



CSE 201: DIGITAL LOGIC DESIGN

D,JK,T FLIP FLOP

Prepared By

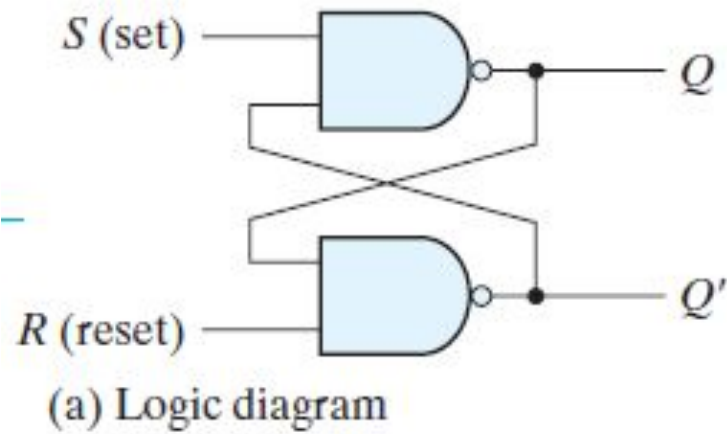
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CSE, MIST



D FLIP-FLOP

SR LATCH WITH NAND GATE



S	R	Q	Q'
1	0	0	1
1	1	0	1
0	1	1	0
1	1	1	0
0	0	Invalid	

Memory

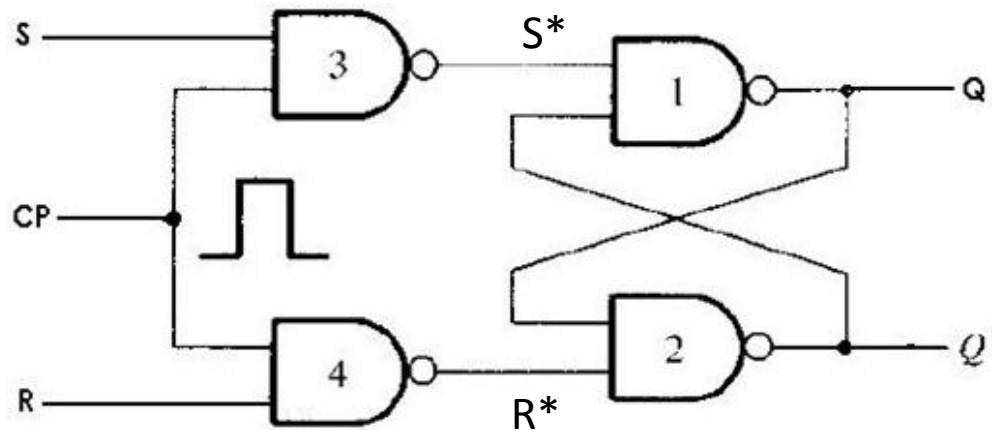
Memory

S	R	Q	Q'
0	0	Invalid	
0	1	1	0
1	0	0	1
1	1	Memory	



LIMITATIONS IN SR FLIP FLOP

1. It has an invalid input combination. Circuit gives unexpected outcome if such combination occurs. In D flip-flop this combination is eliminated.



S*	R*	Q	Q'
0	0	Invalid	
0	1	1	0
1	0	0	1
1	1	Memory	

CP	S	R	Q	Q'
0	x	x	Memory	
1	0	0	Memory	
1	0	1	0	1
1	1	0	1	0
1	1	1	Invalid	

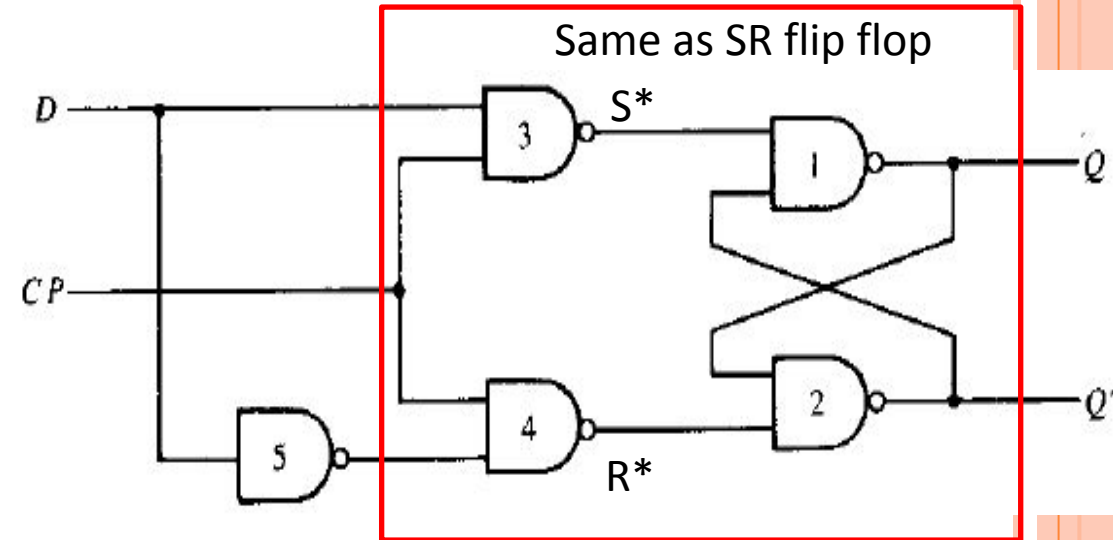
D (DATA) FLIP FLOP

Truth Table of SR flip flop

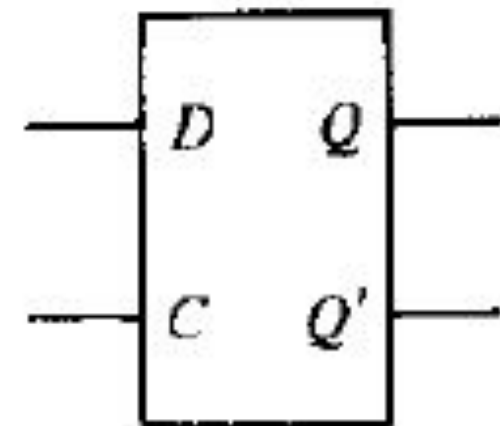
CP	S	R	Q_{t+1}
0	x	x	Q_t
1	0	0	Q_t
1	0	1	0
1	1	0	1
1	1	1	Invalid

Truth Table of D flip flop

CLK	D	Q_{t+1}
0	X	Q_t
1	0	0
1	1	1



Graphic symbol of SR flip flop



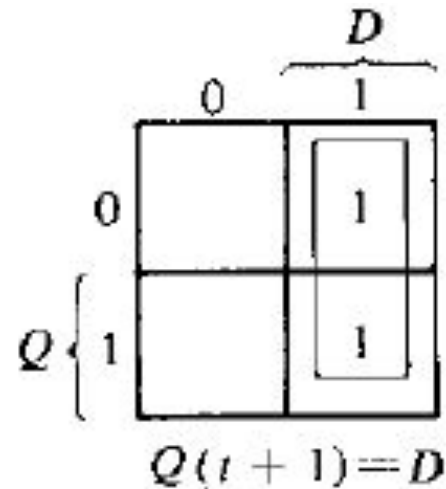
D FLIP FLOP

Truth Table of **D** flip flop

CLK	D	Q_{t+1}
0	X	Q_t
1	0	0
1	1	1

Characteristics Table of D flip flop

Q_t	D	Q_{t+1}
0	0	0
0	1	1
1	0	0
1	1	1



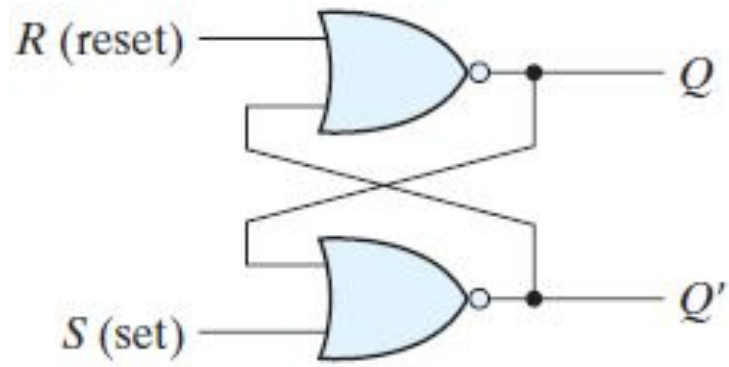
Excitation Table of D flip flop

Q_t	Q_{t+1}	D
0	0	0
0	1	1
1	0	0
1	1	1



JK FLIP-FLOP

SR LATCH WITH NOR GATE



(a) Logic diagram

S	R	Q	Q'
1	0	1	0
0	0	1	0
0	1	0	1
0	0	0	1
1	1	Forbidden	

Memory

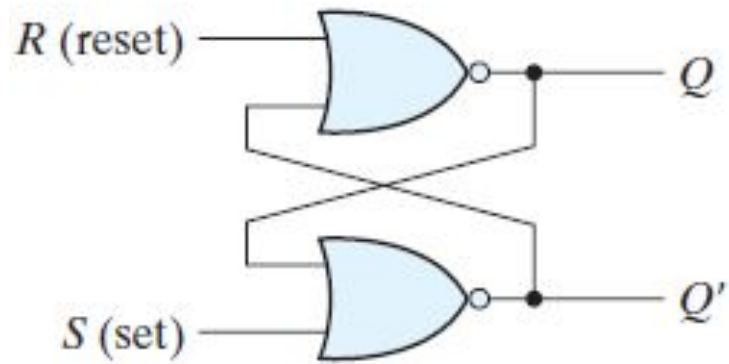
Memory

Truth Table of NOR gate

A	B	F
0	0	1
0	1	0
1	0	0
1	1	0



SR LATCH



(a) Logic diagram

S	R	Q	Q'
1	0	1	0
0	0	1	0
0	1	0	1
0	0	0	1
1	1	Forbidden	

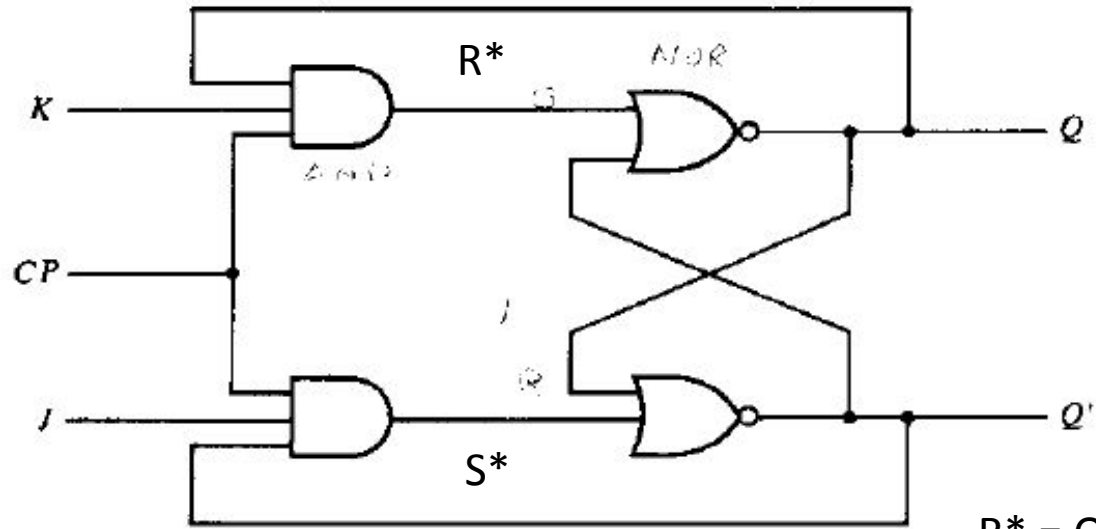
Memory

Memory

S	R	Q	Q'
0	0	Memory	
0	1	0	1
1	0	1	0
1	1	Forbidden	



JK FLIP FLOP



$$R^* = Q.K.CP$$

$$S^* = Q'.J.CP$$

S^*	R^*	Q	Q'
0	0	Memory	
0	1	0	1
1	0	1	0
1	1	Forbidden	

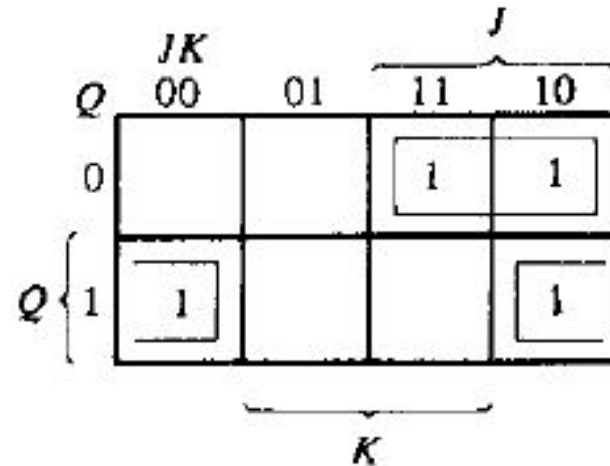
Characteristics Table of JK flip flop

Q	J	K	Q(t+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

JK FLIP FLOP

Characteristics Table of JK flip flop

Q	J	K	Q(t+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



$$Q(t+1) = JQ' + K'Q$$

(c) Characteristic equation

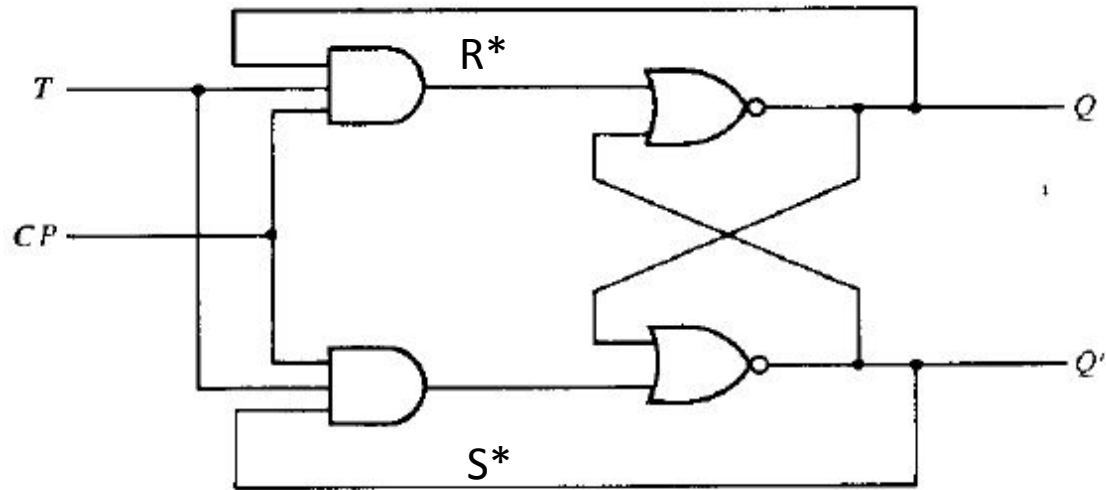
Excitation Table of JK flip flop

Q_t	Q_{t+1}	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0



T FLIP-FLOP

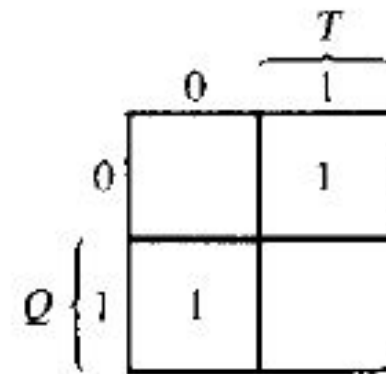
T FLIP FLOP



$$S^* = Q'.T.CP$$

$$R^* = Q.T.CP$$

S^*	R^*	Q	Q'
0	0	Memory	
0	1	0	1
1	0	1	0
1	1	Forbidden	



$$Q(t+1) = TQ' + T'Q$$

(c) Characteristic equation

Characteristics Table of JK flip flop

Q	T	Q(t+1)
0	0	0
0	1	1
1	0	1
1	1	0

Excitation Table of D flip flop

Q_t	Q_{t+1}	D
0	0	0
0	1	1
1	0	1
1	1	0

