



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35**  
**An Autonomous Institution**



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **19ECB234 – DIGITAL ELECTRONICS**

II YEAR/ III SEMESTER

UNIT 4 – DESIGN OF SEQUENTIAL CIRCUITS

TOPIC – RING COUNTER

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# RING COUNTER



A ring counter is a Shift Register (a cascade connection of flip-flops) with the output of the last flip flop connected to the input of the first. It is initialized such that only one of the flip flop output is 1 while the remainder is 0.



## WHAT IS THE PURPOSE OF RING COUNTER?



It is also known as switch-tail ring counter, walking ring counter or Johnson counter. It connects the complement of the output of the last shift register to the input of the first register and circulates a stream of ones followed by zeros around the ring. Here, we use Clock (CLK) for all the flip-flops.



# Ring Counters



- One flip-flop (stage) for each state in the sequence.
- The output of the last stage is connected to the D input of the first stage.
- An  $n$ -bit ring counter cycles through  $n$  states.
- No decoding gates are required, as there is an output that corresponds to every state the counter is in.

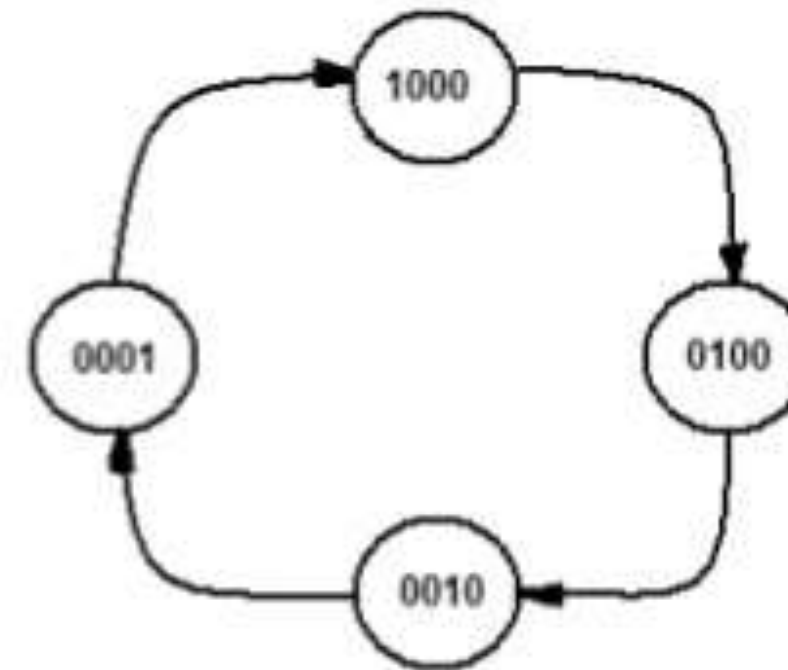


# RING COUNTER



## Ring Counter (continue)

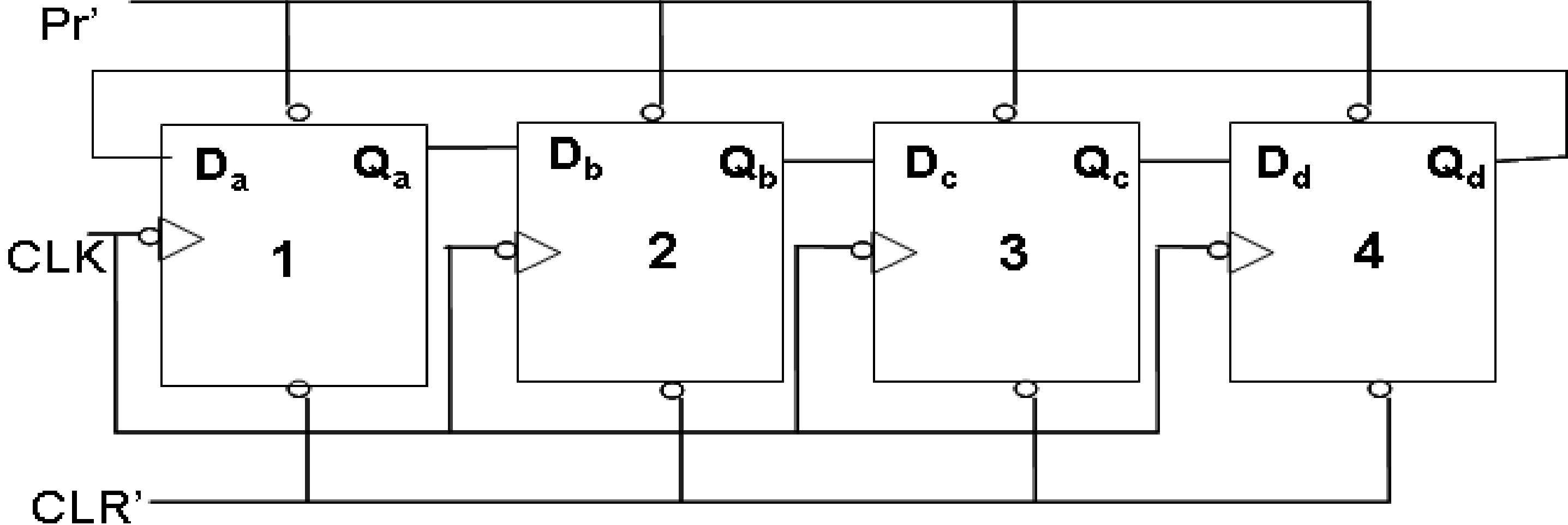
- ❑ Ring counters are used to construct "One-Hot" counters
- ❑ It can be constructed for any desired MOD number
- ❑ A MOD-N ring counter uses N flip-flops connected in the arrangement as shown in fig. a)
- ❑ In general ring-counter will require more flip-flops than a binary counter for the same MOD number



d) State Diagram



# 4 BIT RING COUNTER





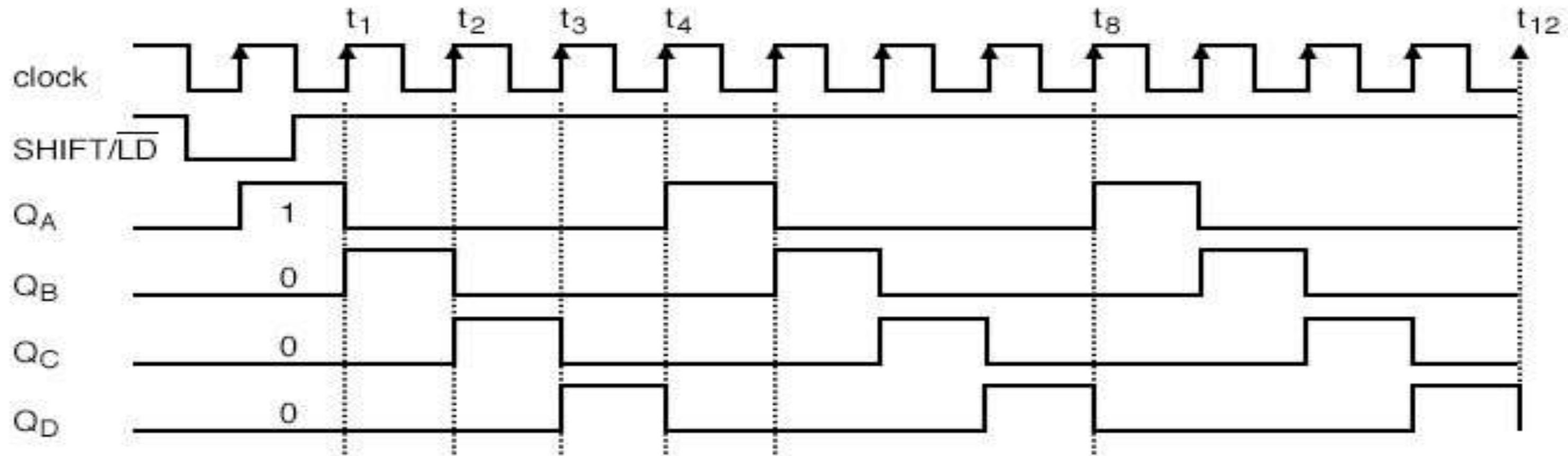
# TRUTH TABLE



| States | $Q_A$ | $Q_B$ | $Q_C$ | $Q_D$ |
|--------|-------|-------|-------|-------|
| 1      | 0     | 0     | 0     | 0     |
| 2      | 1     | 0     | 0     | 0     |
| 3      | 1     | 1     | 0     | 0     |
| 4      | 1     | 1     | 1     | 0     |
| 5      | 1     | 1     | 1     | 1     |
| 6      | 0     | 1     | 1     | 1     |
| 7      | 0     | 0     | 1     | 1     |
| 8      | 0     | 0     | 0     | 1     |



# TIMING DIAGRAM



Load 1000 into 4-stage ring counter and shift





# Applications of Ring Counter



- Animation and simulation video.
- Data counting loop.
- (BCD) counter and divider circuit.
- Quadrature generator.
- Use in Digital Clocks



# APPLICATIONS



## Ring Counter Application

- Some devices require scanning. Scanning is when devices are enabled one at a time to:
  - check their status, or
  - enable their output
- An example of scanning is for keyboard inputs. The ring counter enables each of the keys in turn to check on their state.



# ASSESSMENT



1. What is Register?
2. List the types of Shift registers.
3. Explain the operation of SISO, SIPO shift register.



**THANK YOU**