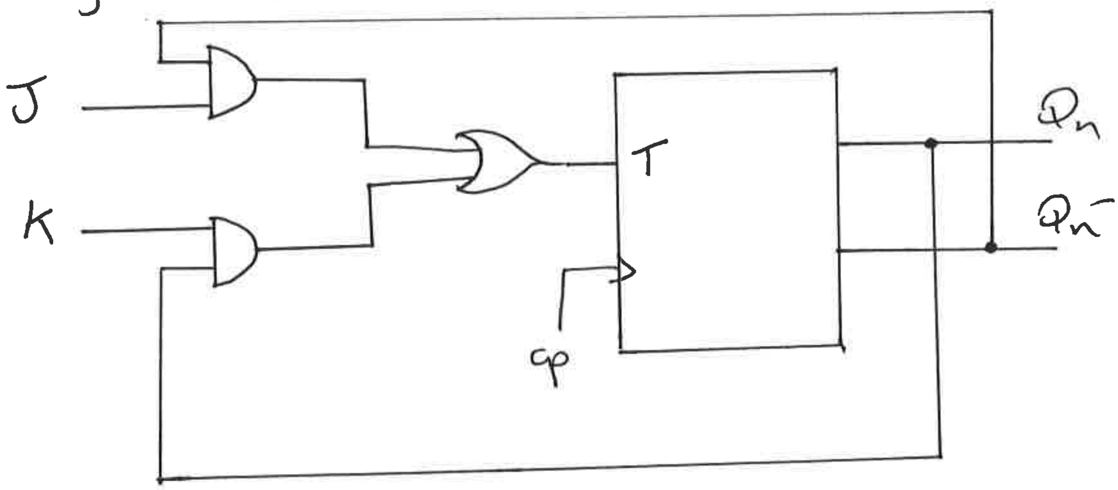
* Truth table of J-K/F.F

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

J \ KQ_n	00	01	11	10
0			1	
1	1		1	1

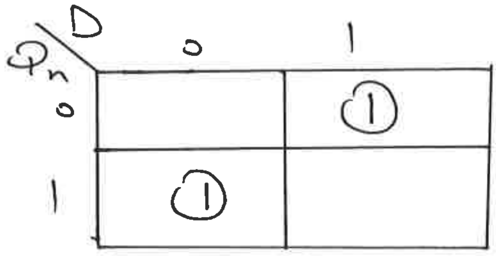
* ch/s eq. $T = KQ_n + J\bar{Q_n}$

* The Logic cct:-



Ex) Transform T/F.F to D/F.F

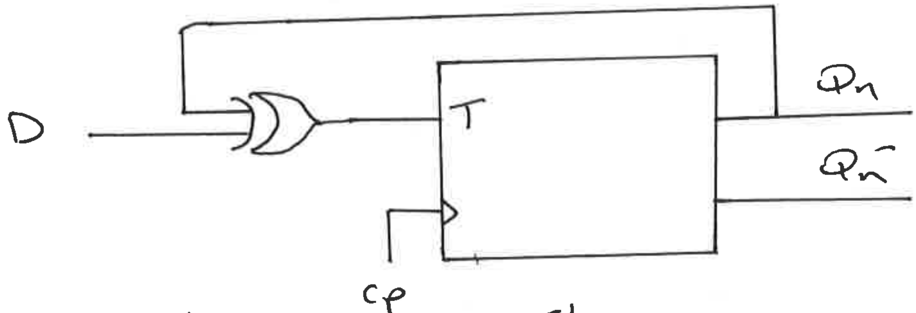
D	Q_n	Q_{n+1}	T
0	0	0	0
0	1	0	1
1	0	1	1
1	1	1	0



ch/s eq $\quad T = \bar{D}Q_n + D\bar{Q_n}$

$= D \oplus Q_n$

Logic cct:-

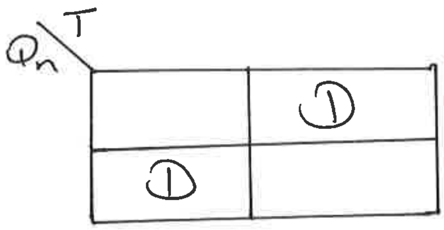


Ex) Transform D/F.F to T/F.F

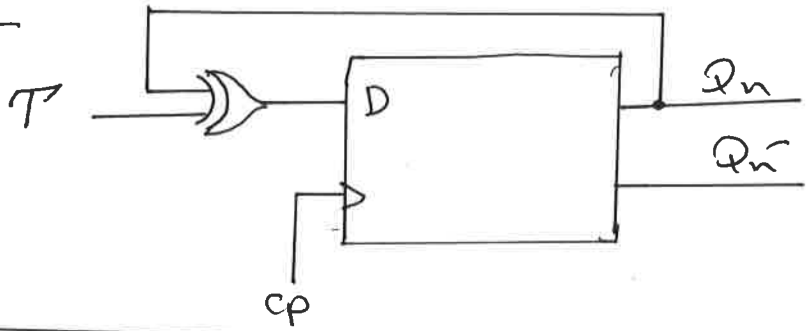
T	Q_n	Q_{n+1}	D
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

$D = \bar{T}Q_n + T\bar{Q_n}$

$= T \oplus Q_n$



Logic cct:-



Ex) Convert S-R/F.F to D/F.F

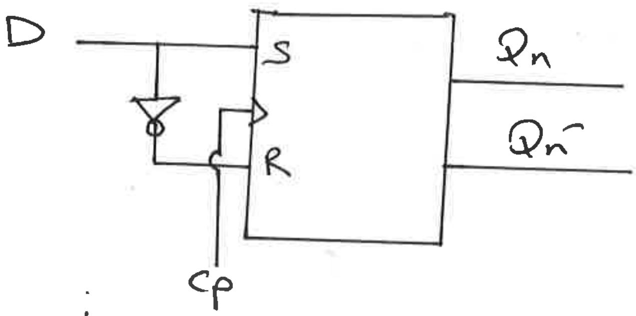
D	Q_n	Q_{n+1}	S	R
0	0	0	0	d
0	1	0	0	1
1	0	1	1	0
1	1	1	d	0

Q_n \ D	0	1
0	0	1
1	0	d

$S = D$

Q_n \ D	0	1
0	d	0
1	1	0

$R = \bar{D}$



Ex) Design T/F.F by using S-R/F.F ?

T	Q_n	Q_{n+1}	S	R
0	0	0	0	d
0	1	1	d	0
1	0	1	1	0
1	1	0	0	1

Q_n \ T	0	1
0	0	1
1	d	0

$S = T\bar{Q_n}$

Q_n \ T	0	1
0	d	0
1	0	1

$R = TQ_n$