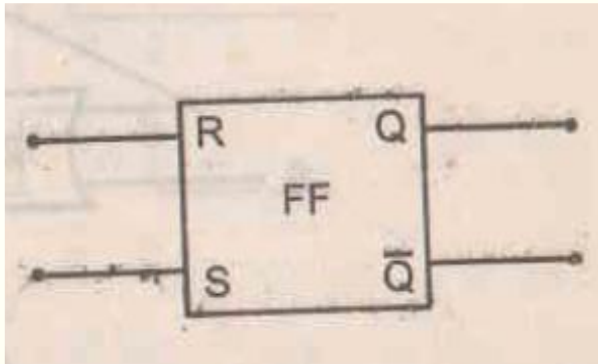
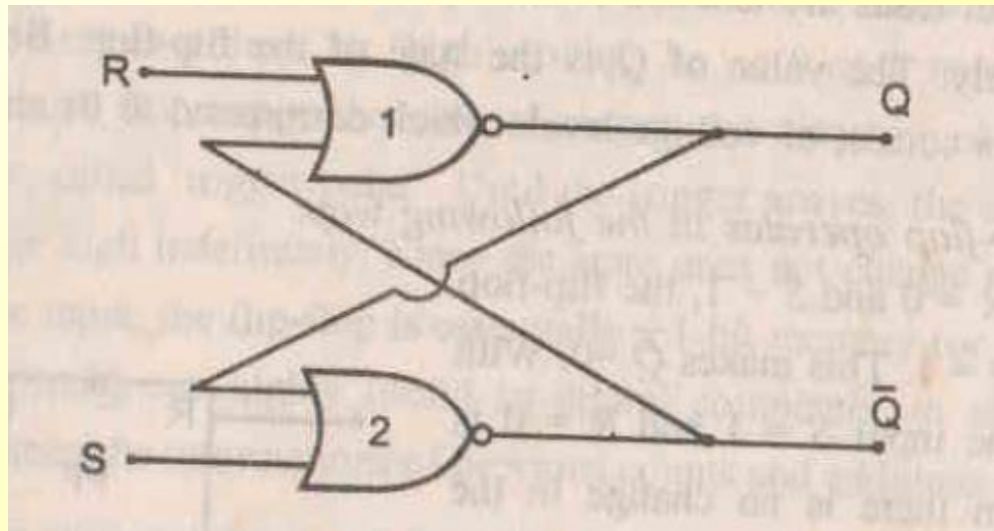


# RS Flip Flop



$R$	$S$	$Q$	Comment
0	0	NC	no change
0	1	1	set
1	0	0	reset
1	1	*	not allowed



# Clocked RS Flip Flop

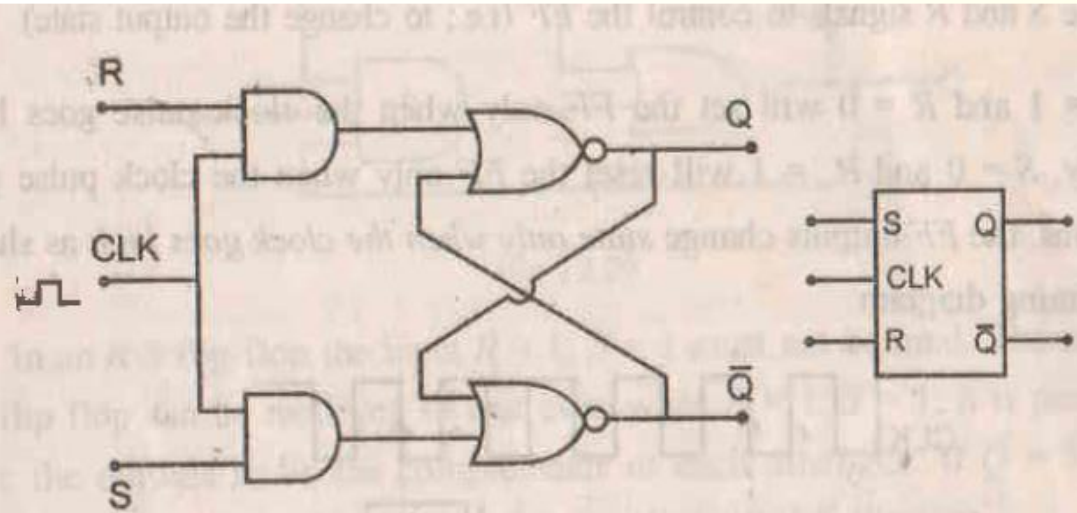
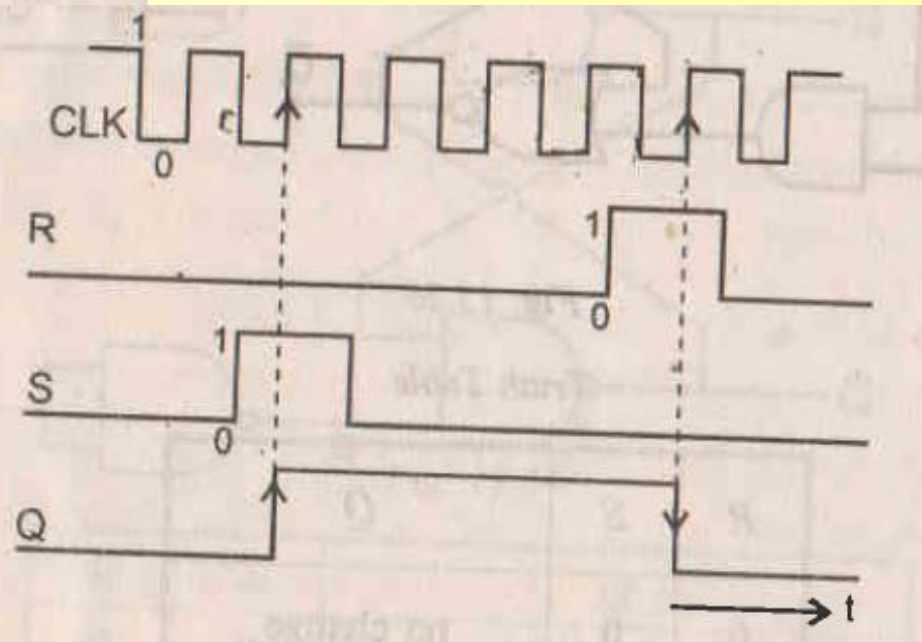


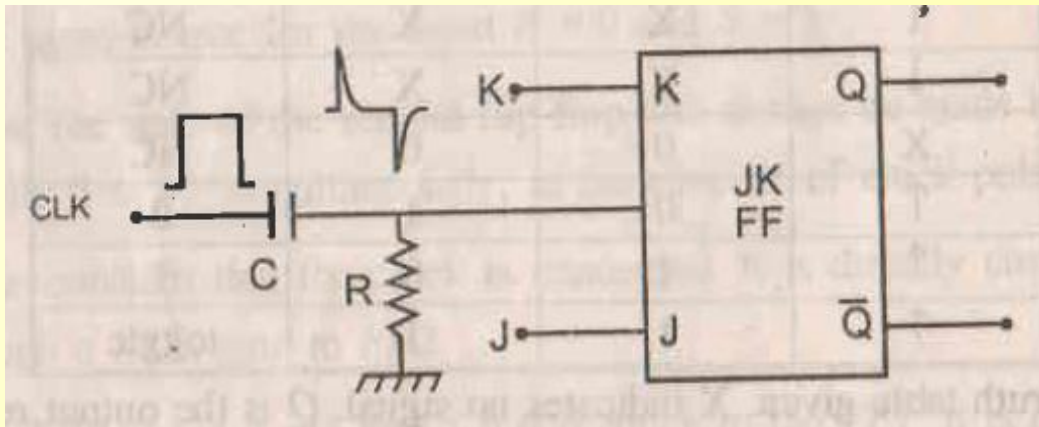
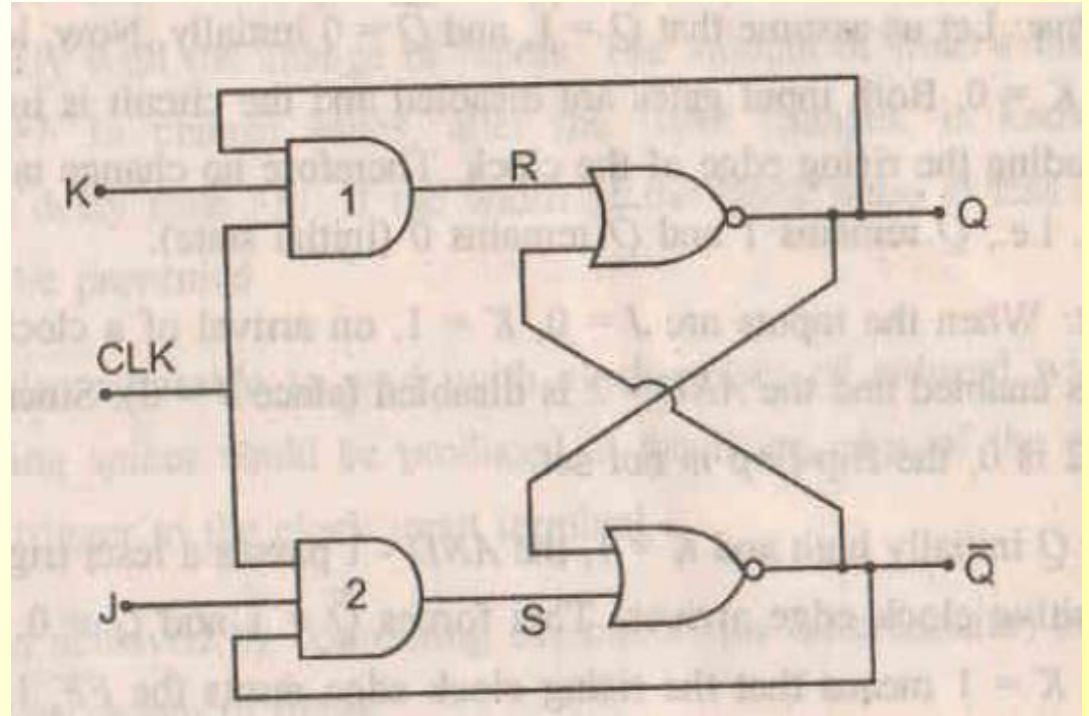
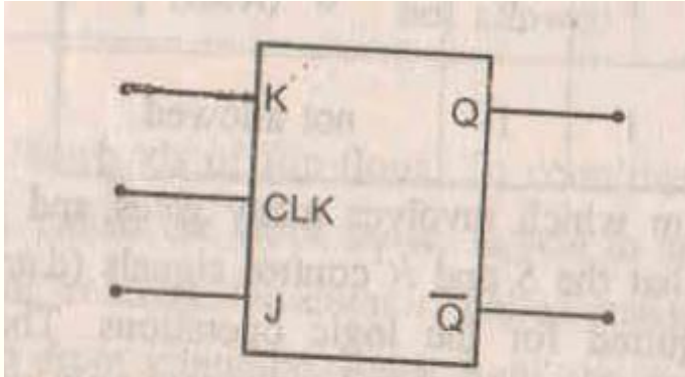
Fig. 12.26

Truth Table

R	S	Q
0	0	no change
0	1	1 (set)
1	0	0 (reset)
1	1	not allowed



# JK Flip Flop



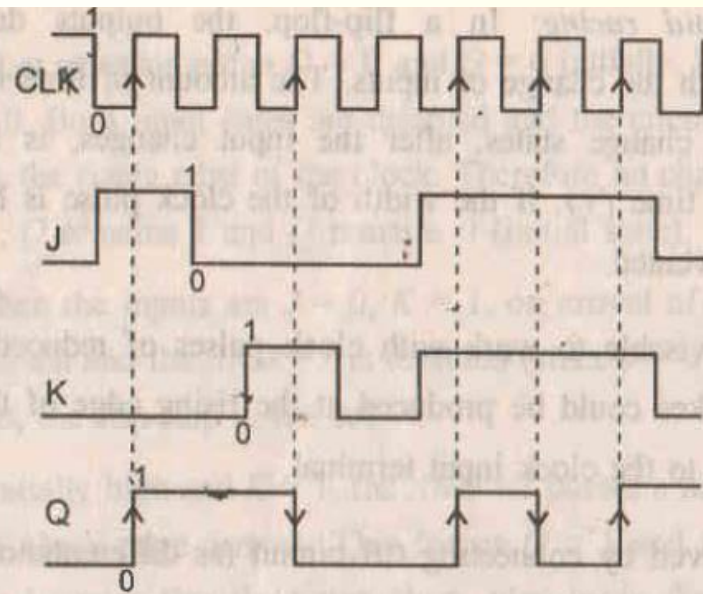


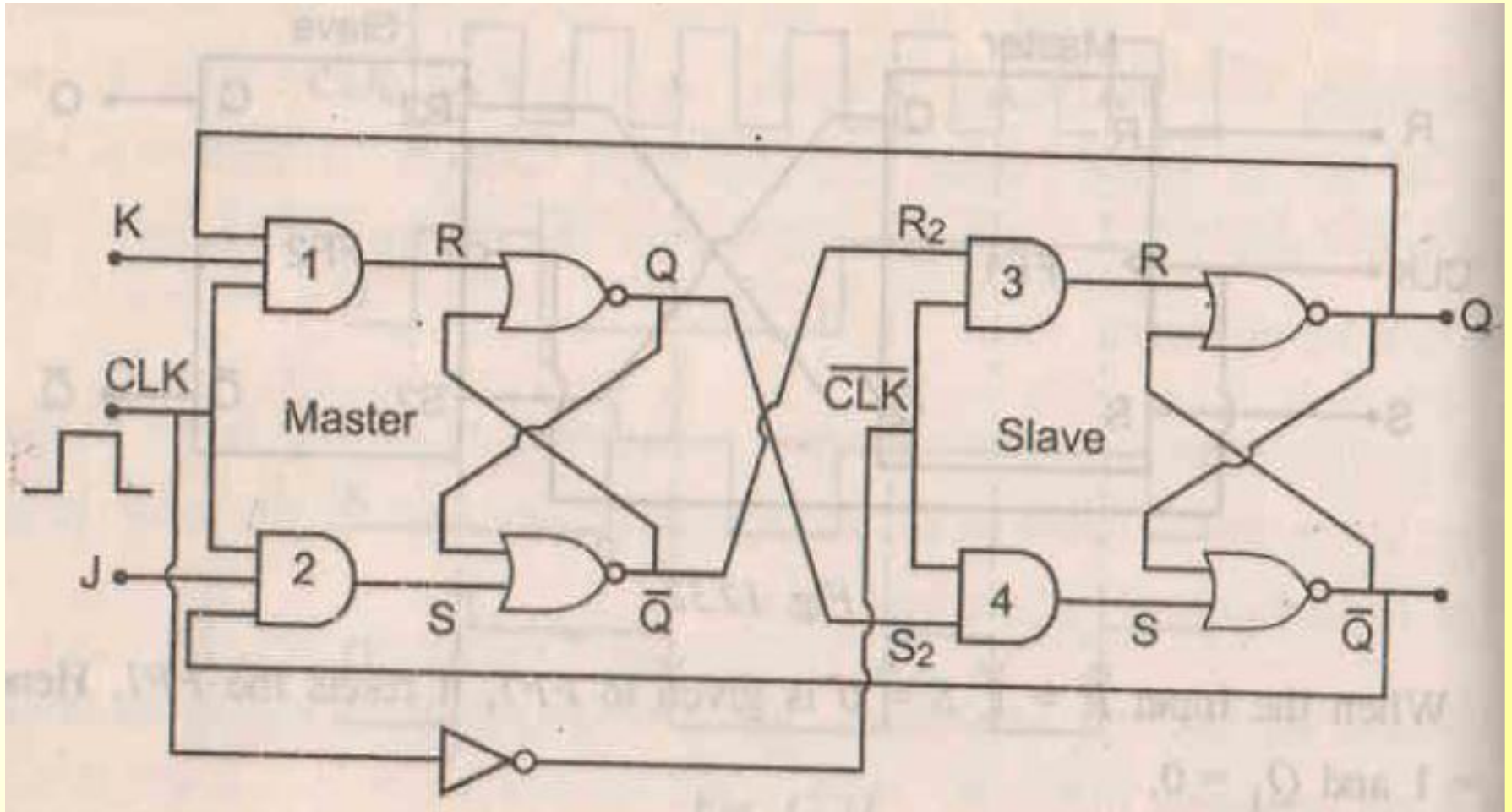
Fig. 12.31

Truth Table of positive edge triggered  $J$ - $K$  flip flop:

CLK	$J$	$K$	$Q$
0	X	X	NC
1	X	X	NC
↓	X	X	NC
X	0	0	NC
↑	0	1	0
↑	1	0	1
↑	1	1	toggle

In the truth table given, X indicates no signal.  $Q$  is the output representing the state of the flip flop. NC means no change.  $\uparrow$  stands for positive spike,  $\downarrow$  stands for negative spike. 0 stands for low state (low voltage) and 1 signifies high state.

# Master Slave JK Flip Flop



# D Flip Flop

D	Q
0	0
1	1

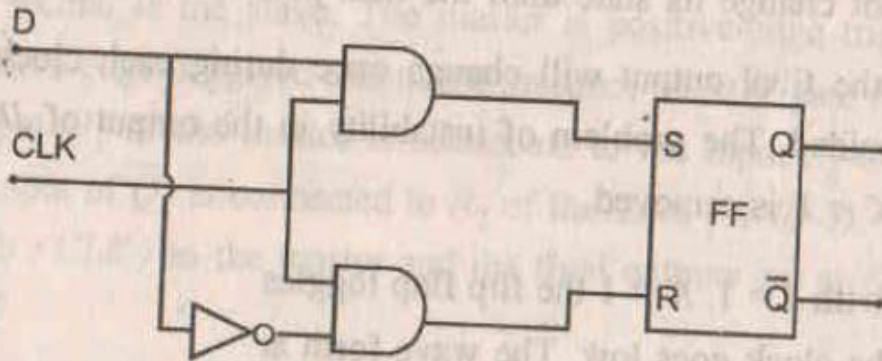
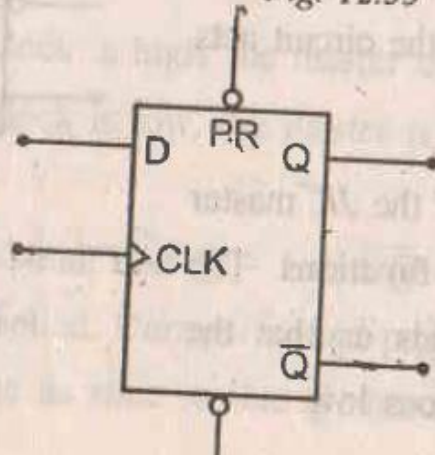
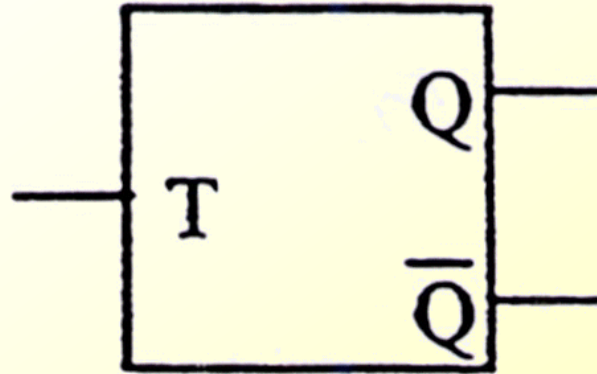


Fig. 12.35

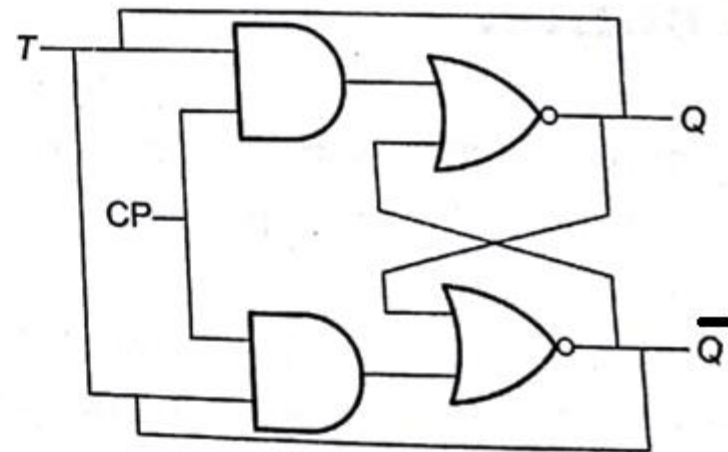


# T Flip Flop



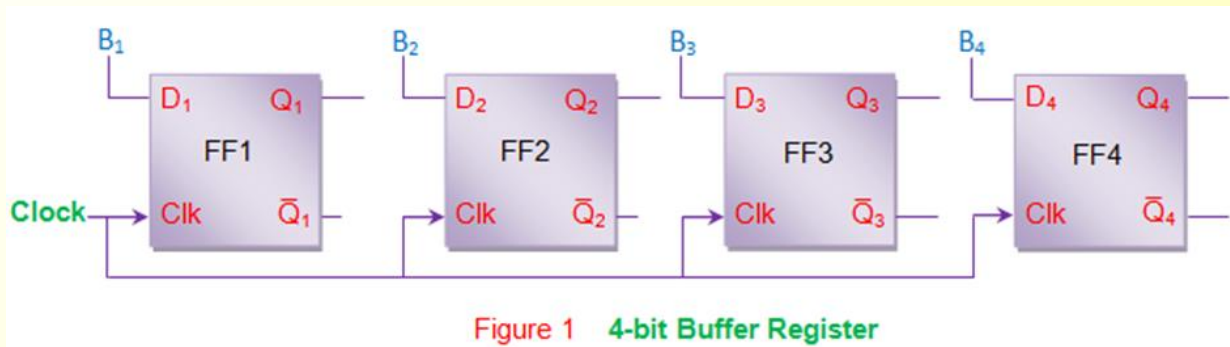
Truth Table of Flip-Flop When Clock Pulse is 1

Present state of $(Q_{n-1})$	$T$	$Q$
0	0	0
0	1	1
1	0	1
1	1	0



T- flip-flop

# Buffer Register





# Shift Register



Figure 2 Unidirectional Shift Registers (a) Right-Shift Register (b) Left-Shift Register

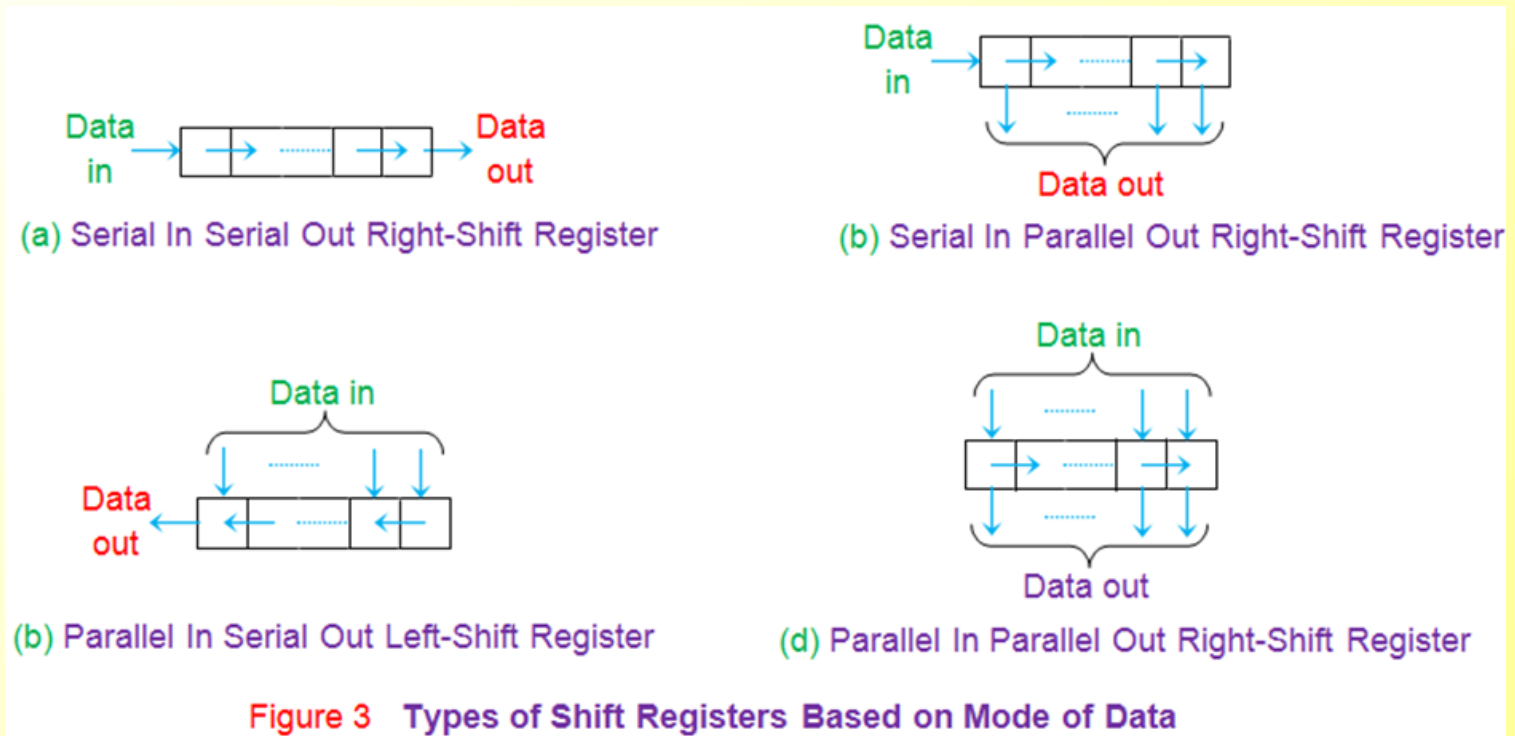
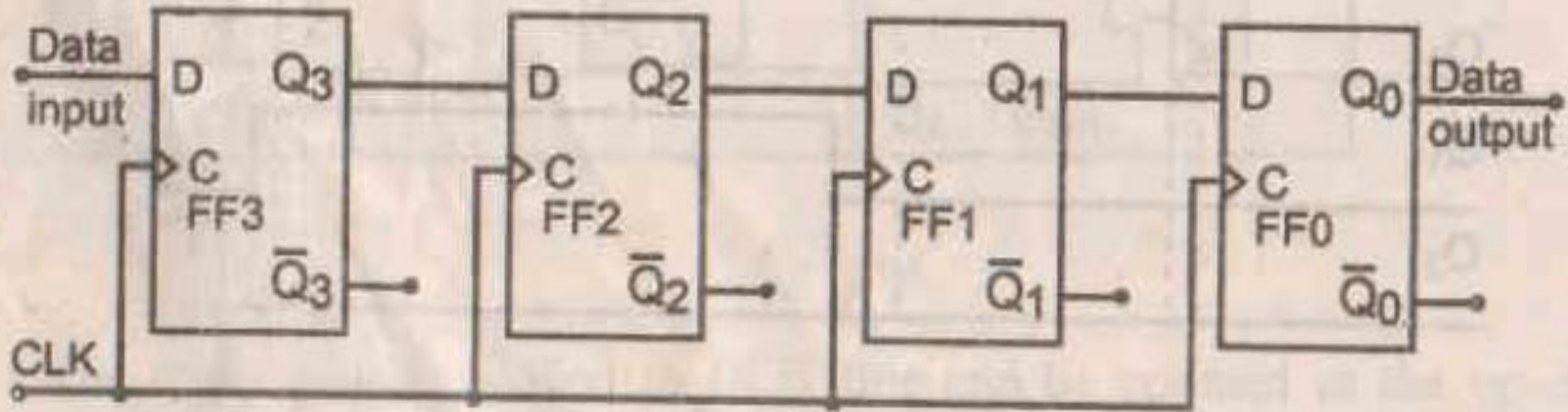


Figure 3 Types of Shift Registers Based on Mode of Data

# 4 bit Shift Register (SIPO)

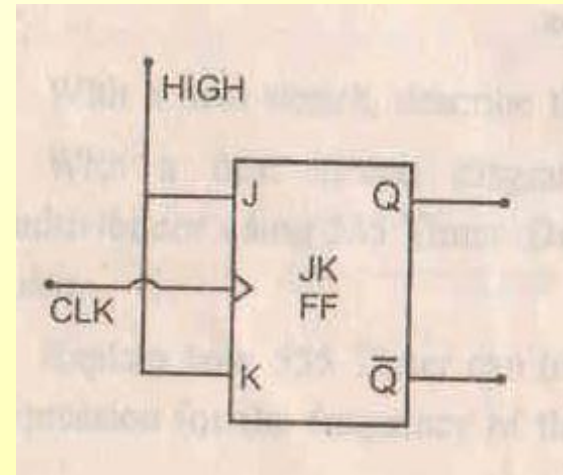
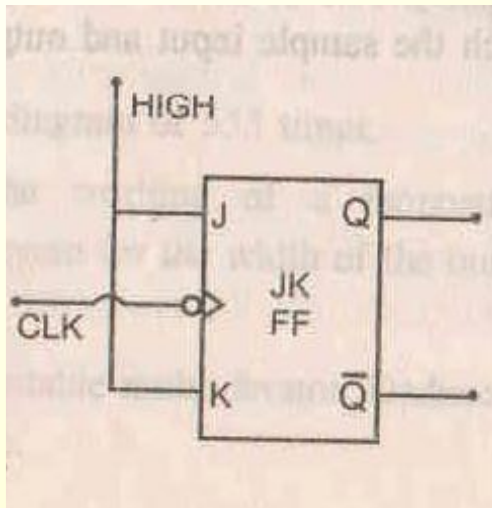


Before the first clock pulse  
 After the first clock pulse  
 After the second clock pulse  
 After the third clock pulse  
 After the fourth clock pulse

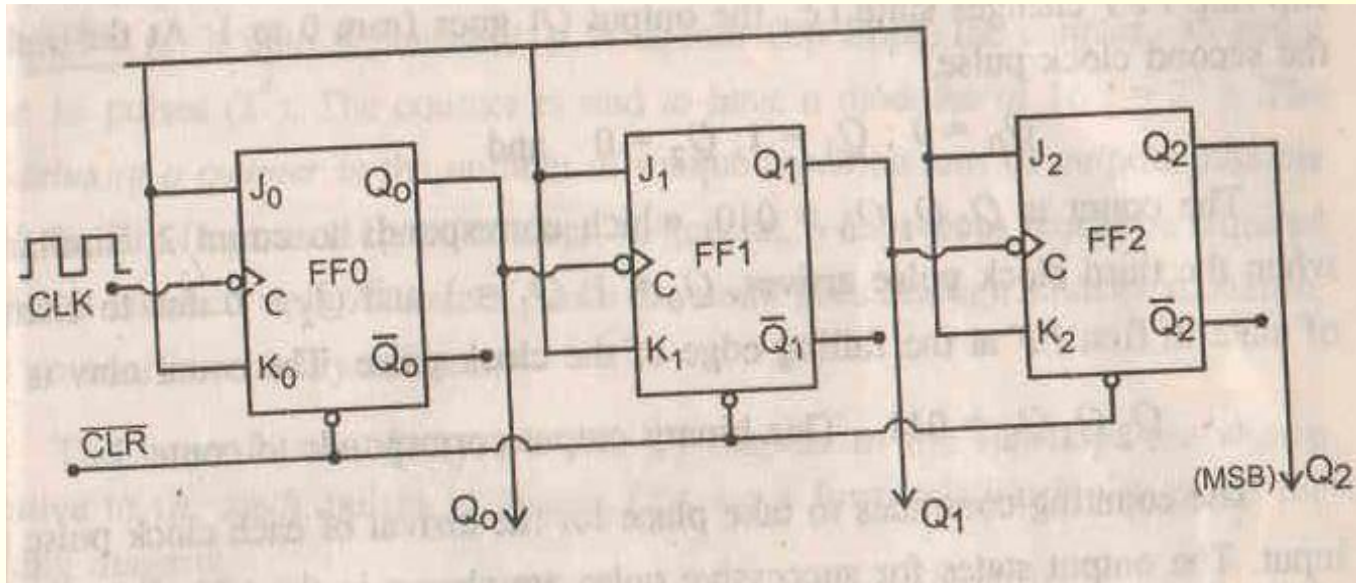
.....  
 After the fifth clock pulse

	$Q_3$	$Q_2$	$Q_1$	$Q_0$
Before the first clock pulse				
After the first clock pulse	0			
After the second clock pulse	1	0		
After the third clock pulse	0	1	0	
After the fourth clock pulse	1	0	1	0
.....				
After the fifth clock pulse		1	0	1

# Counter

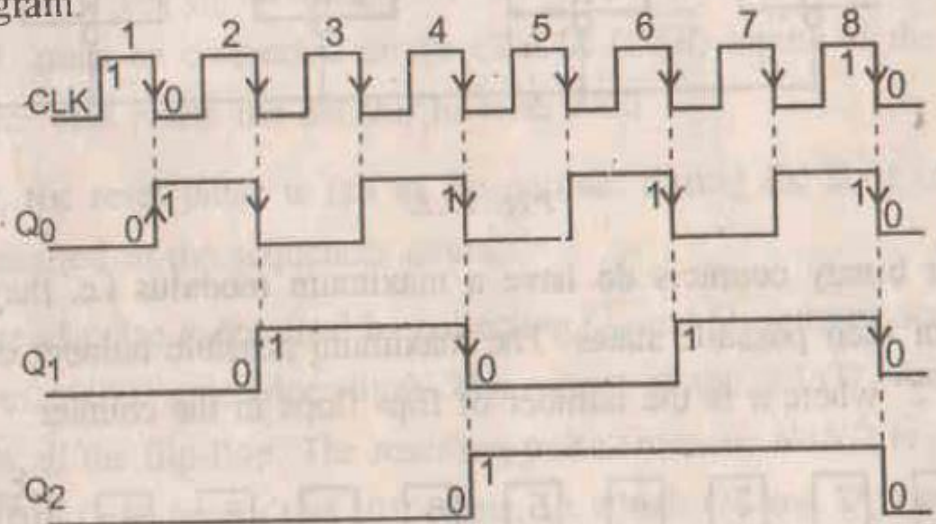


# Binary Ripple Counter

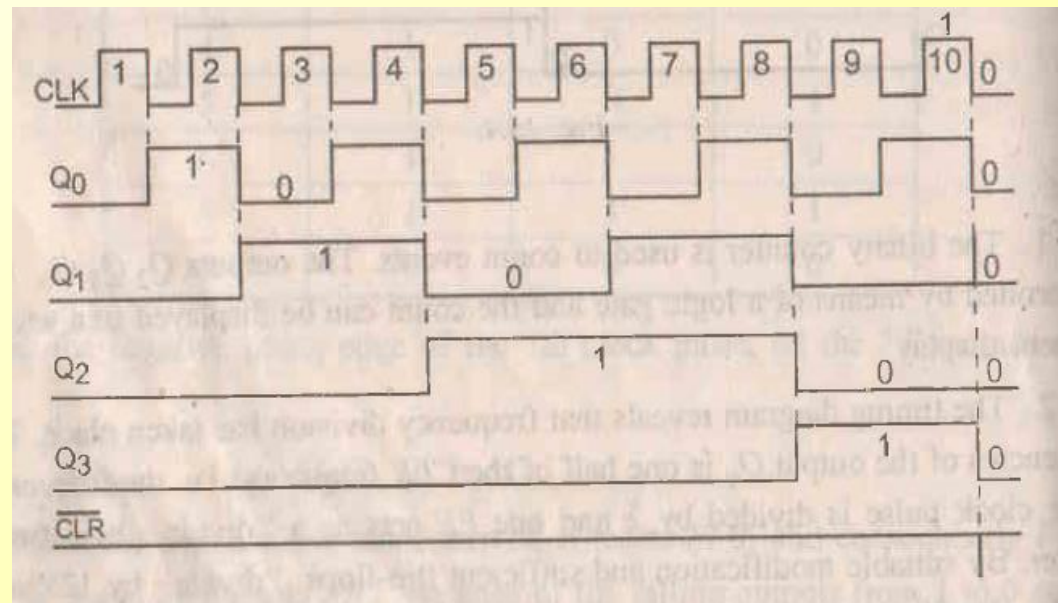
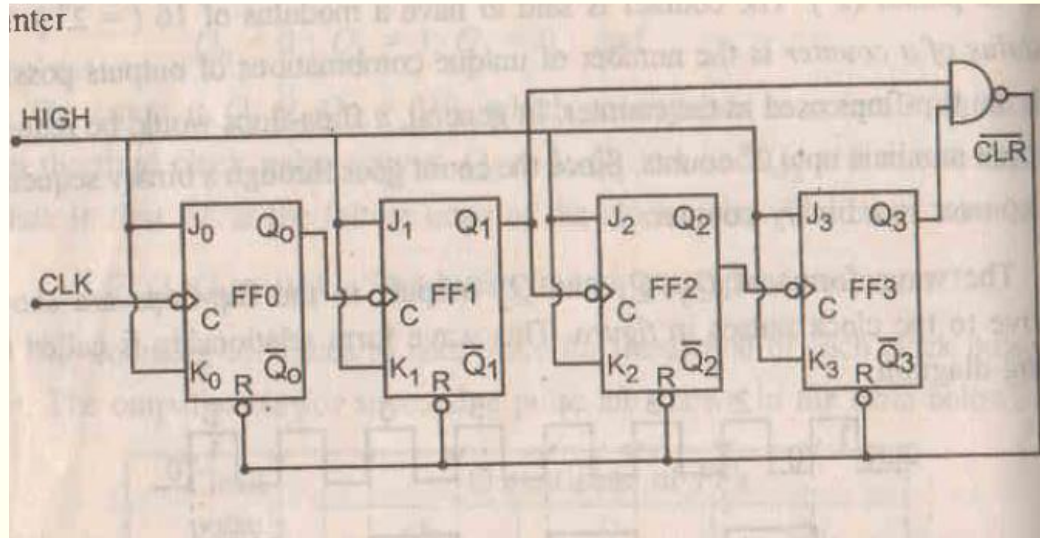


Clock pulse	Output state of FFs		
	$Q_2$	$Q_1$	$Q_0$
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1
8	0	0	0

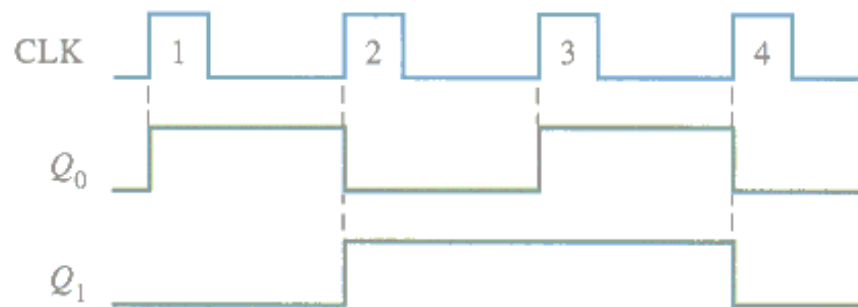
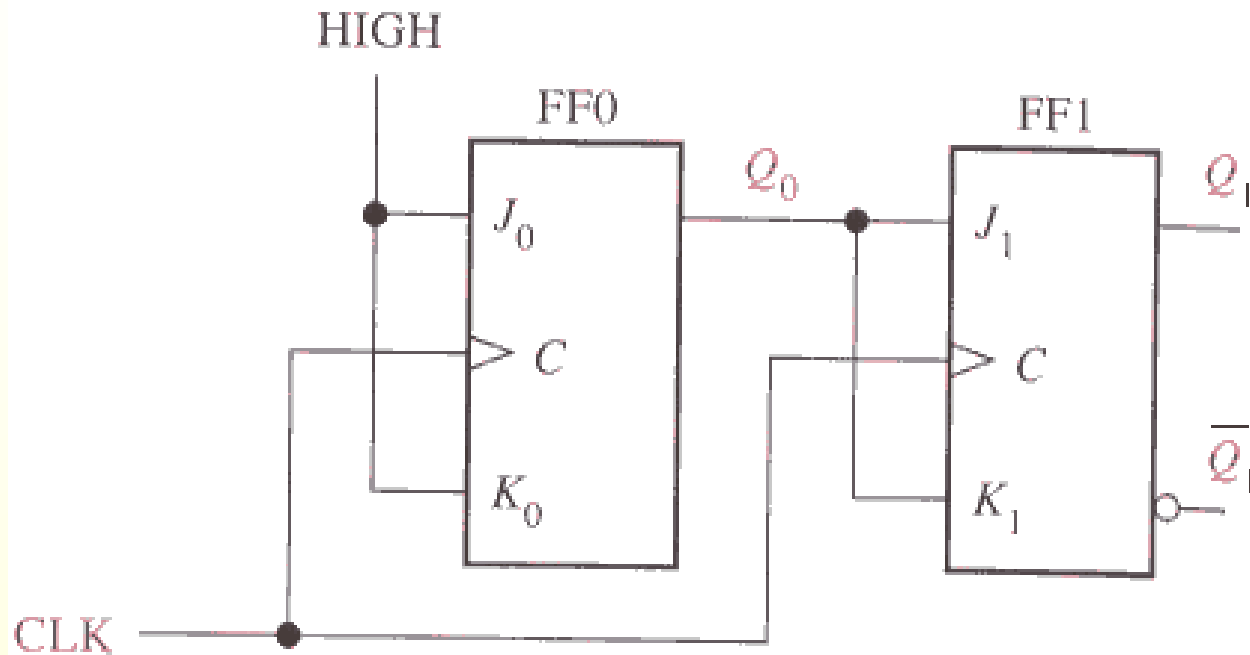
agram.



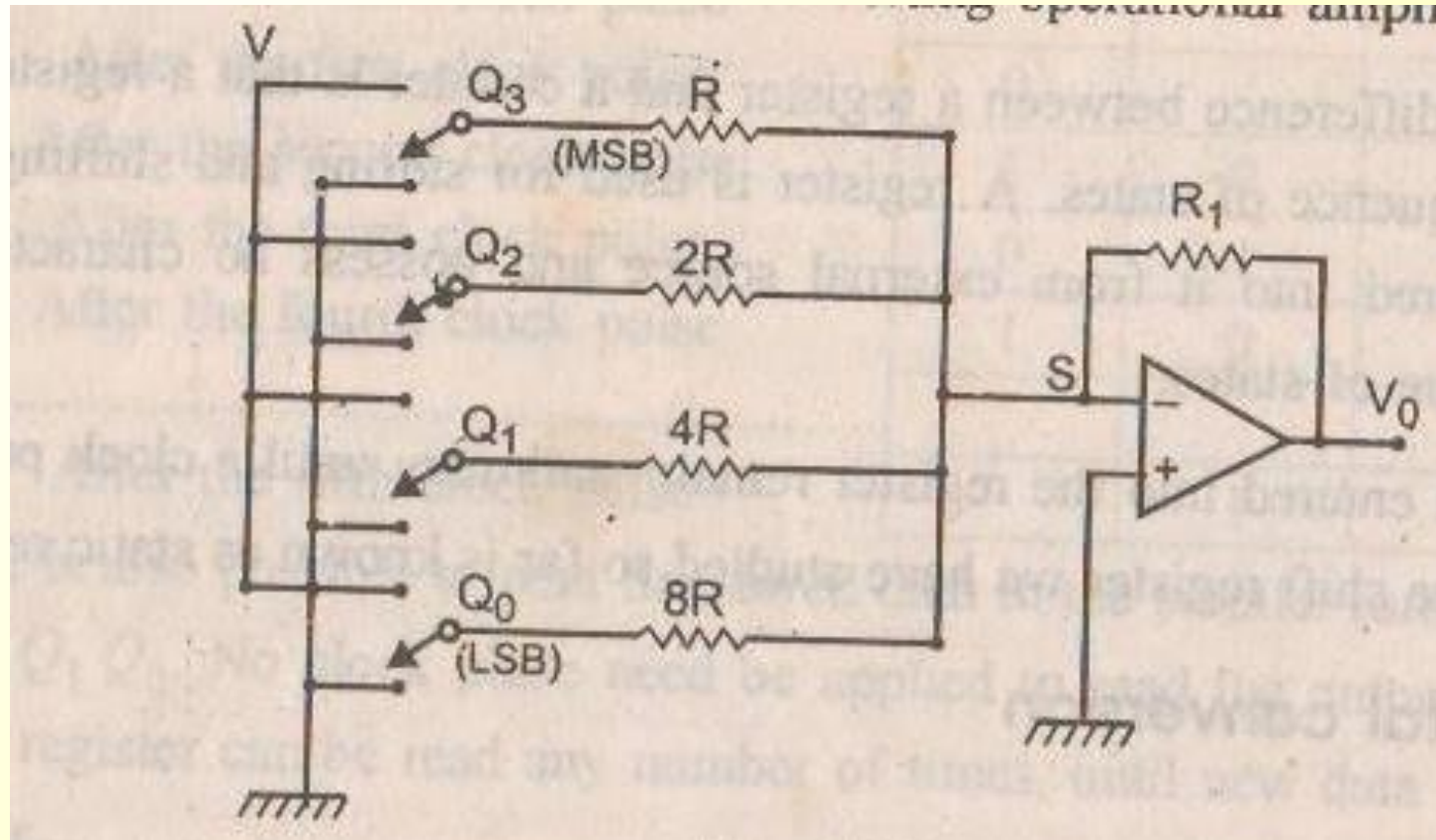
# BCD (Decade) Ripple Counter



# Synchronous Counter



# D/A Converter (Ladder Type)



# AD Converter (Counter Type)

