

Department of BES-II

Digital Design and Computer Architecture

23ECI1202

Topic:

Shift Registers

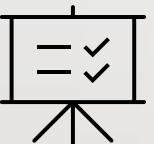
Session No: 15

AIM OF THE SESSION

To familiarize students with the basic concept of shift register and its types, applications

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

- 
- I. Demonstrate the importance of clock signals in the operation of shift registers.
 2. Describe how shift registers are used for efficient data transfer and storage.
 3. List out the types of shift registers.
 4. Describe the operation of various types of shift registers.

LEARNING OUTCOMES



At the end of this session, you should be able to:

- I. Define shift register.
2. Describe the operation of various types of shift registers.
3. Summarize the applications of shift registers in real time.

Shift register

- A shift register provides the data shifting function from one flip-flop to another.
- A shift register “shifts” its output once every clock cycle.
- A shift register is a group of flip-flops set up in a linear fashion with their inputs and outputs connected together in such a way that the data is shifted from one device to another when the circuit is active.

Shift Register Types & Directions

Direction

- Left shift
- Right shift
- Rotate (right or left)
- Bidirectional

Types

- Serial-in, Serial-out
- Serial-in, Parallel-out
- Parallel-in, Serial-out
- Parallel-in, Parallel-out
- Universal

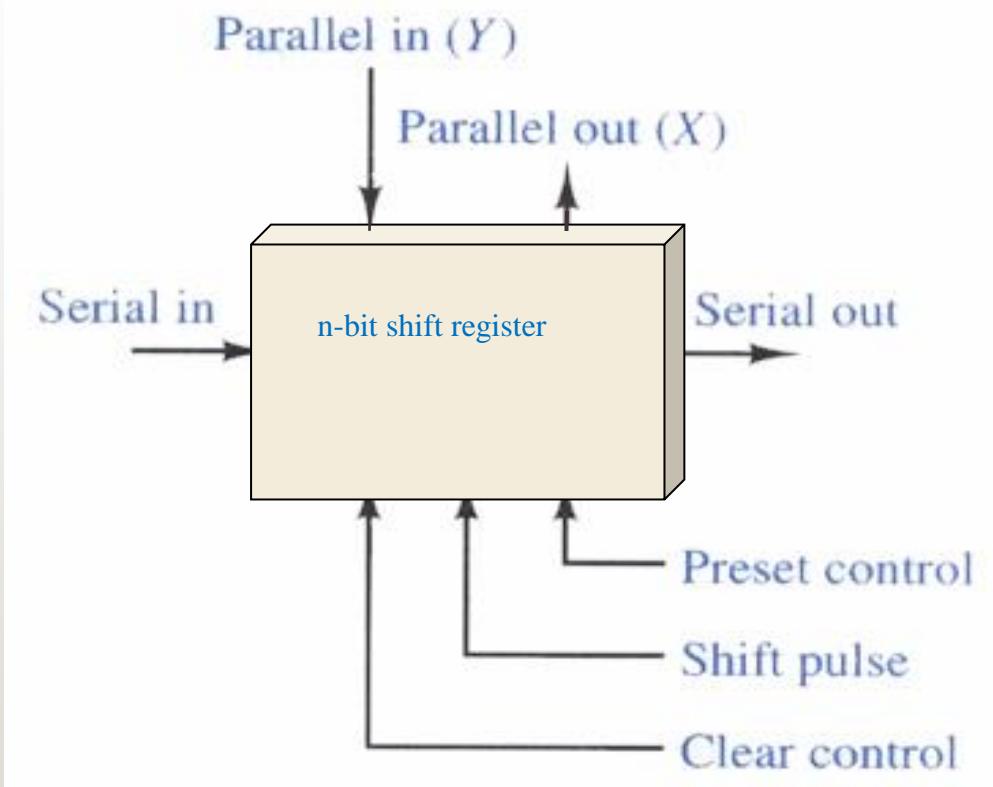
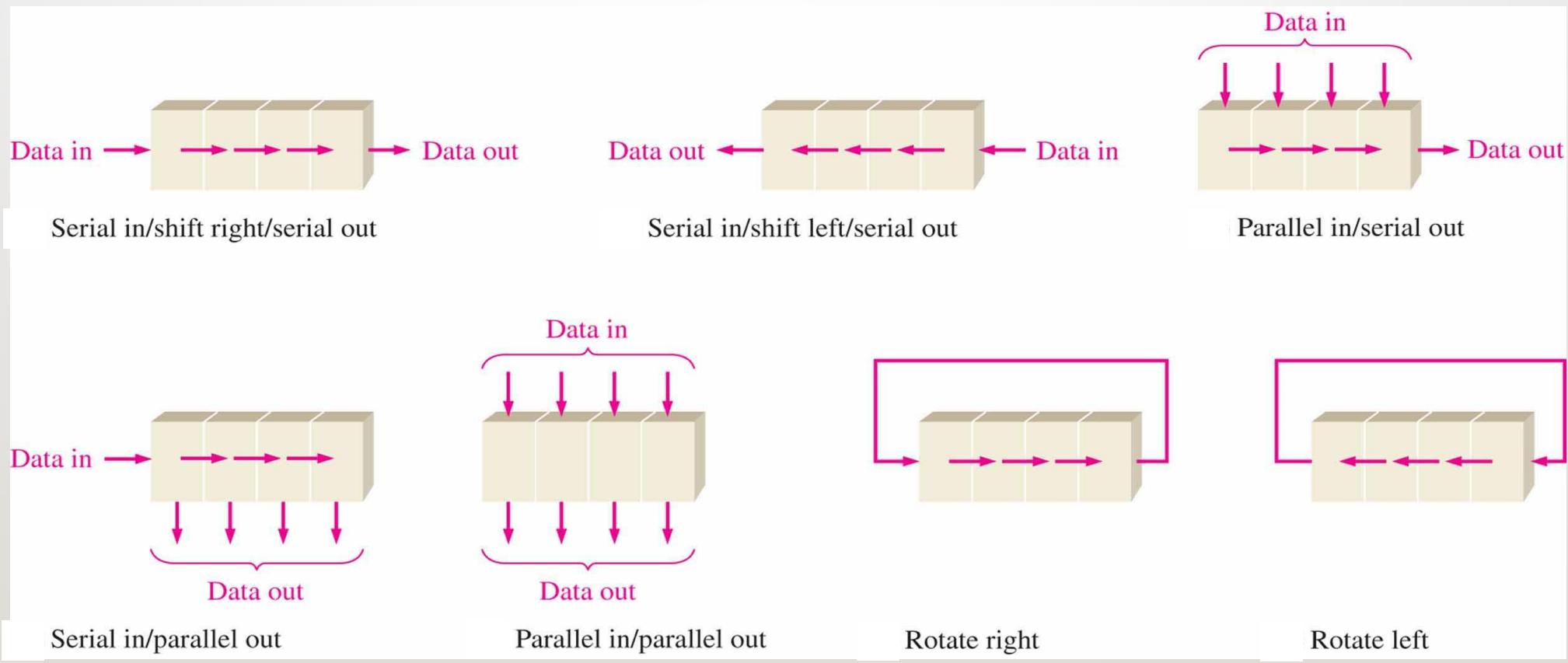
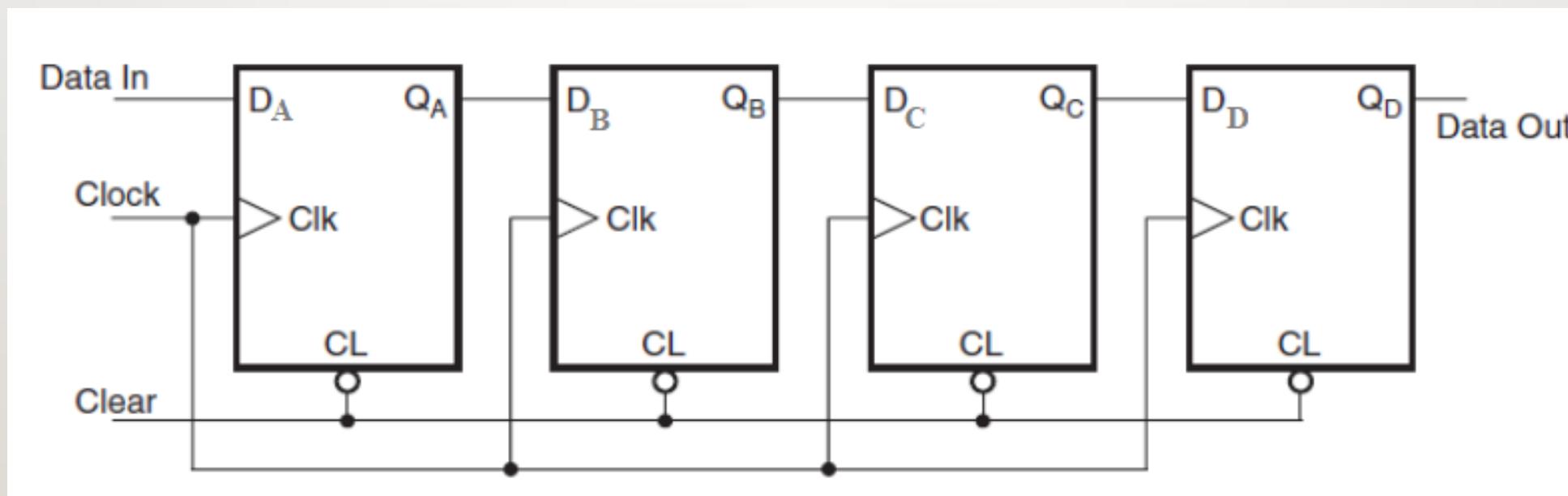


Illustration of Shift/Rotate Operations



Serial IN Serial OUT (SISO) Shift Register

- Serial IN Serial OUT shift register stores and shifts data in a serial manner
- The input data is applied to the first flip flop in a series with the clock pulse

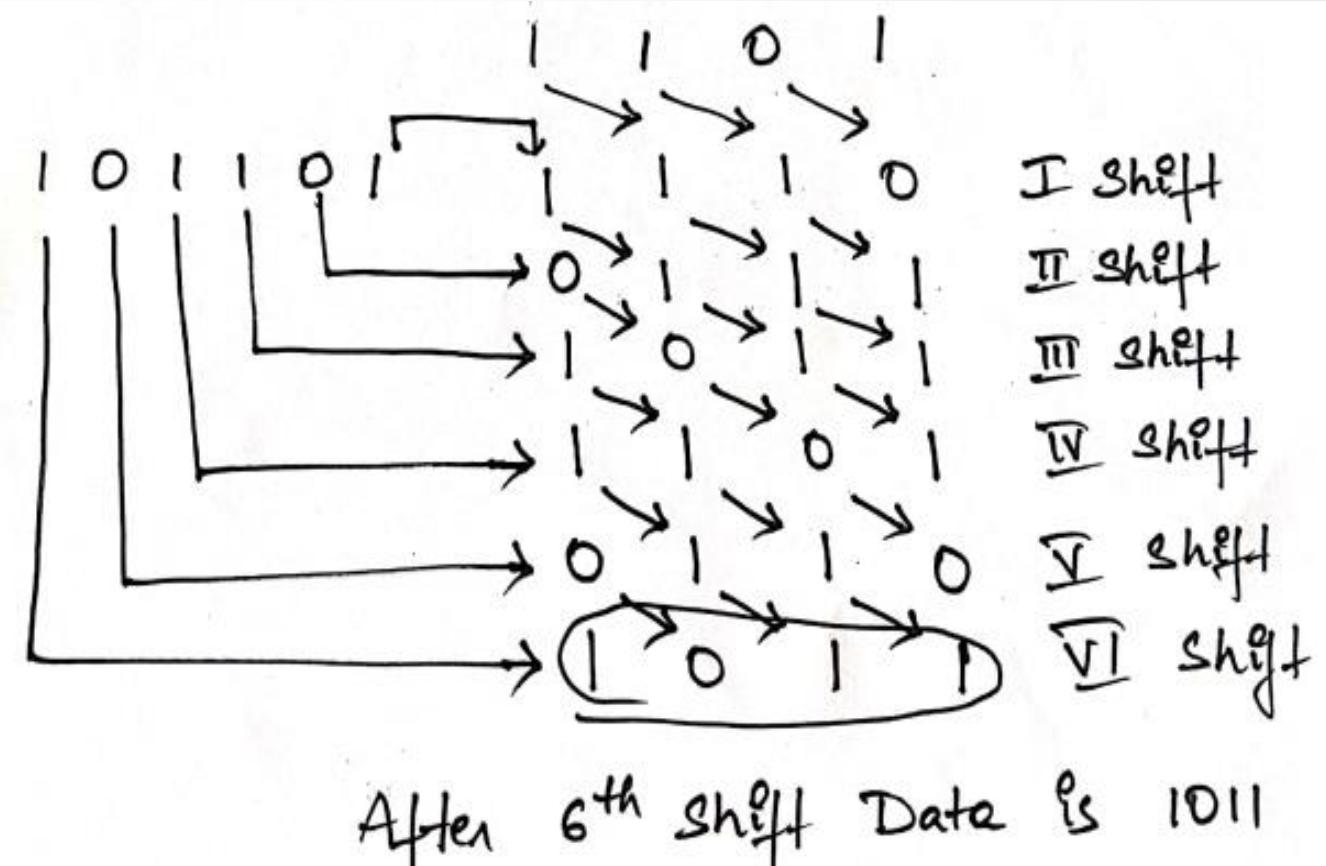


Serial IN Serial OUT (SISO) Shift Register Example

- A 4-bit shift register is initially filled with data 1101. The register is shifted six times to the right with the serial input being 101101. what is the content of register after each shift ?

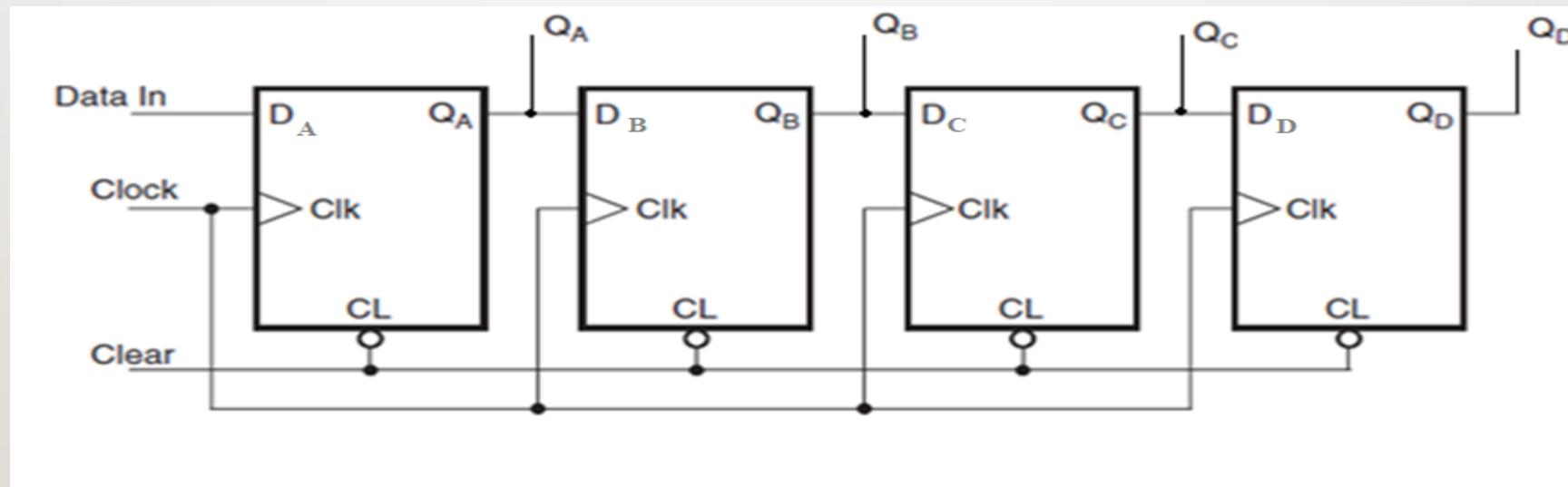
Sol: Given data 1101

Given serial input data 101101



Serial IN Parallel OUT Shift Register

- Serial IN Parallel OUT Shift register consists of flip flops connected in series.
- The data is shifted from one flip-flop to the next either in a serial or parallel fashion depending upon the mode of operation.

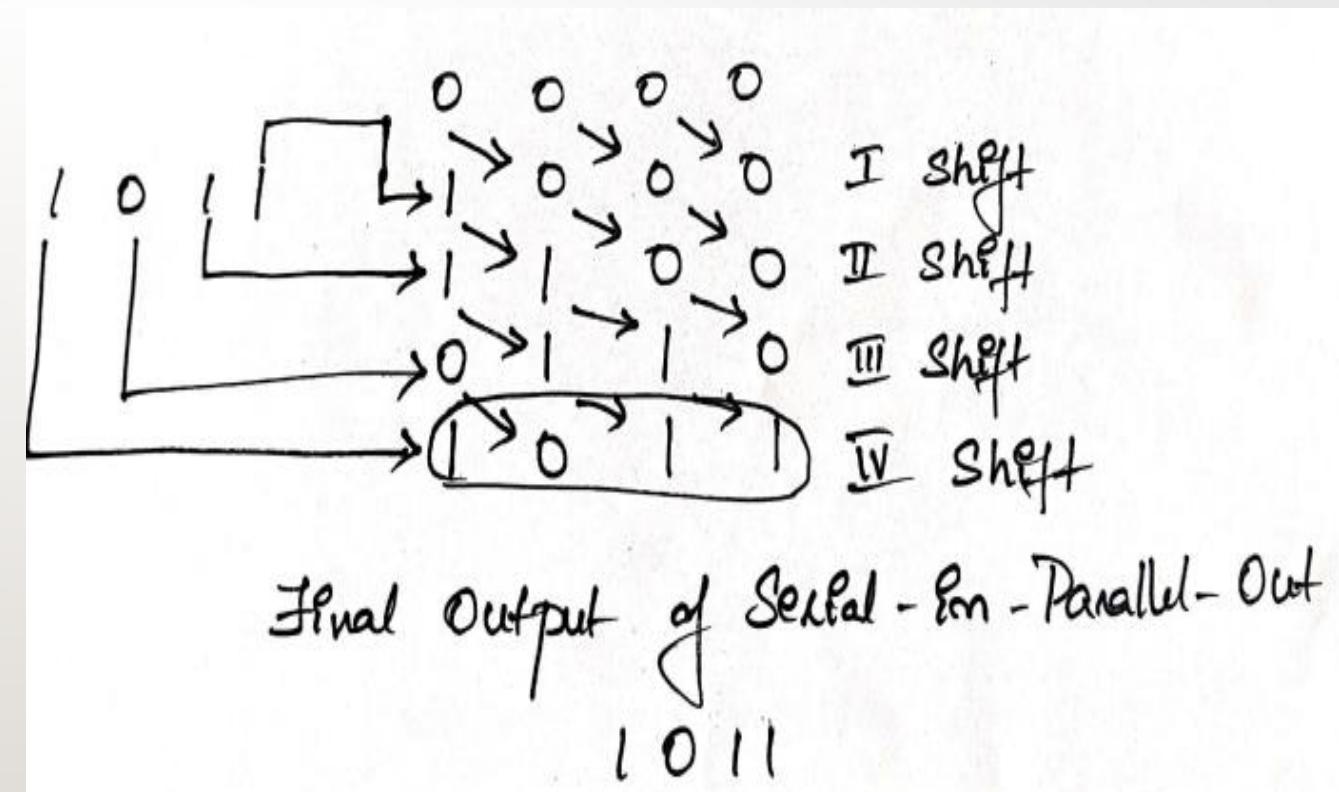


Serial IN Parallel OUT Shift Register Example

- Construct a 4-bit shift register configuration that outputs the binary data pattern 1011 in parallel format after receiving it serially.

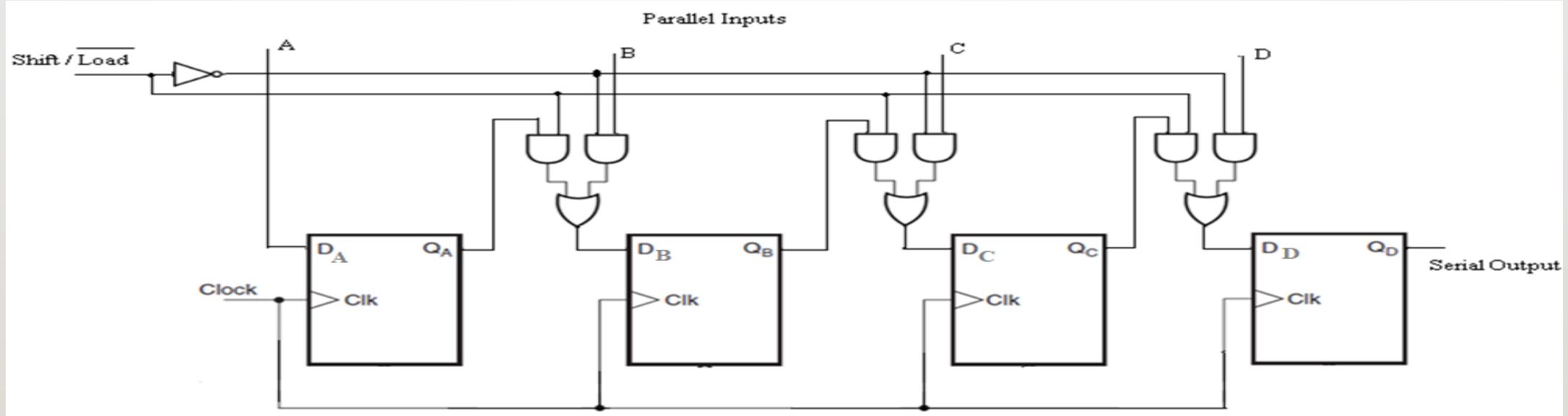
Sol: Let us consider the initial contents of shift register

0000



Parallel IN Serial OUT Shift Register

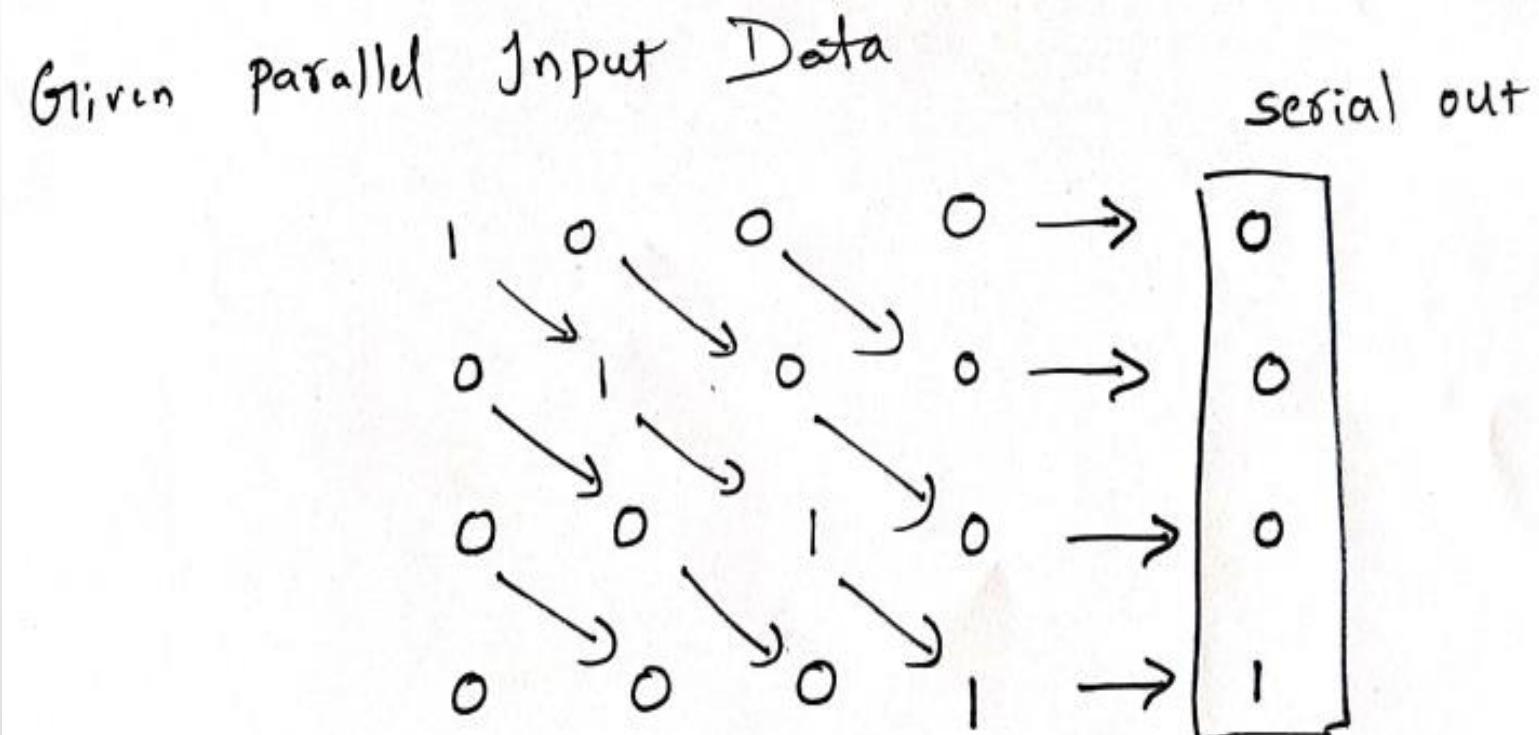
- Parallel IN Serial OUT Shift register takes data in parallel and outputs data in a serial form.
- Here, each flip flop is capable of storing one-bit data



Parallel IN Serial OUT Shift Register Example

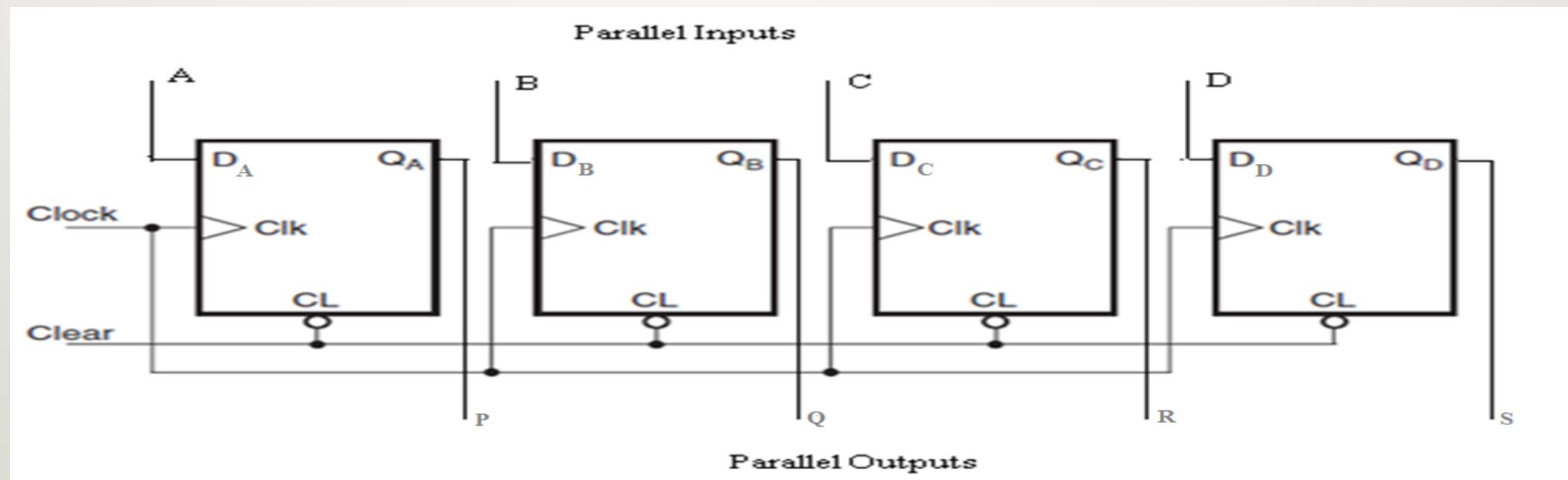
- Design a 4-bit shift register setup that converts parallel input into serial output, specifically outputting the binary data pattern as 1000

Sol: Given Input data as
1000



Parallel IN Parallel OUT Shift Register

- Parallel IN Parallel OUT Shift register stores data and outputs the same in parallel form
- Here, all flip flops are arranged in a series



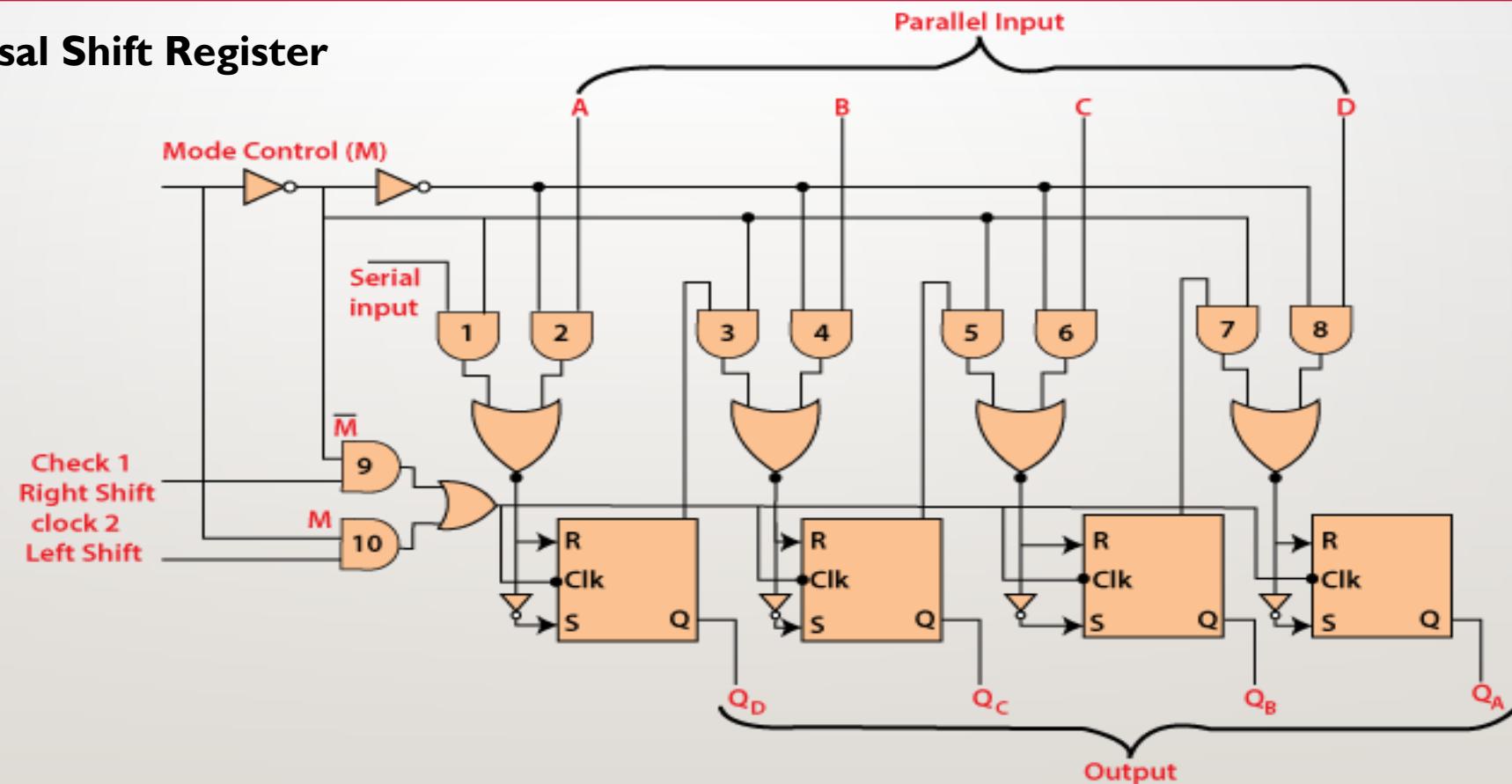
Applications of Shift Registers

Registers are used in digital electronic devices like computers as

- . Temporary data storage
- . Data transfer
- . Data manipulation
- . As counters

ACTIVITIES/ CASE STUDIES/ IMPORTANT FACTS RELATED TO THE SESSION

- Universal Shift Register



SUMMARY

- A shift register is a vital component in digital electronics and sequential logic circuits. It is designed to store and manipulate binary data efficiently.
- In summary, shift registers are crucial components that enable efficient handling and processing of binary data in sequential logic circuits. Their versatility and applications make them fundamental in various technological domains.

SELF-ASSESSMENT QUESTIONS

1. What is a shift register?

- (a) A device for adjusting voltage levels
- (b) A type of memory unit
- (c) **A sequential logic circuit for retaining and shifting binary data**
- (d) A digital-to-analog converter

2. How is the output of one flip-flop connected in a shift register?

- (a) To the clock input of the next flip-flop
- (b) To the output of the next flip-flop
- (c) To the reset input of the next flip-flop
- (d) To the data input of the next flip-flop**

SELF-ASSESSMENT QUESTIONS

3. What is the primary function of a shift register?

- (a) Arithmetic calculations
- (b) Shifting and storing binary data
- (c) Analog signal processing
- (d) Logical comparisons

4. In a shift register, what is synchronized by the same clock signal?

- (a) Flip-flop outputs
- (b) Data input
- (c) Reset signals
- (d) Power supply

TERMINAL QUESTIONS

Short answer questions:

1. List the different types of shift registers.
2. Illustrate the purpose of a clear and reset pin on a shift register.

Long answer questions:

1. A 4-bit register is initially filled with the data "1101". The register is shifted six times to the right with the serial input being 101101. What is the content of the register after each shift?
2. Construct a 4-bit shift register configuration that outputs the binary data pattern "1011" in parallel format after receiving it serially.

TERMINAL QUESTIONS

Long answer questions:

3. Design a 4-bit parallel-to-serial data converter using a PISO shift register.
4. Construct a 4-bit shift register that detects a specific bit pattern of "1010" in a serial input stream.
Initially it starts with "0110".
5. Describe the different types of shifting operations that can be performed using shift registers.

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Computer System Architecture by M. Morris Mano
2. Fundamentals of Digital Logic with Verilog HDL by Stephen Brown and ZvonkoVranesic

Sites and Web links:

1. <https://www.javatpoint.com/shift-registers-in-digital-electronics>
2. https://www.tutorialspoint.com/digital_circuits/digital_circuits_shift_registers.html

THANK YOU



Team – Digital Design & Computer Architecture