Experiment-6

To Design a 3 bit binary up/down counter using flip flop

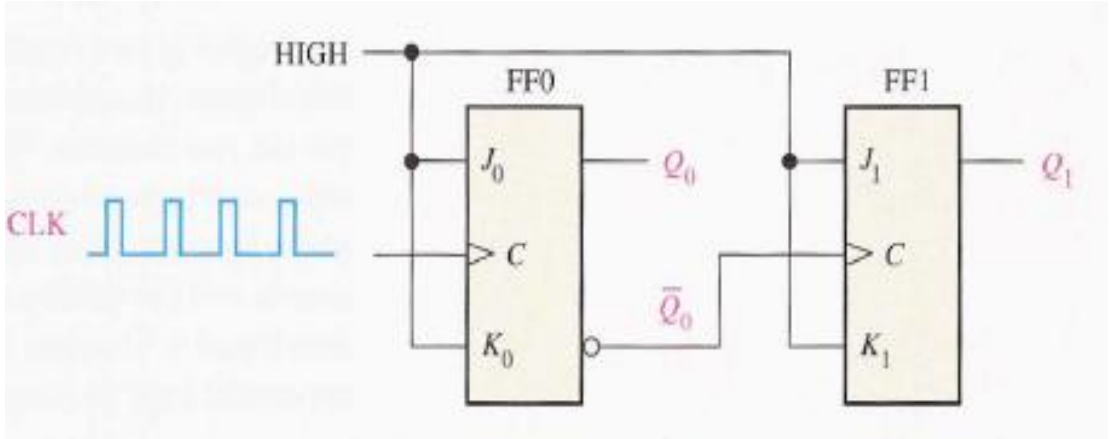
What is Counter?

- A counter is a sequential circuit that goes through a prescribed sequence of states upon the application of input pulses.

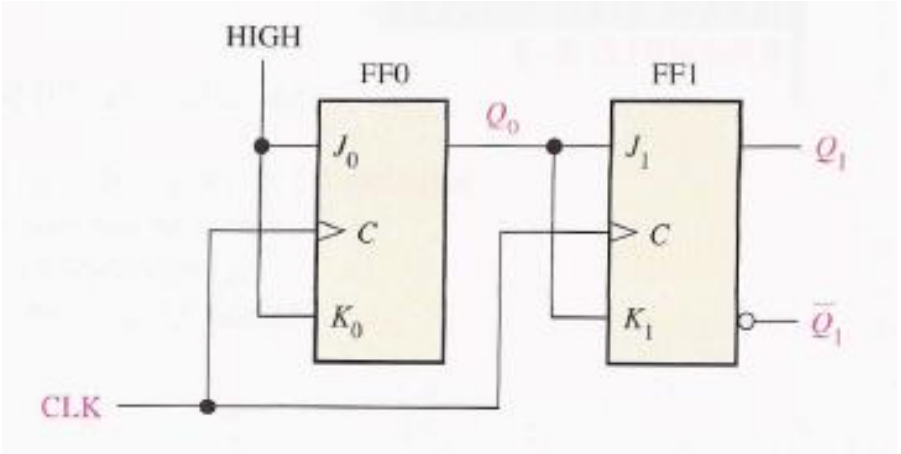
- The input pulses called count pulses, may be clock pulses, or they may originate from an external source and may occur at prescribed intervals of time or at random.

Types

Asynchronous Counter



Synchronous Counter



3- bit counter

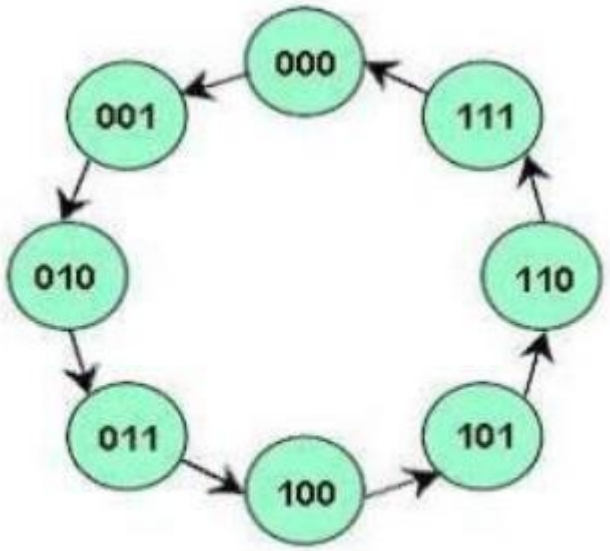


Fig: State diagram of 3-bit binary up counter

Present State			Next State		
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	1	1
0	1	1	1	0	0
1	0	0	1	0	1
1	0	1	1	1	0
1	1	0	1	1	1
1	1	1	0	0	0

Fig: Truth Table of 3-bit binary up counter

3-bit synchronous up counter

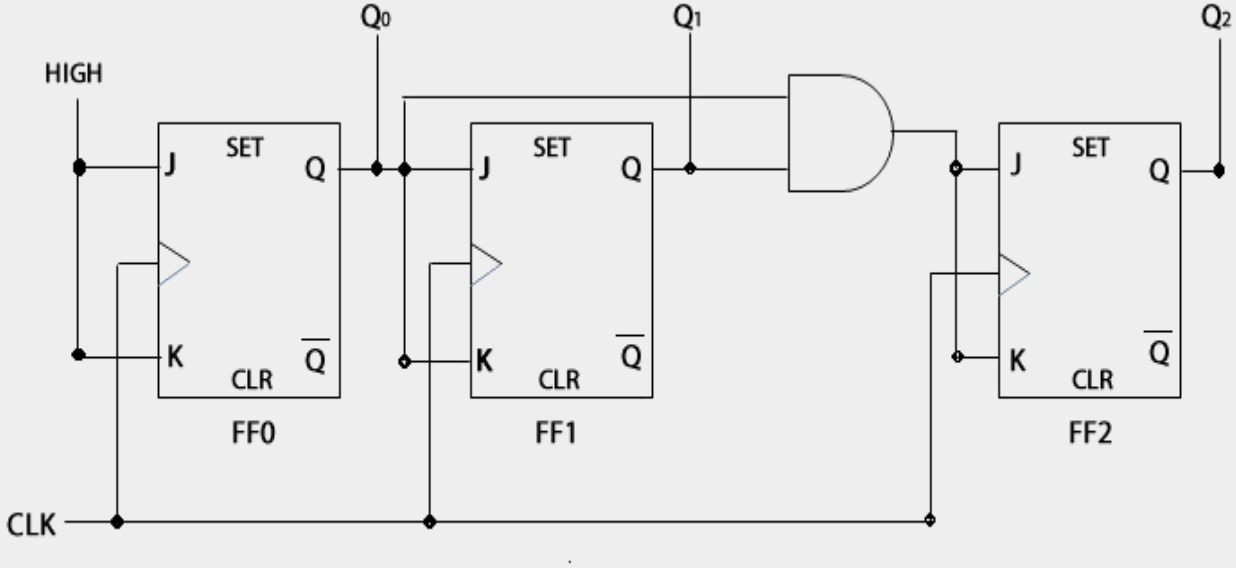
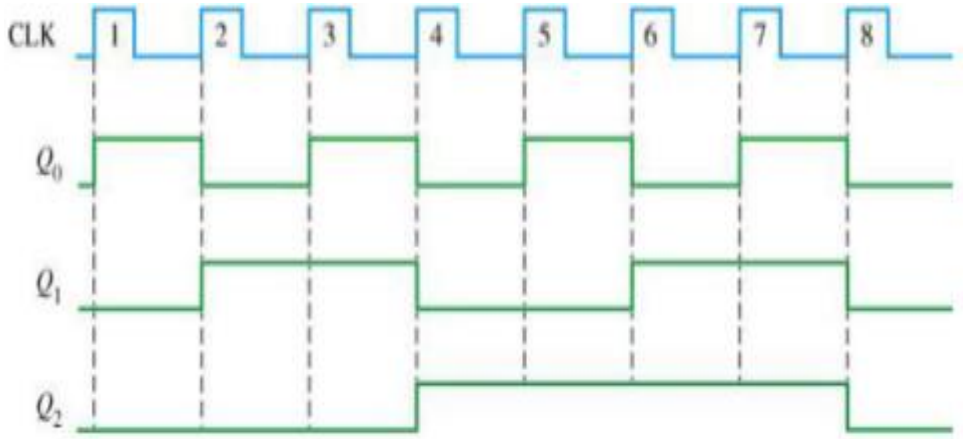
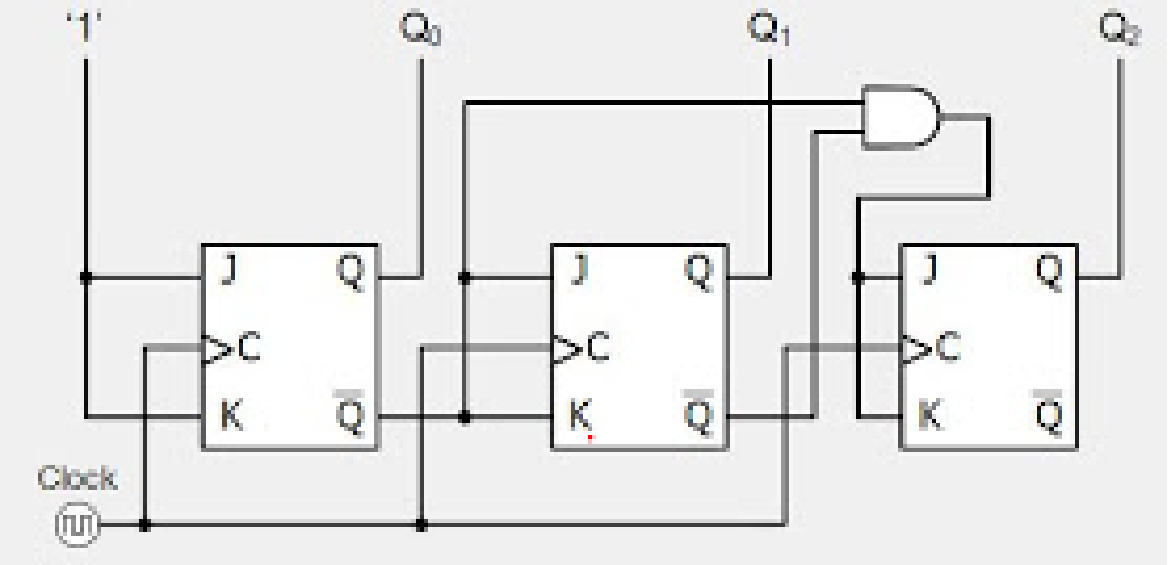


Figure: A 3-bit synchronous binary counter>



CLOCK PULSE	Q_2	Q_1	Q_0
Initially	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 (recycles)	0	0	0

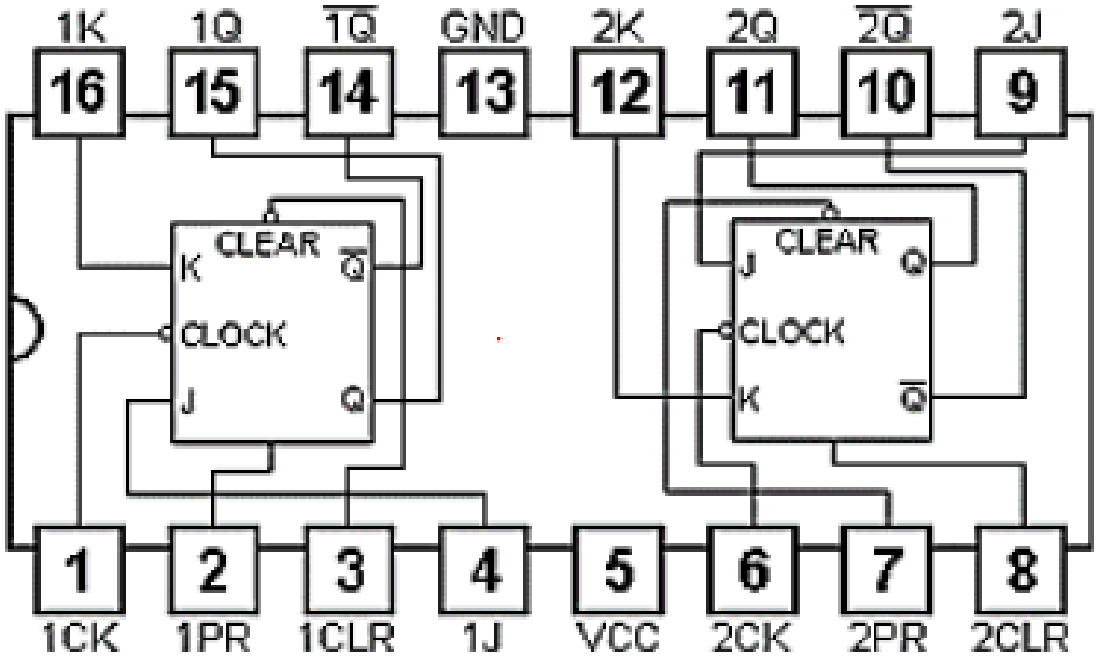
3-bit synchronous down counter



Application of counters

- Frequency counters
- Digital clock
- Time measurement
- A to D converter
- Frequency divider circuits
- Digital triangular wave generator.

IC 7476


1K
1Q
1Q̄
GND
2K
2Q
2Q̄
2J
16
15
14
13
12
11
10
9
CLEAR
K
Q̄
CLOCK
J
Q
CLEAR
J
Q
CLOCK
K
Q̄
1
2
3
4
5
6
7
8
1CK
1PR
1CLR
1J
VCC
2CK
2PR
2CLR

MCQ

- 1. In digital logic, a counter is a device which _____
  a) Counts the number of outputs
  b) Stores the number of times a particular event or process has occurred
  c) Stores the number of times a clock pulse rises and falls
  d) Counts the number of inputs

MCQ

- A counter circuit is usually constructed of _____
  a) A number of latches connected in cascade form
  b) A number of NAND gates connected in cascade form
  c) A number of flip-flops connected in cascade
  d) A number of NOR gates connected in cascade form

MCQ

How many different states does a 2-bit asynchronous counter have?

a) 1
b) 4
c) 2
d) 8