



Dhirubhai Ambani Institute of Information
and Communication Technology

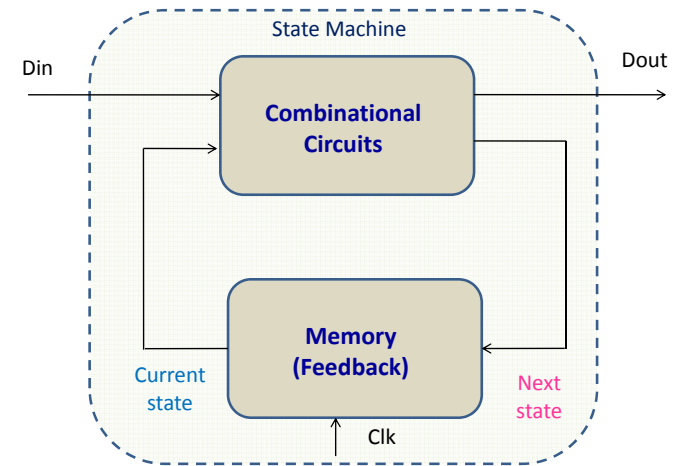
EL114

Digital Logic Design

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Introduction

Sequential Circuit



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Applications of Flip-flop

- Memory design and data storage
- Logic control devices
- Shift registers
- Frequency division
- Counters

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Introduction

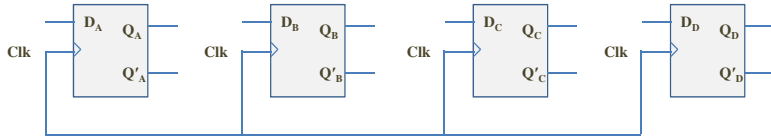
Registers

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Registers

What is Register...?



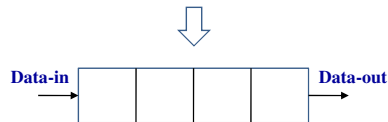
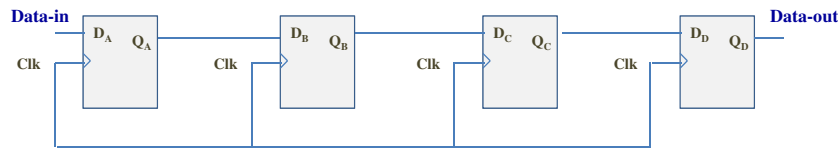
Shift Registers

Types of shift registers

- Serial-in Serial-out Shift Register
- Serial-in Parallel-out Shift Register
- Parallel-in Serial-out Shift Register
- Parallel-in Parallel-out Shift Register

Serial-in Serial-out Shift Register

(a) Shift Right



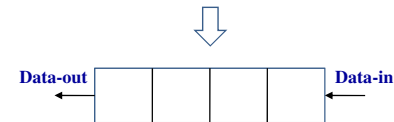
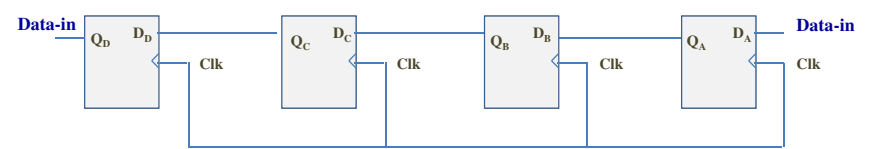
Suppose Data-in is '1010'

Clk1	Q _A	Q _B	Q _C	Q _D
Clk2	Q _A	Q _B	Q _C	Q _D
Clk3	Q _A	Q _B	Q _C	Q _D
Clk4	Q _A	Q _B	Q _C	Q _D



Serial-in Serial-out Shift Register

(b) Shift Left



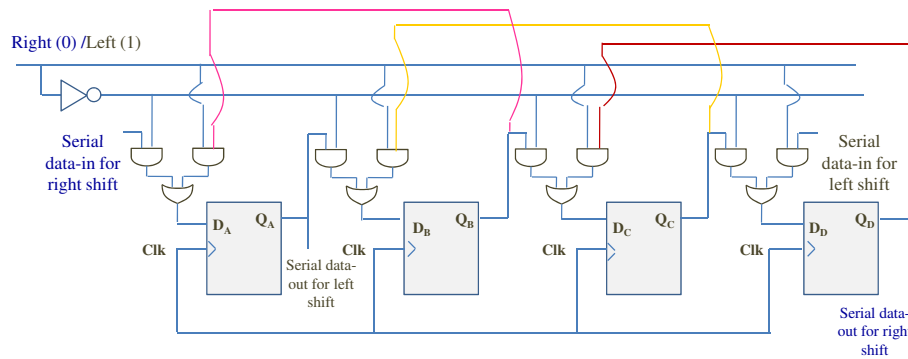
Suppose Data-in is '1010'

Clk1	Q _D	Q _C	Q _B	Q _A
Clk2	Q _D	Q _C	Q _B	Q _A
Clk3	Q _D	Q _C	Q _B	Q _A
Clk4	Q _D	Q _C	Q _B	Q _A



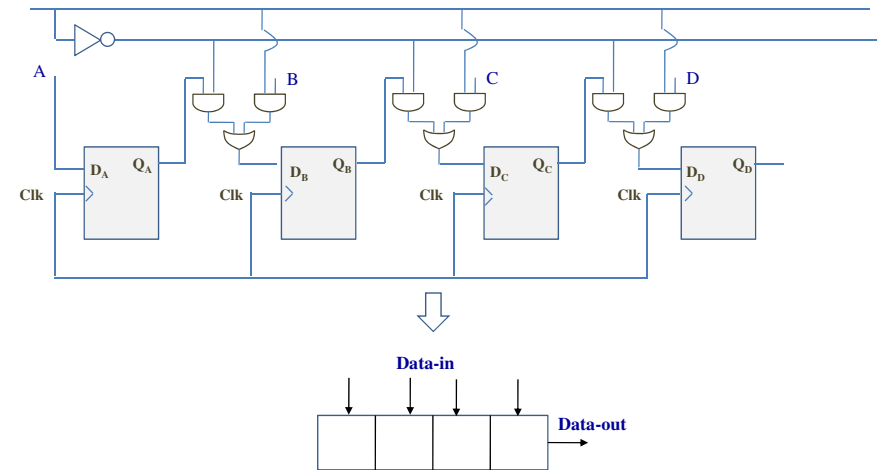
Serial-in Serial-out Shift Register

(c) Bi-directional Shift Register

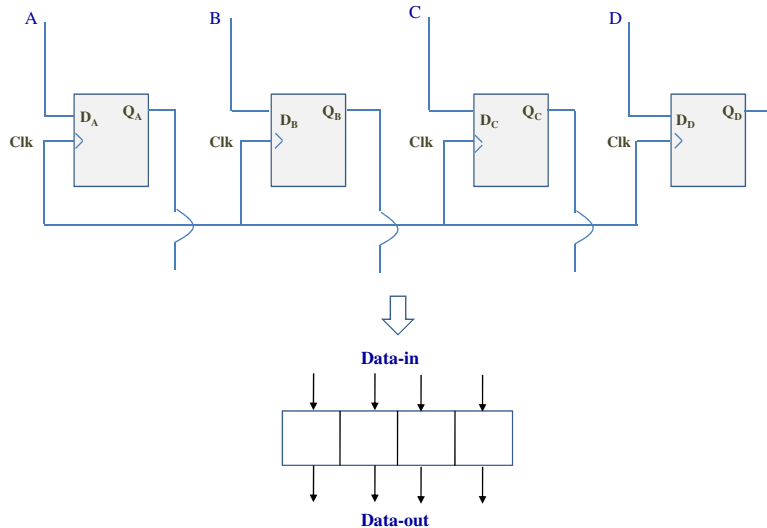


Parallel-in Serial-out Shift Register

Shift (0) / Load (1)



Parallel-in Parallel-out Shift Register



Applications of Register

- Memory Element
- To generate delay
- Serial to Parallel converter
- Parallel to Serial converter
- Counters, Multiplication and Division Circuits
- Sequence Generator