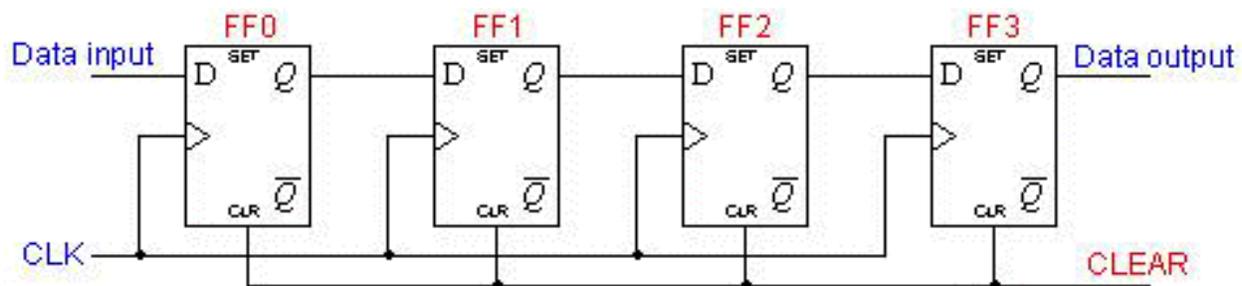


## Registers :-

Register is a group of flip flop used to storing multiple bit of binary information. The most common application area of a register is inside the cpu where CPU uses several registers for temporarily storage of data . Each flip-flop used in a register is used to store one bit of binary digit. Therefore, the number of flip flops used in a register signifies the number of bits of data that register can store. Registers are D type flip-flop because the input of D type flip flop is same as the input value.

The 4-bit register with D type flip flop may be shown as :

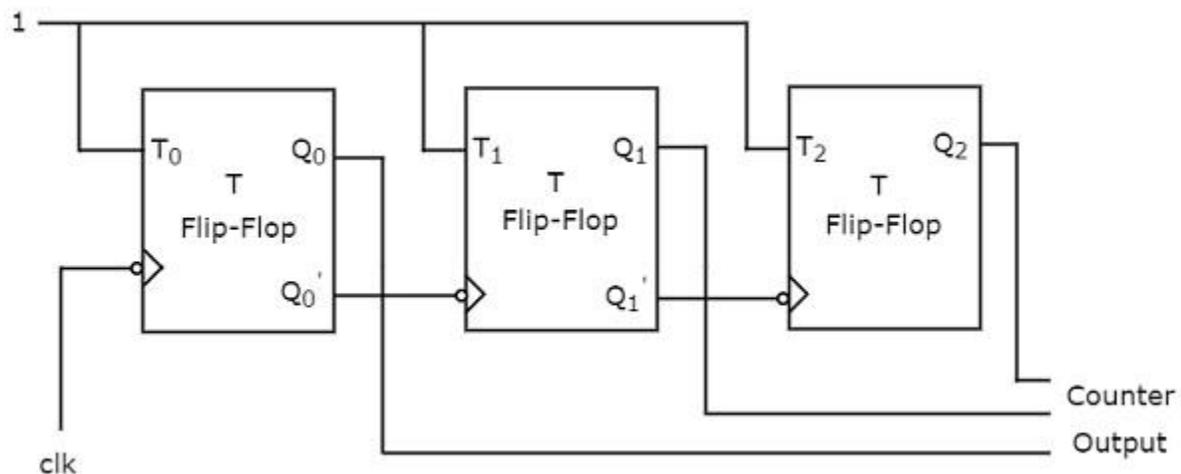


## Counters :-

Counters are used as timers in digital circuits that help to count the clock pulse. This circuit consists of flip-flops and basic gates logically arranged for counting the clock pulse. The counters can be categorized on the following basis.

1. On the basis of counting order i.e ascending and descending . the counter that counts in ascending order is called up counter while that count in descending order is called down counter.
2. On the basis of type of clock used i.e synchronous and asynchronous . the counter that uses asynchronous clock is known as asynchronous counter while the other that uses synchronous clock pulse is known as synchronous counter.

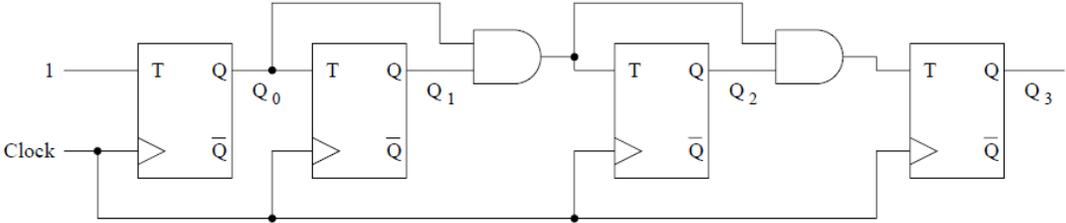
Asynchronous counter :- this counter can either be constructed using T-type or JK type flip flop. If the counter consist with T-type flip flop then value 1 is applied in all the inputs of flip flop and if the counter consist with JK type flip-flop then value 1 is applied to both J and k . the output of the first flip flop is used as clock of other flip flop. Therefore, in asynchronous counter each flip flop receive the clock signal in different time. This counter is also known as “Ripple counter”.



Synchronous counter :- In Synchronous counter , each flip flop receives the clock input at the same time . hence, all flip-flops in the synchronous counter change their states at the same time . A synchronous counter logically arranges the flip-flops and AND gates for implementing the counting functionality

Synchronous Up-Counter with T Flip-Flops

An example of a 4-bit synchronous up-counter is shown in Figure 5.



-----X-----  
 -----