
Chapter Objectives

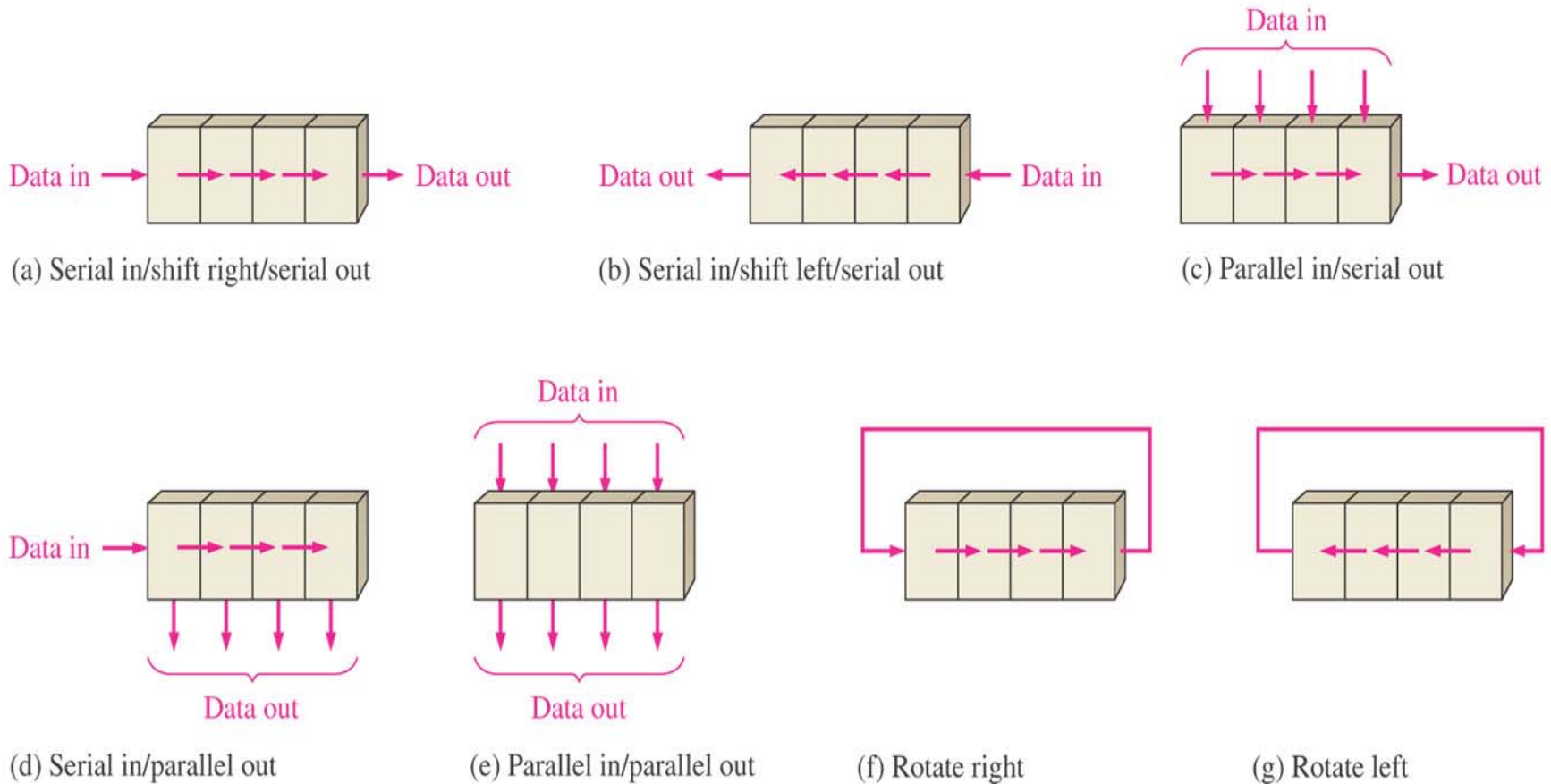
- Identify the basic form of data movement in shift registers
 - Explain how serial in/serial out, serial in/parallel out, parallel in/serial out and parallel in/parallel out shift registers operate
 - Describe how a bidirectional shift register operates
 - and more ...
-

Basic Shift Register

- Shift register consist of arrangements of flip-flop and are important in applications involving the storage and transfer of data in a digital system.
 - Serial in/serial out shift registers
 - Serial in/parallel out shift registers
 - Parallel in/serial out shift registers
 - Parallel in/parallel out shift registers
 - Bidirectional shift registers
-

Basic data movement in shift registers

A **register** is a digital circuit with two basic functions: **Data Storage** and **Data Movement**

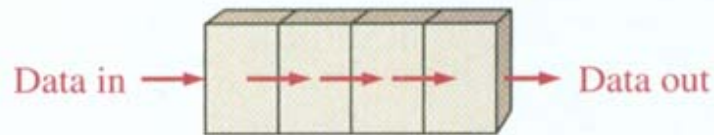


Serial In/Serial Out Shift Registers

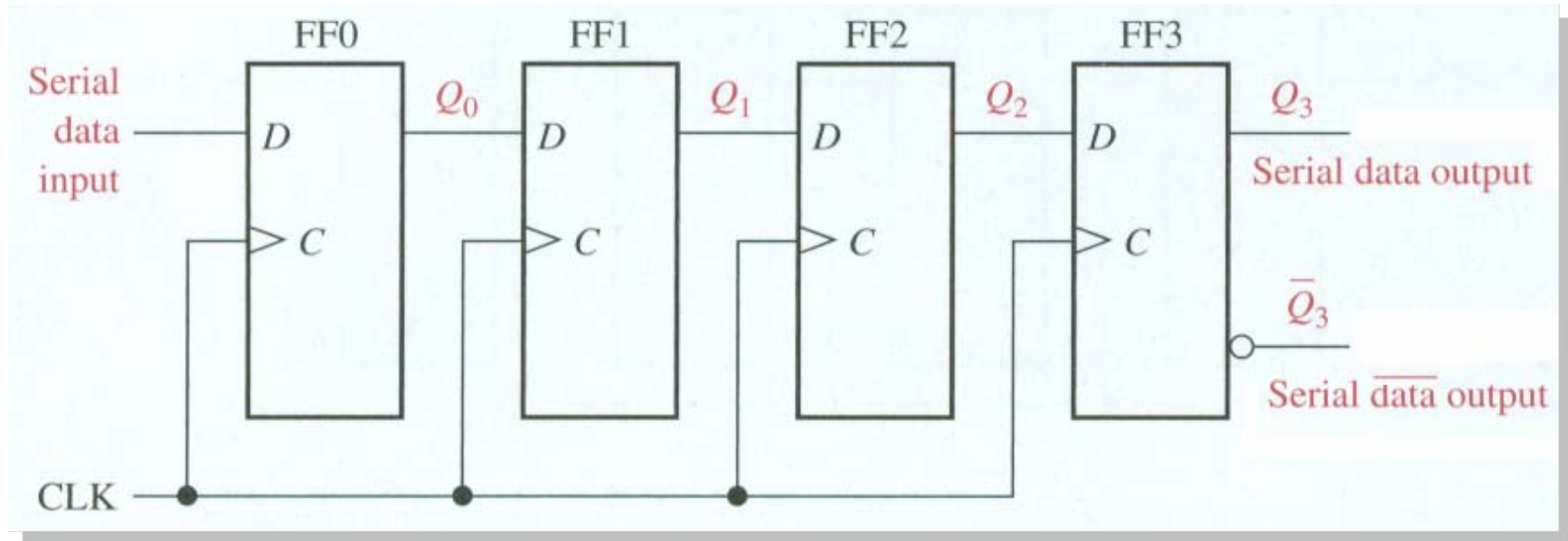
- 4-bit version
 - 5-bit version
-

Serial In/Serial Out Shift Registers

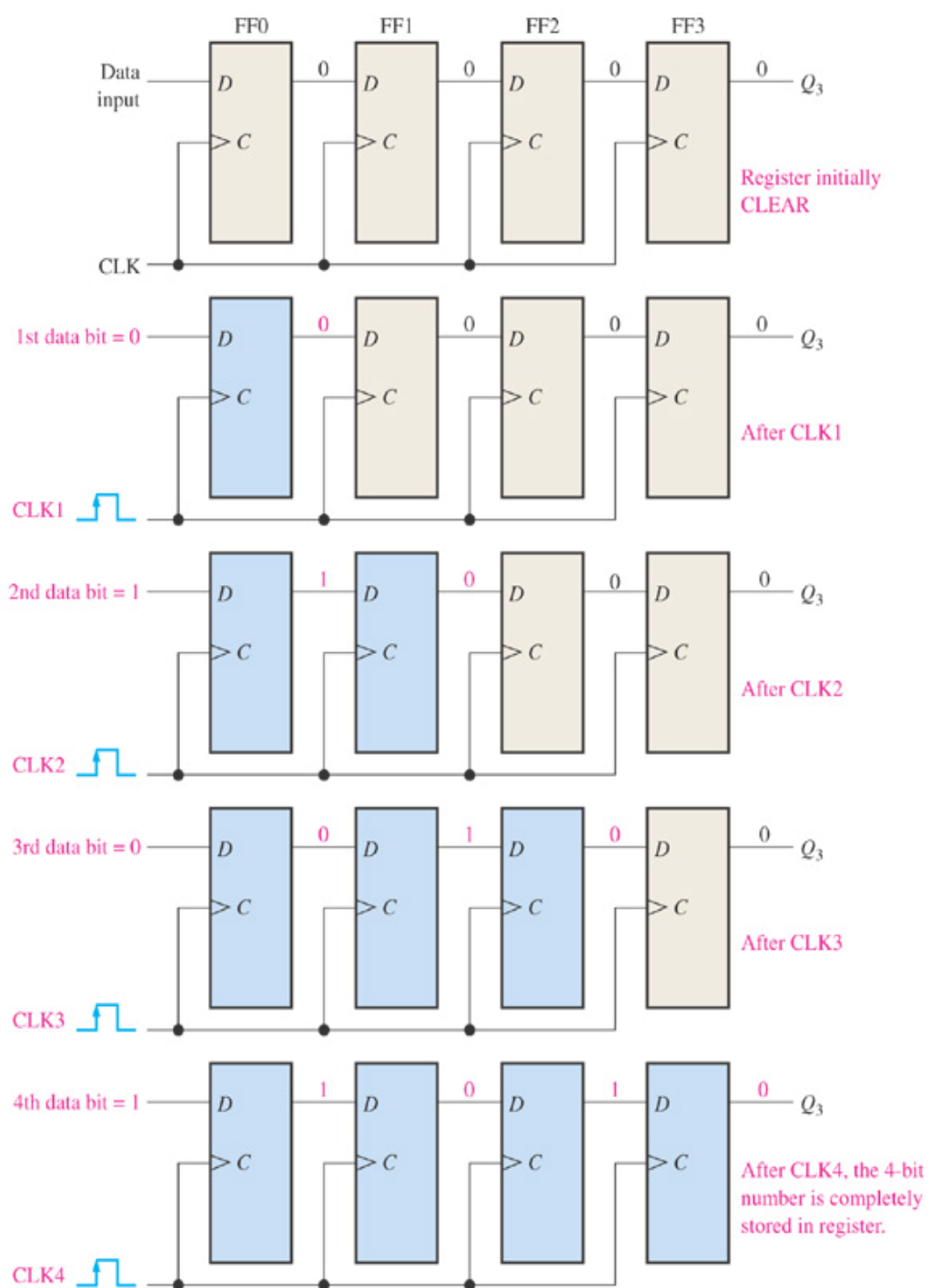
■ 4-bit version

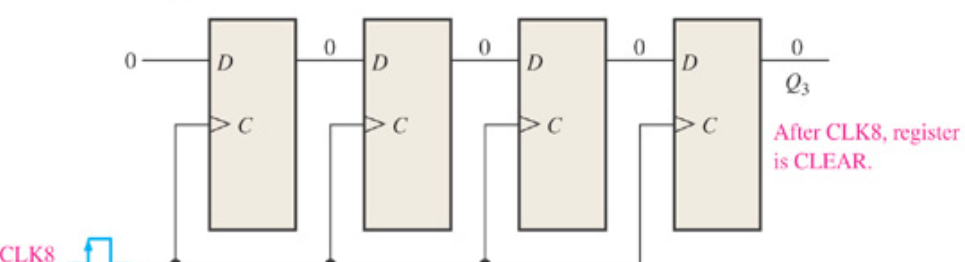
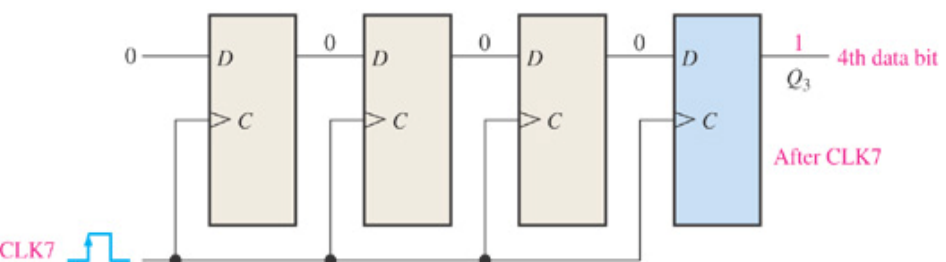
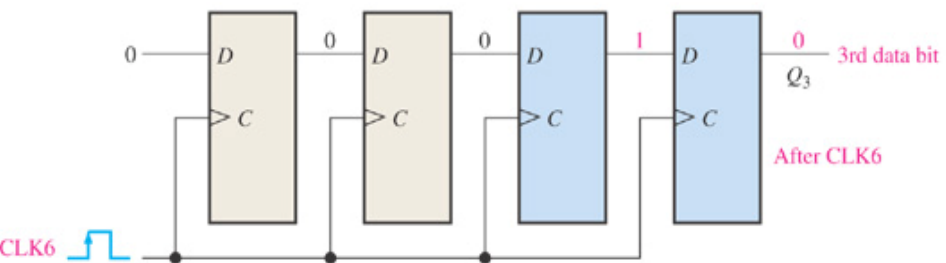
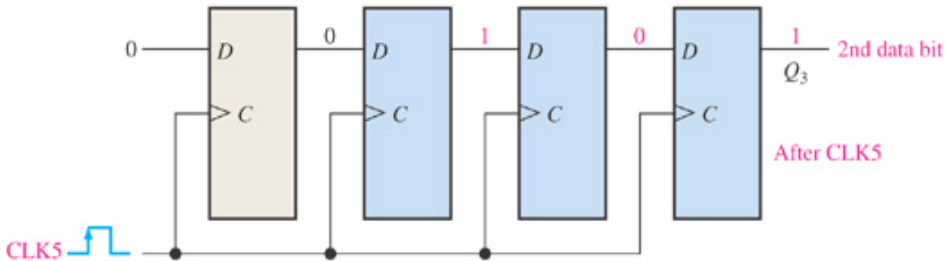
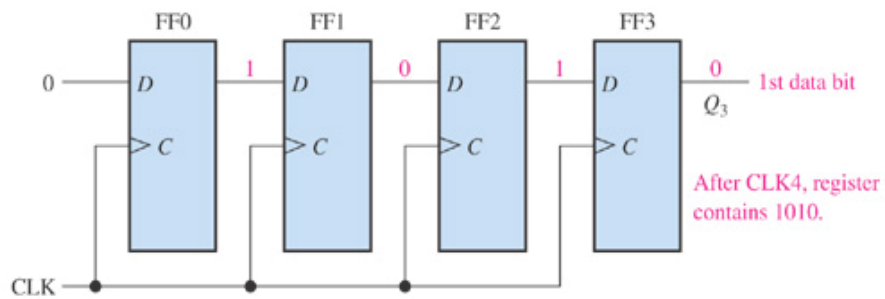


One-bit at a time on a single line!



Four Bits (1010) being entered serially into the register

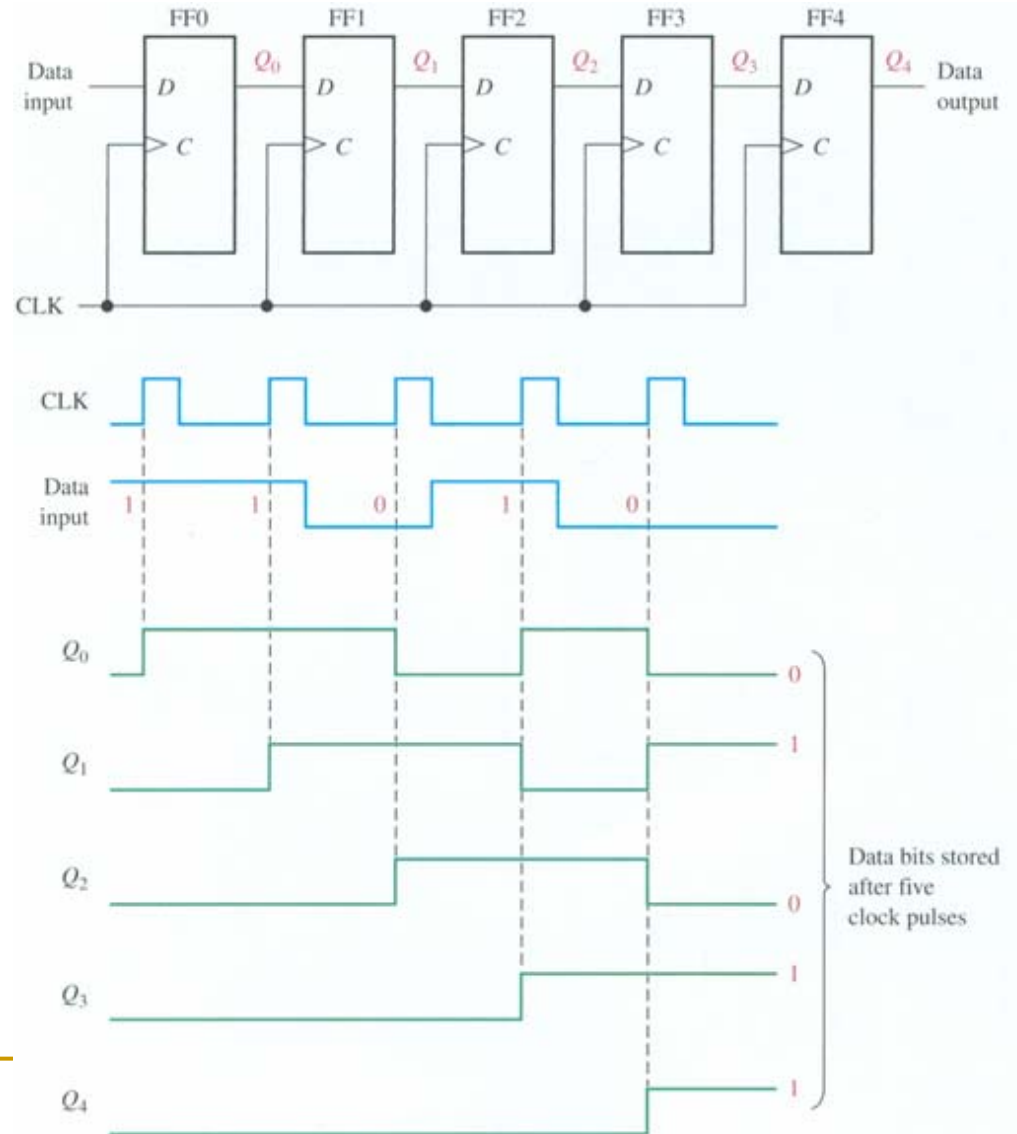
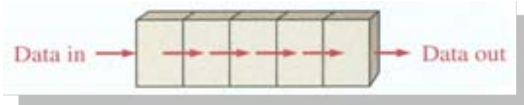




Four Bits (1010) being serially shifted out of the register and replaced by all zeros

Serial In/Serial Out Shift Registers

- 5-bit version



Assume that the register is initially **CLEARED**

Serial In/Parallel Out Shift Registers

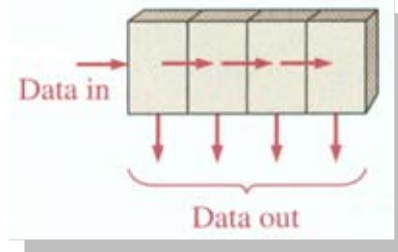
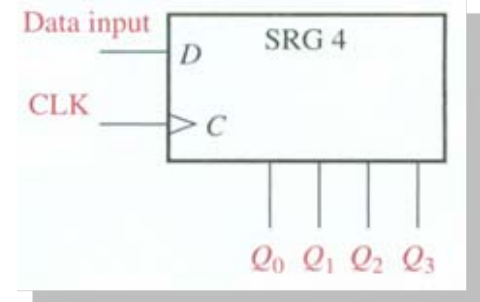
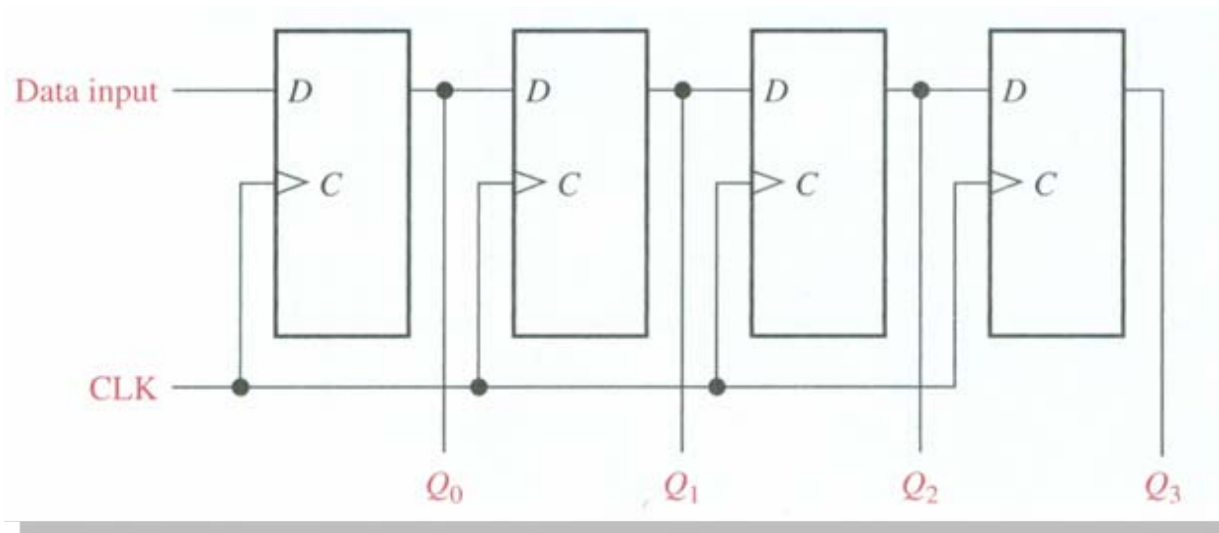
- 4-bit version
- 8-bit version

All output bits are available simultaneously!



Serial In/Parallel Out Shift Registers

- 4-bit serial in/parallel out

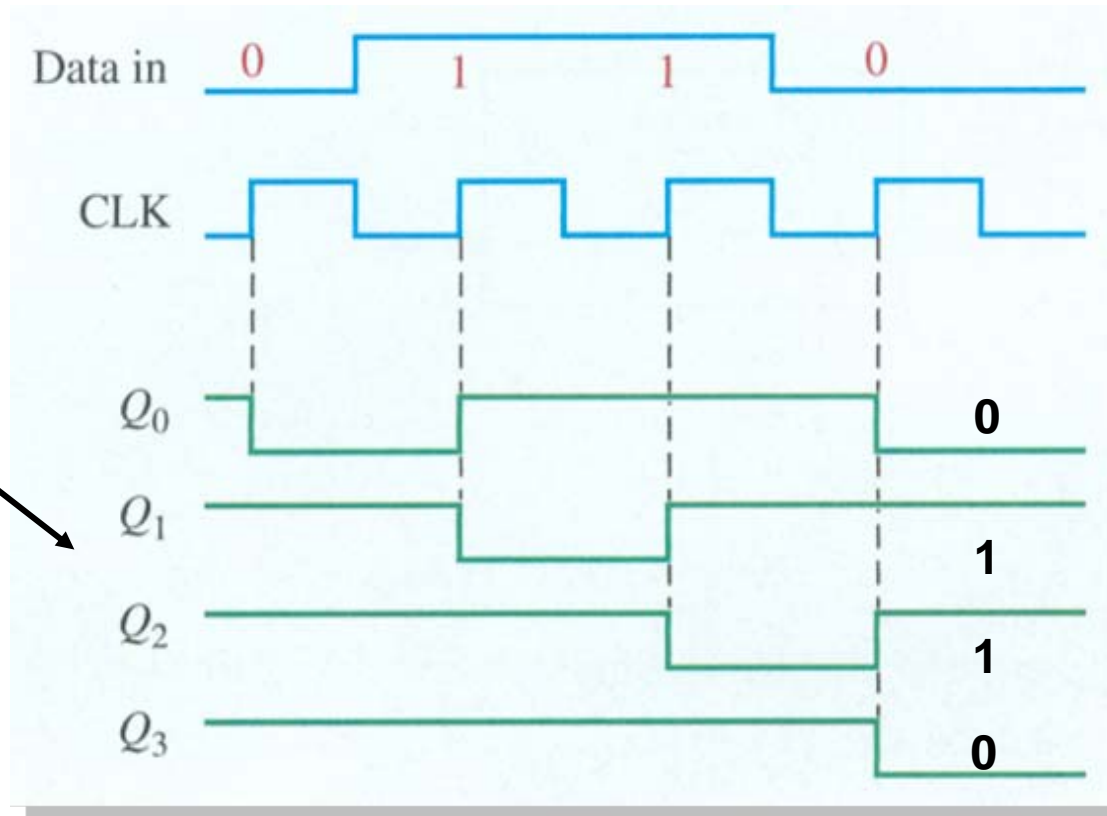


Waveforms

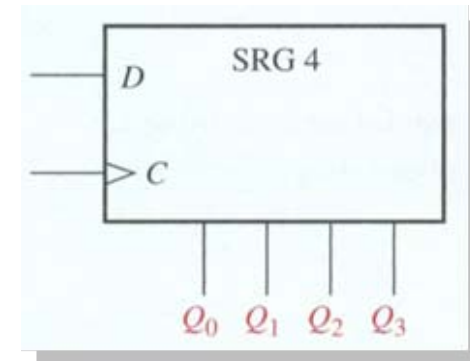


Serial In/Parallel Out Shift Registers

- 4-bit serial in/parallel out

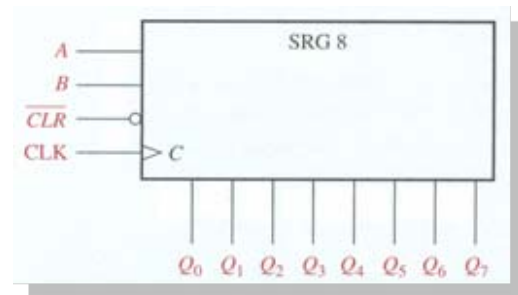
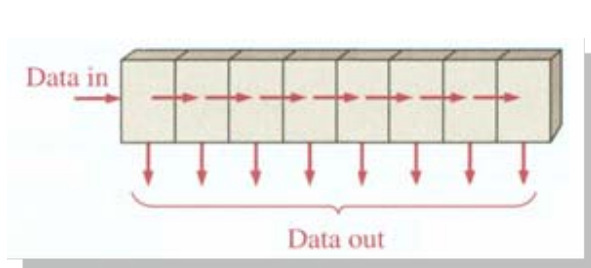
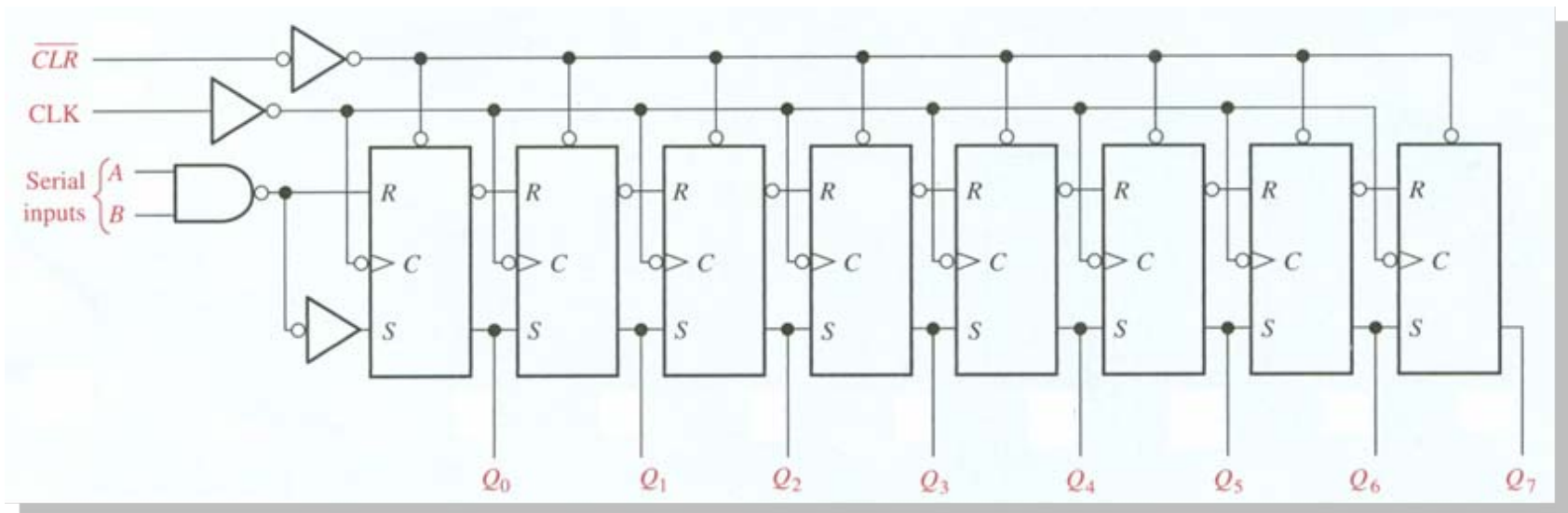


Initially all
1s



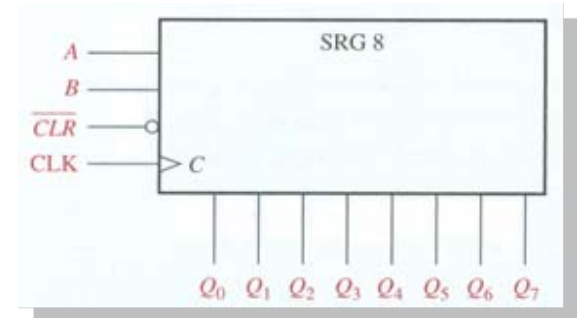
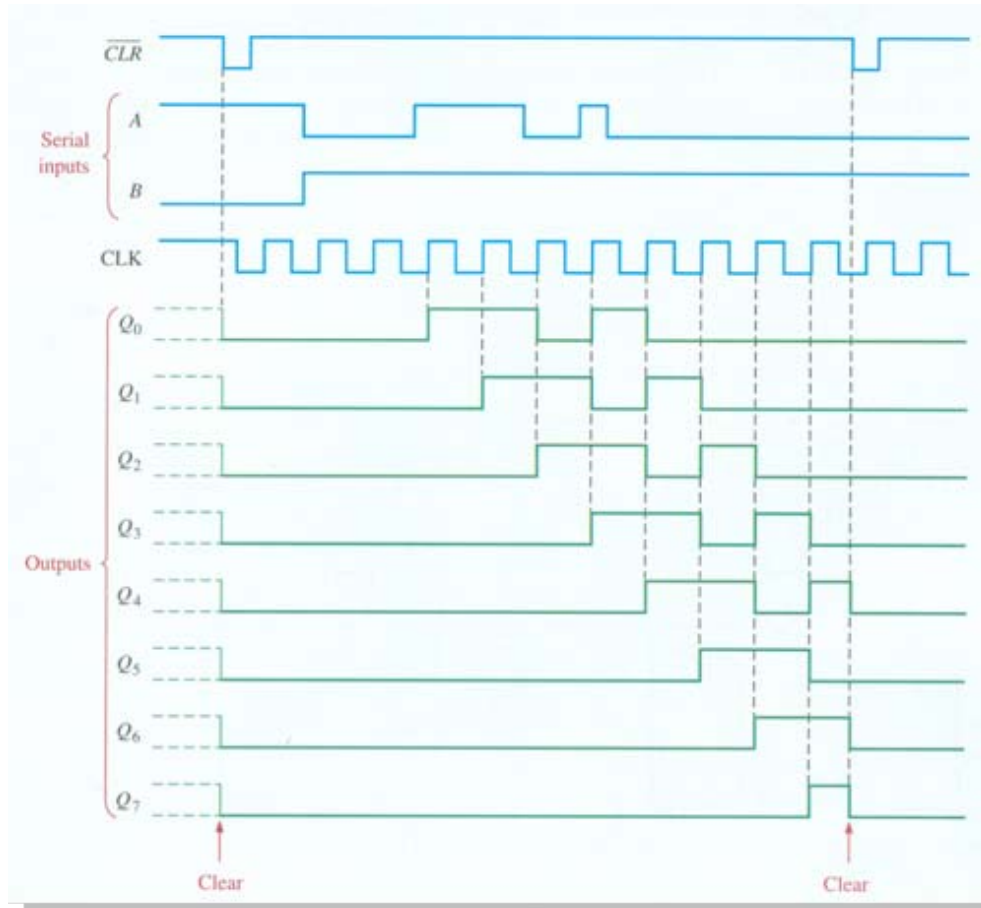
Serial In/Parallel Out Shift Registers

- 8-bit serial in/parallel out



Serial In/Parallel Out Shift Registers

- 8-bit serial in/parallel out



Parallel In/Serial Out Shift Registers

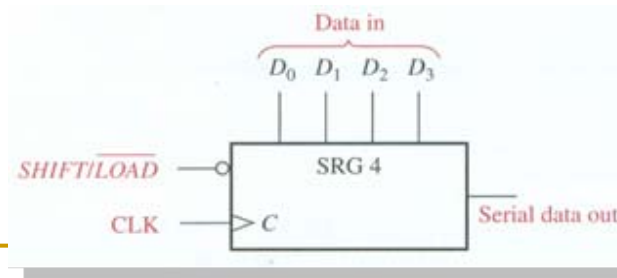
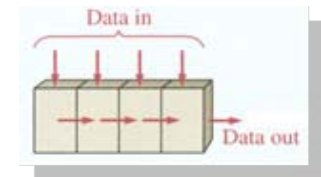
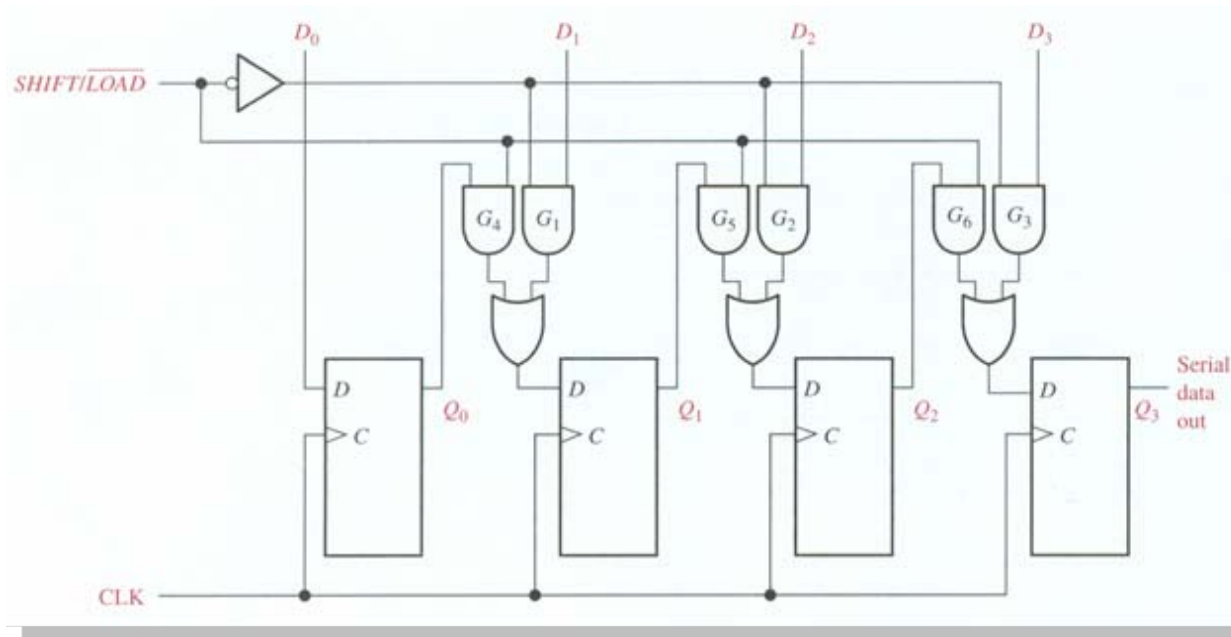
- 4-bit version
- 8-bit version

The bits are entered simultaneously!



Parallel In/Serial Out Shift Registers

- 4-bit parallel in/serial out

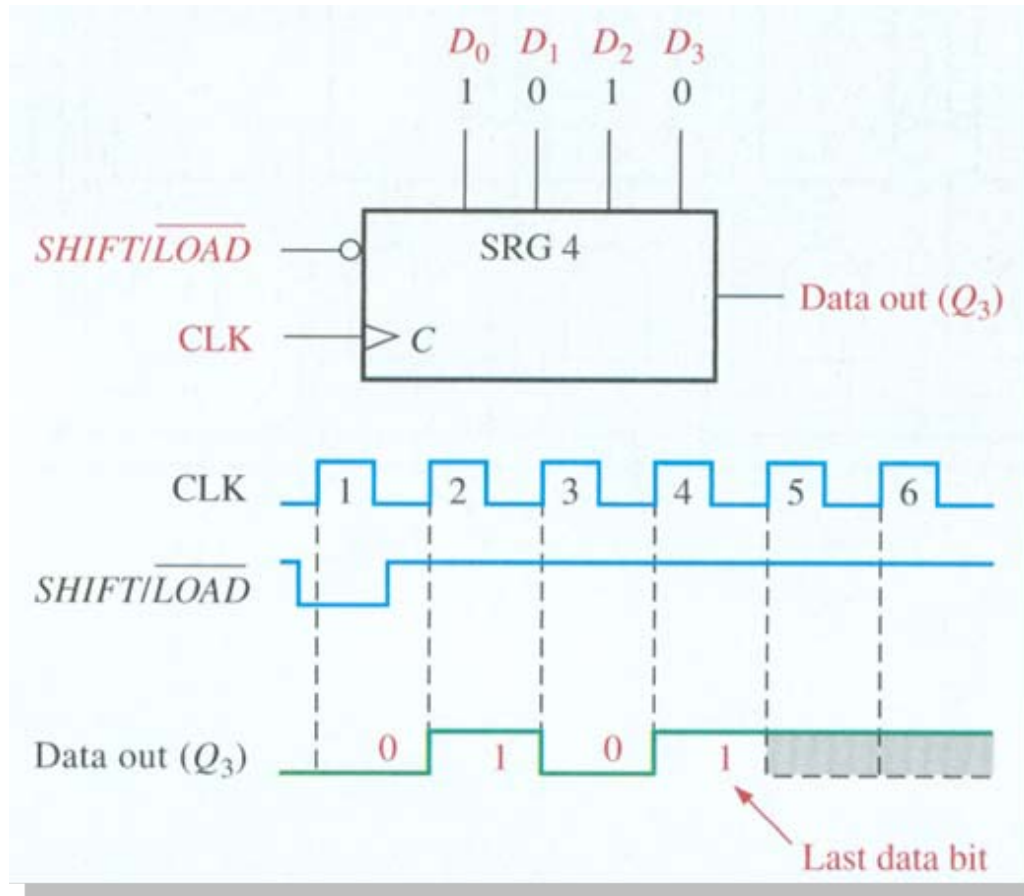


Waveforms



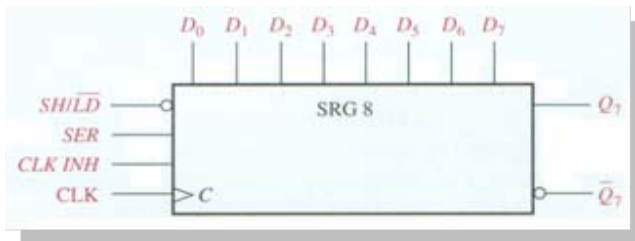
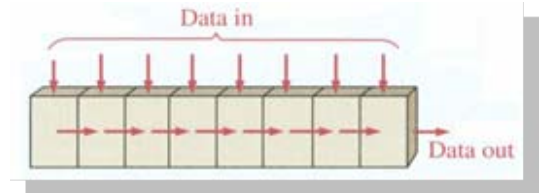
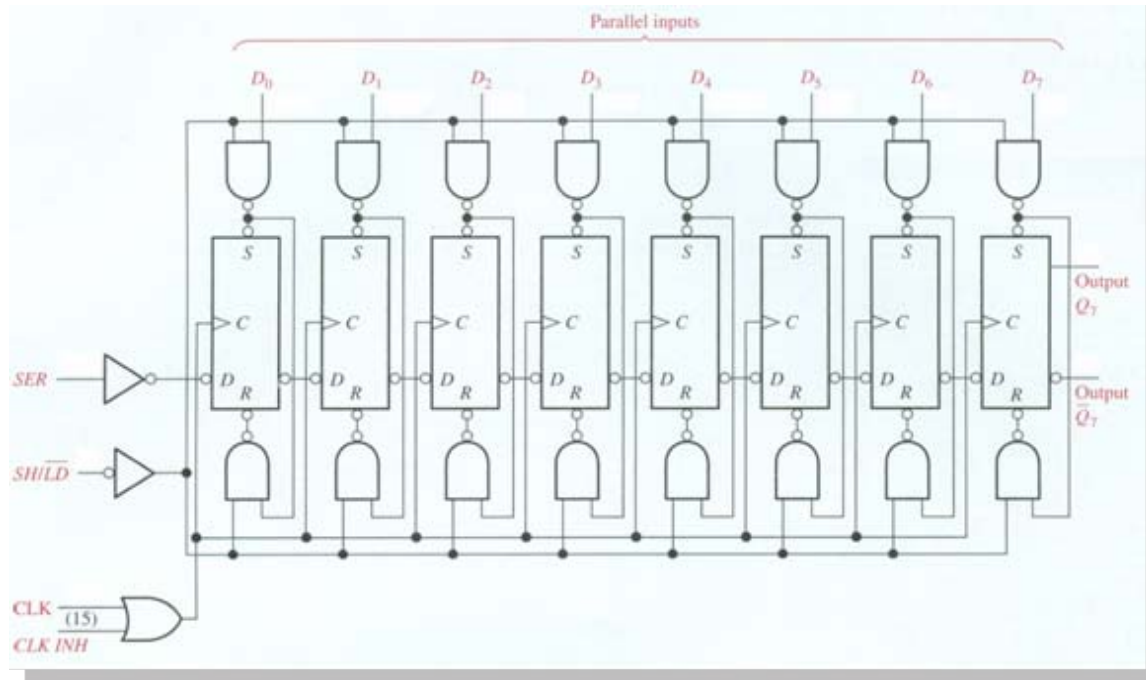
Parallel In/Serial Out Shift Registers

- 4-bit parallel in/serial out



Parallel In/Serial Out Shift Registers

- 8-bit version

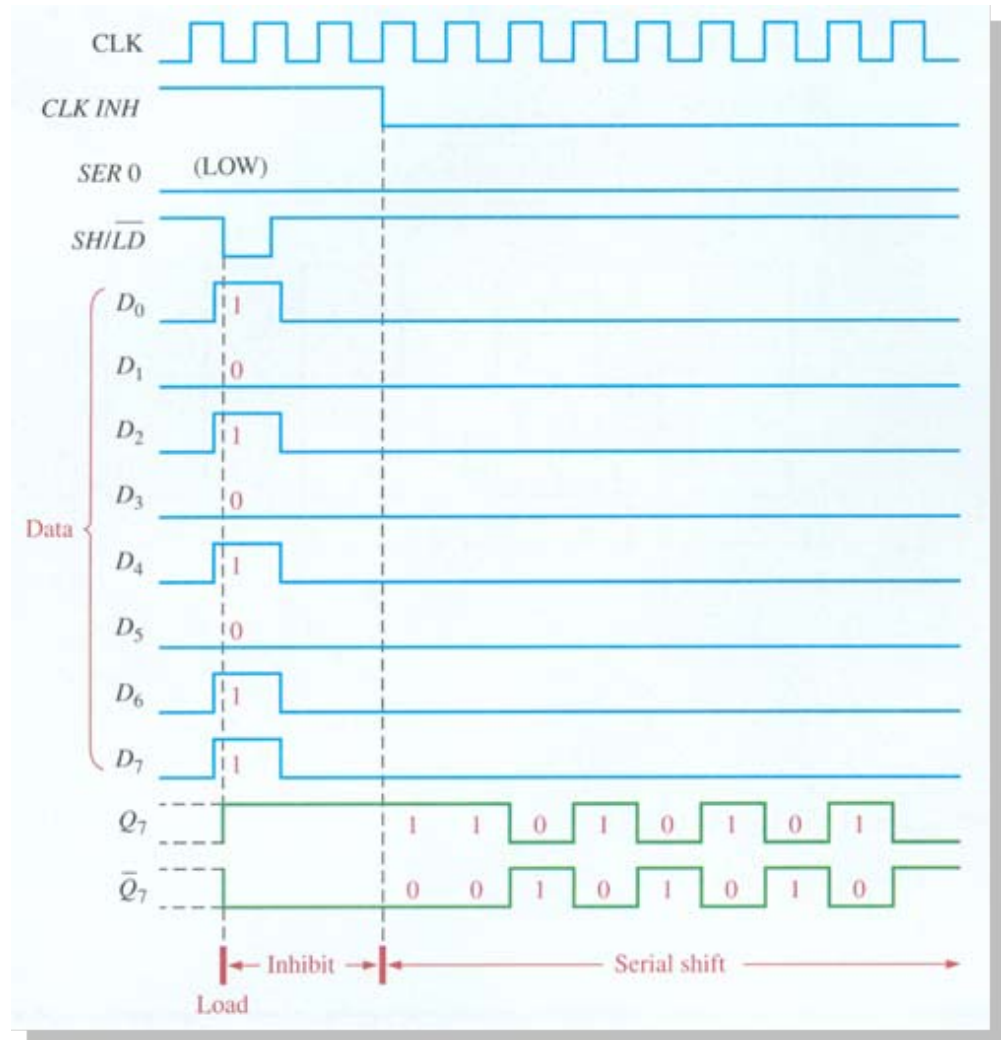
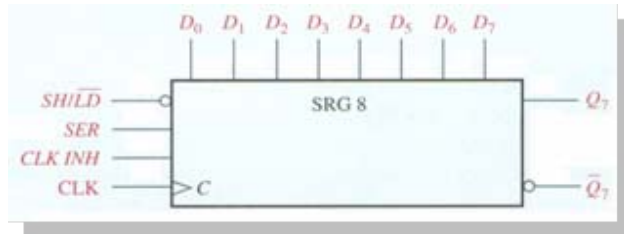


Waveforms



Parallel In/Serial Out Shift Registers

- 8-bit version



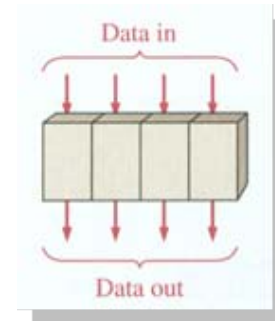
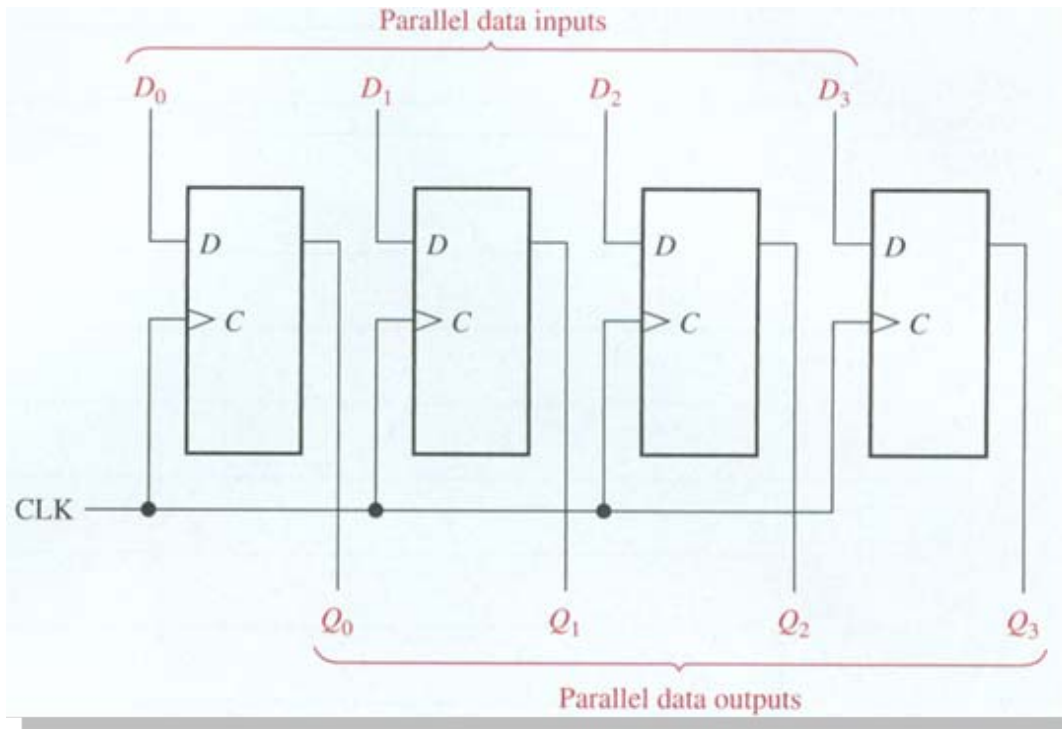
Parallel In/Parallel Out Shift Registers

- 4-bit version
- 8-bit version

The bits entered simultaneously and available simultaneously!

Parallel In/Parallel Out Shift Registers

- 4-bit version

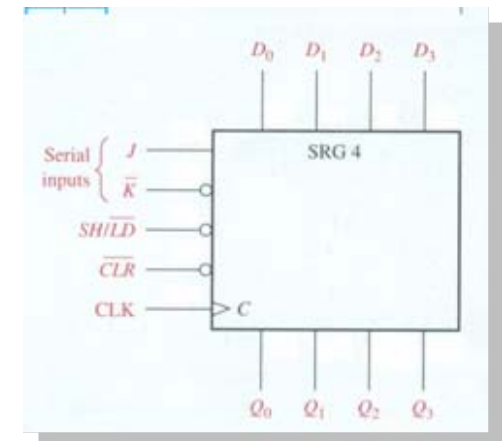
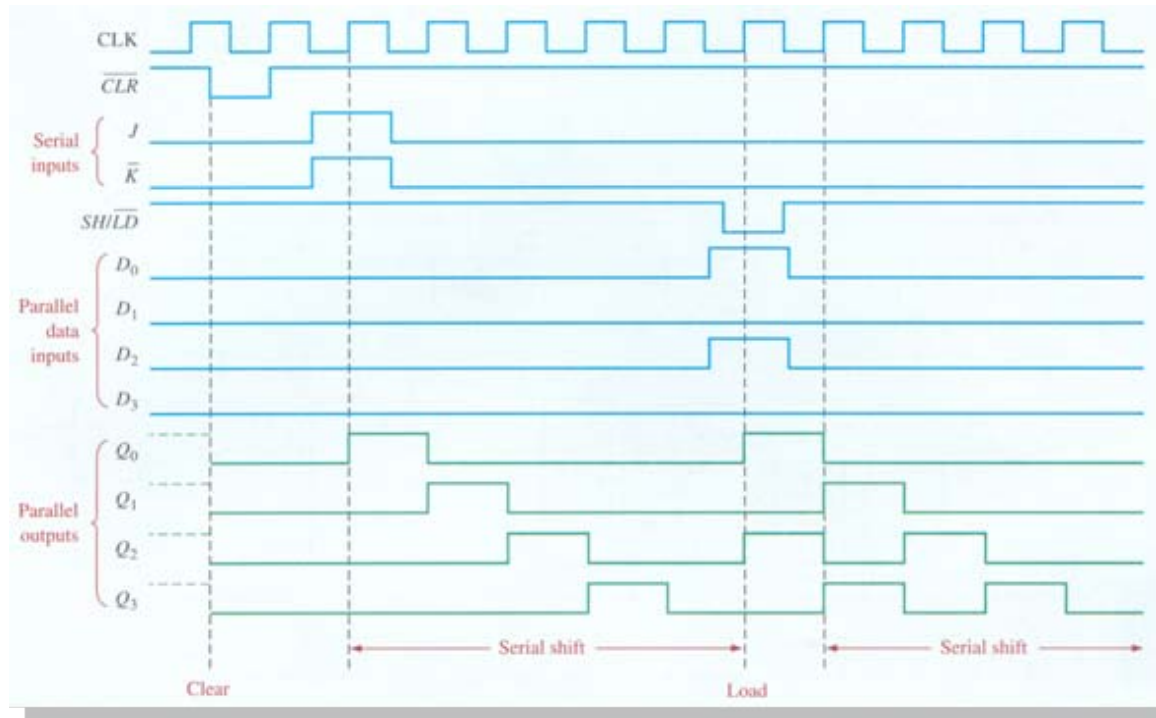


Waveforms



Parallel In/Parallel Out Shift Registers

■ 4-bit version

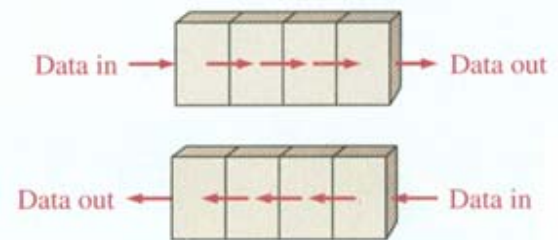
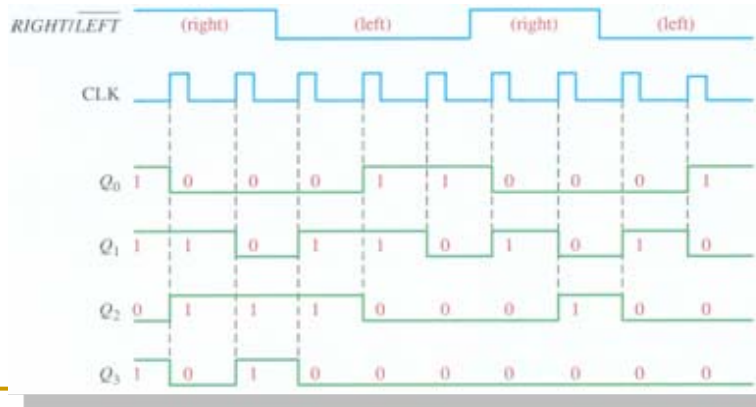
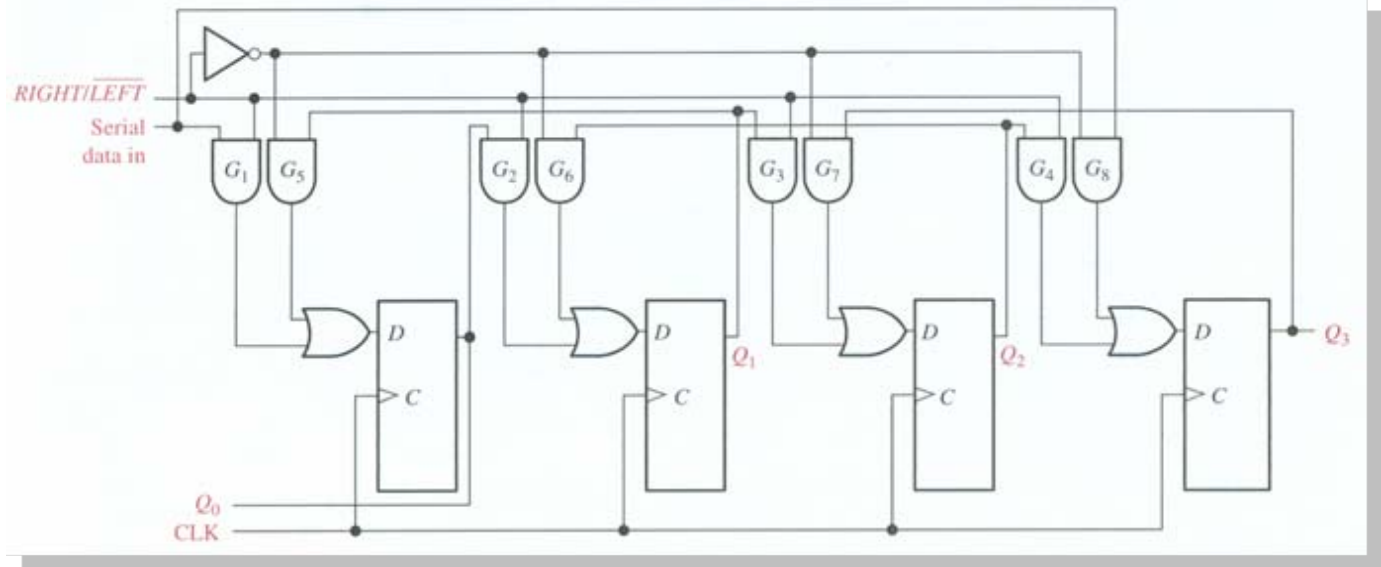


Bidirectional Shift Register

- 4-bit serial in/serial out
 - 4-bit universal
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Bidirectional Shift Register

- 4-bit serial in/serial out



Bidirectional Shift Register

- 4-bit universal

