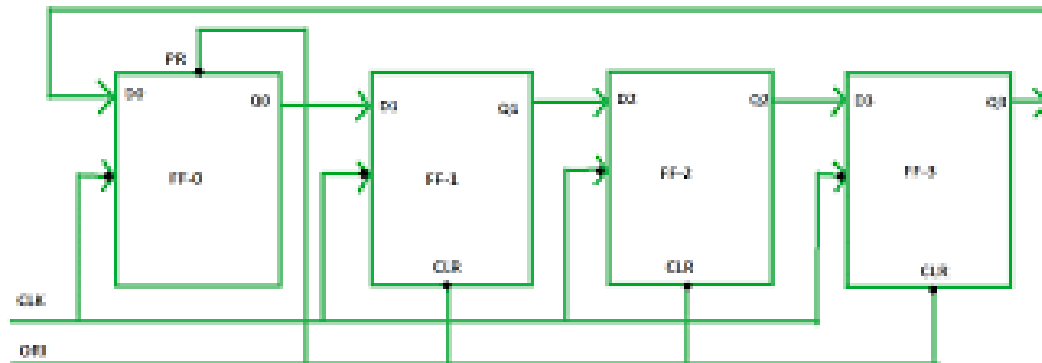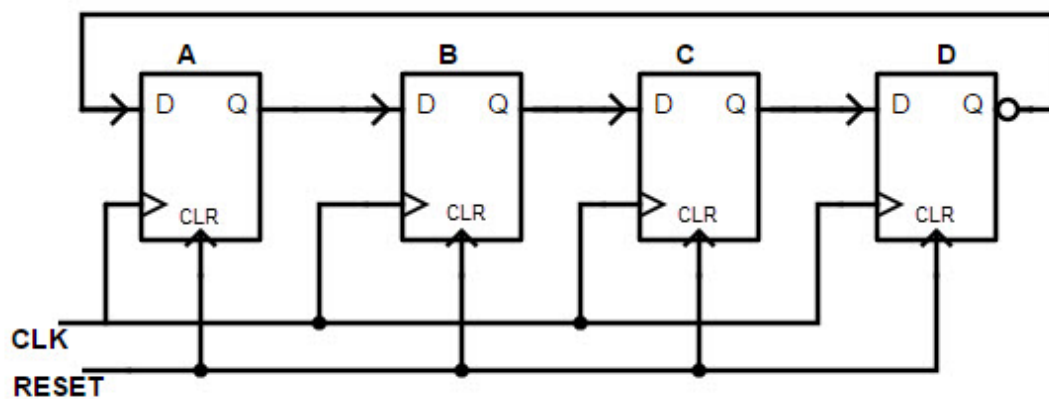1. Design and explain
   a. 4-bit Ring counter
      It is a circuit with 4 D Flip-flops connected in series and the last output is looped back to the first flip-flop.
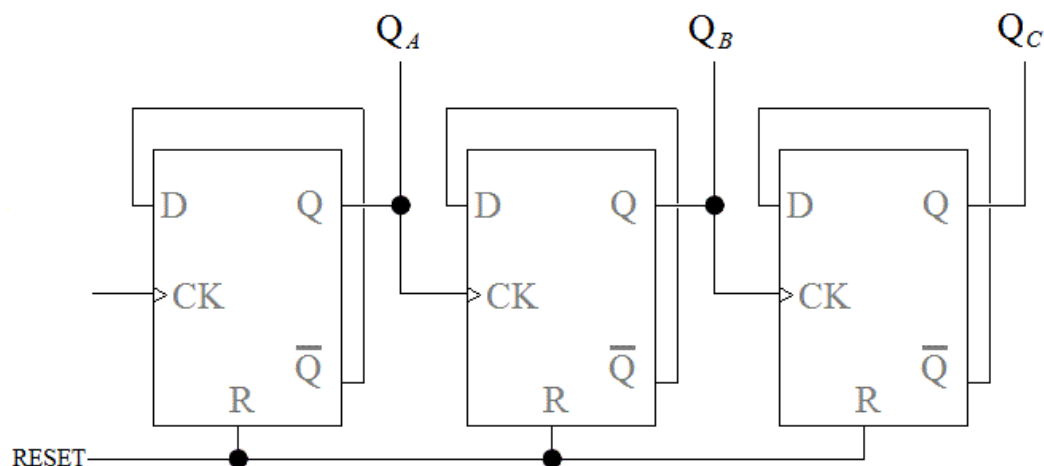

Ring Counter

   b. 4-bit Johnson counter
      It is similar to the Ring counter but at the last output instead of Q the not of Q is lopped back.
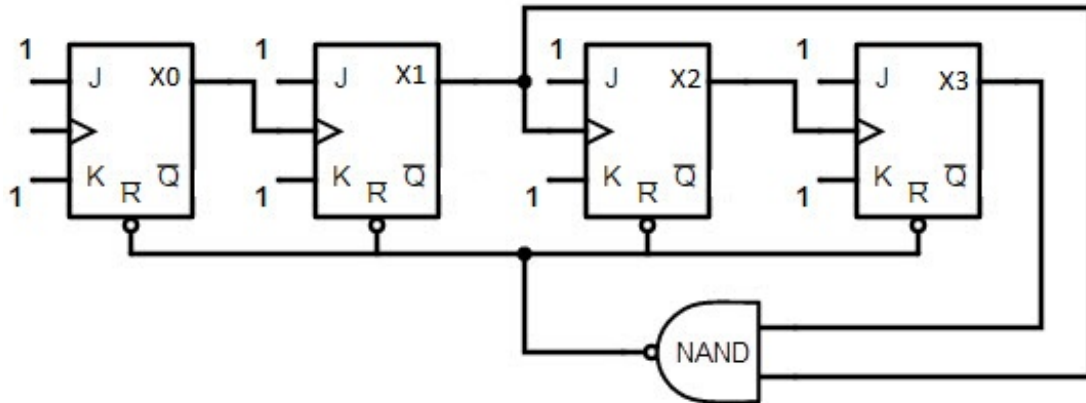

   c. 3-bit Ripple counter
      It is a counter that is used to count from 0 to 8 in binary it upcounts at every positive edge of the clock.

   d. Decade counter

It is a counter used to count from 0 to 10. It is similar to 4-bit ripple counter but the count resets to zero after 10 instead of continuing to 15.

2. Difference between
   a. Timers and Counters
      Timers
      - The register is incremented at every machine cycle.
      - It uses the frequency of the internal clock.
      - Maximum count rate is 1/12 of the oscillator frequency.
      Counters
      - The register is incremented based on an external input.
      - It uses an external input to count pulses.
      - Maximum count rate is 1/24 of the oscillator frequency.
   b. Synchronous and Asynchronous Counters
      The major difference is that Synchronous counters use the same clock whereas Asynchronous counters use the output of the previous flip-flop as clock input. This makes Asynchronous counters easier to design.

3. Working of 555 timer IC
      Depending on the manufacturer, the standard 555 timer package includes 25 transistors, 2 diodes, and 15 resistors on a silicon chip installed in an 8-pin mini dual-in-line package (DIP-8). 55 timer IC is an integrated circuit chip used in various timers, pulse generators, lamp flashers, logic clocks, and oscillators.