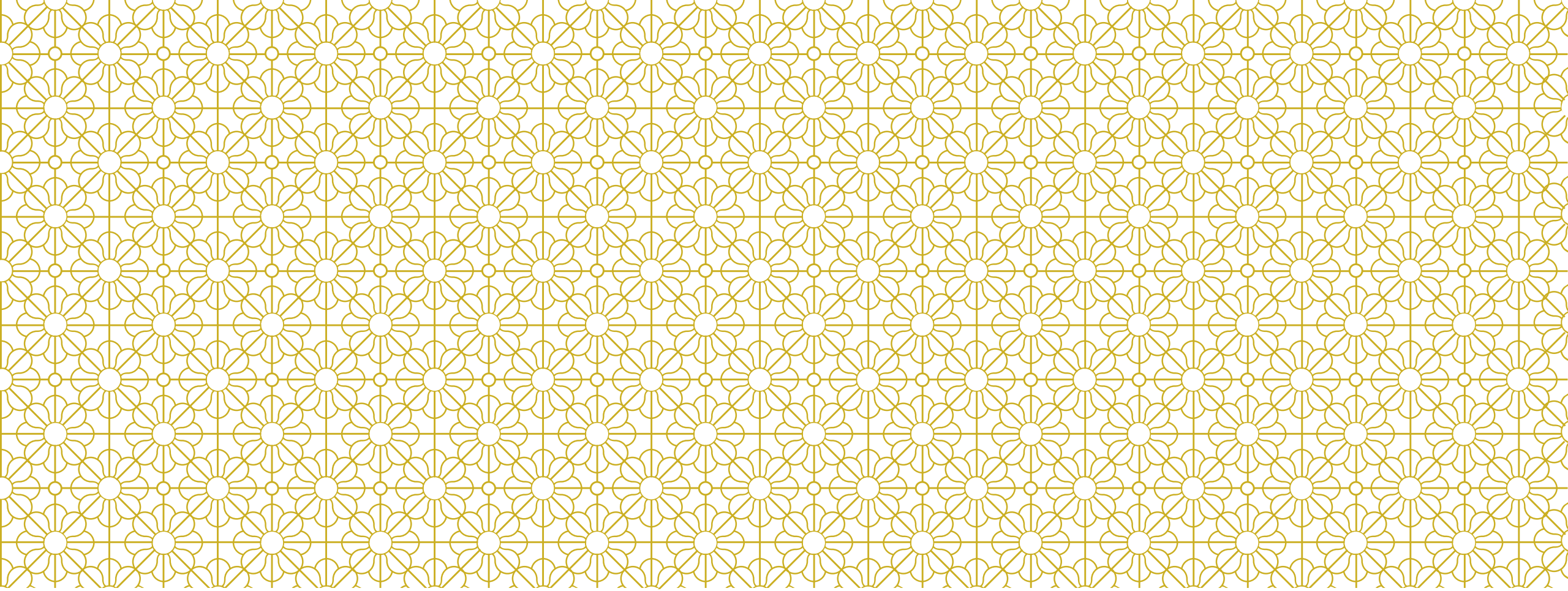
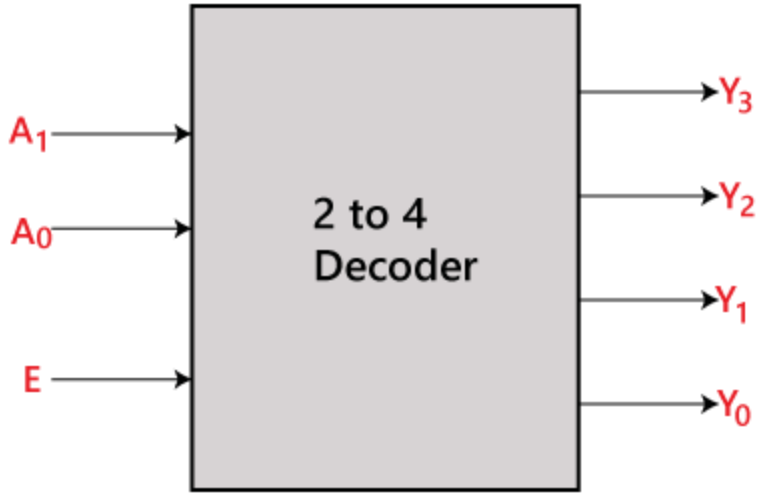


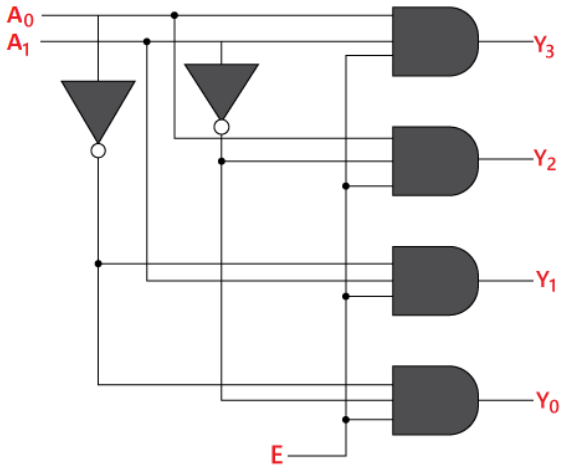
CSE332: COMPUTER ORGANIZATION AND ARCHITECTURE

Introduction Part 2

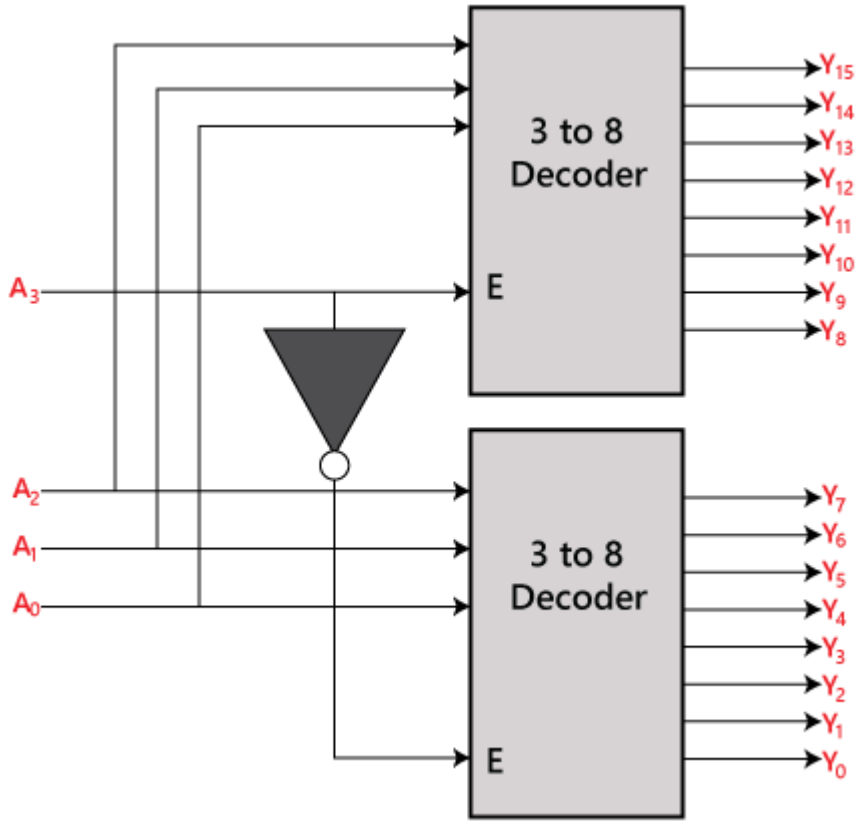
DECODER

- Decoder is a combinational circuit that converts binary information from n input line to 2^N output lines.
- Only one output line is active at a time.
- 2 to 4 line decoder:
  - In the 2 to 4 line decoder, there is a total of three inputs, i.e., A0, and A1 and E and four outputs, i.e., Y0, Y1, Y2, and Y3.
  - For each combination of inputs, when the enable 'E' is set to 1, one of these four outputs will be 1. The block diagram and the truth table of the 2 to 4 line decoder are given below.





DECODER: 4X16 USING 3X8



FULL ADDER WITH A DECODE

$$S(x, y, z) = \Sigma(1, 2, 4, 7)$$

$$C(x, y, z) = \Sigma(3, 5, 6, 7)$$

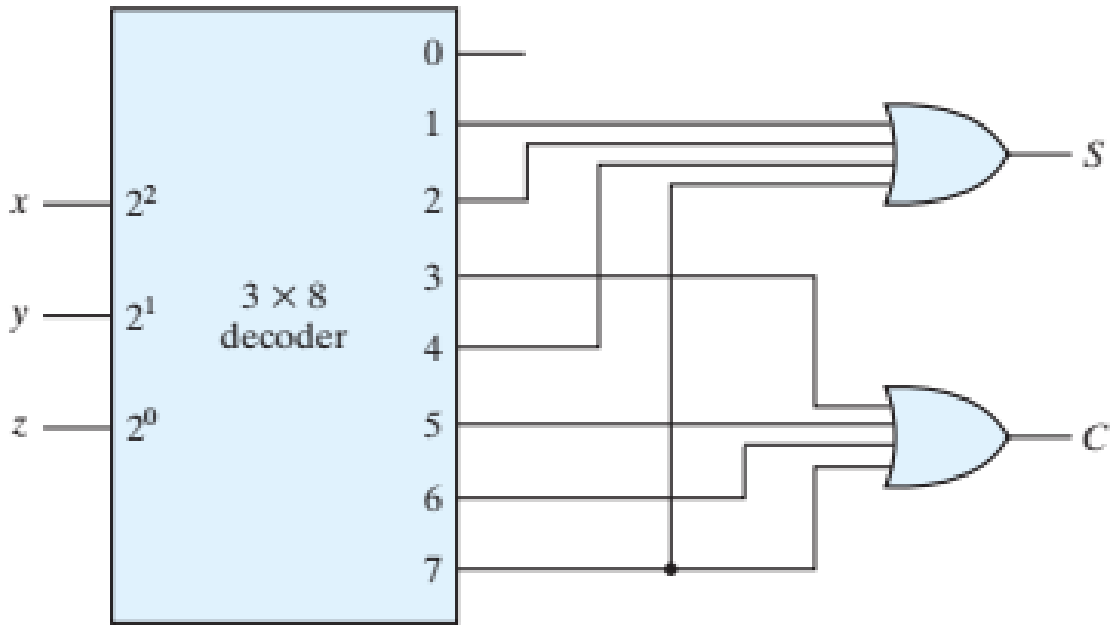
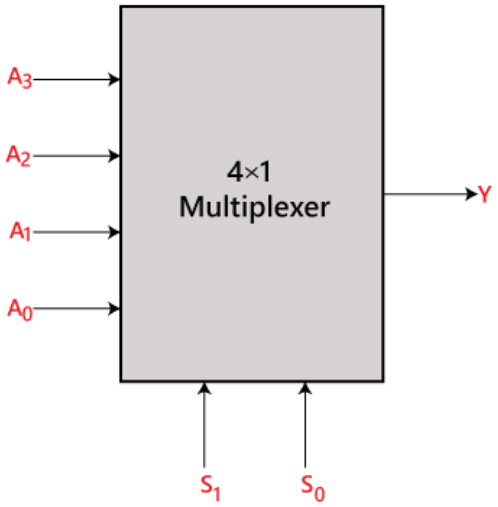
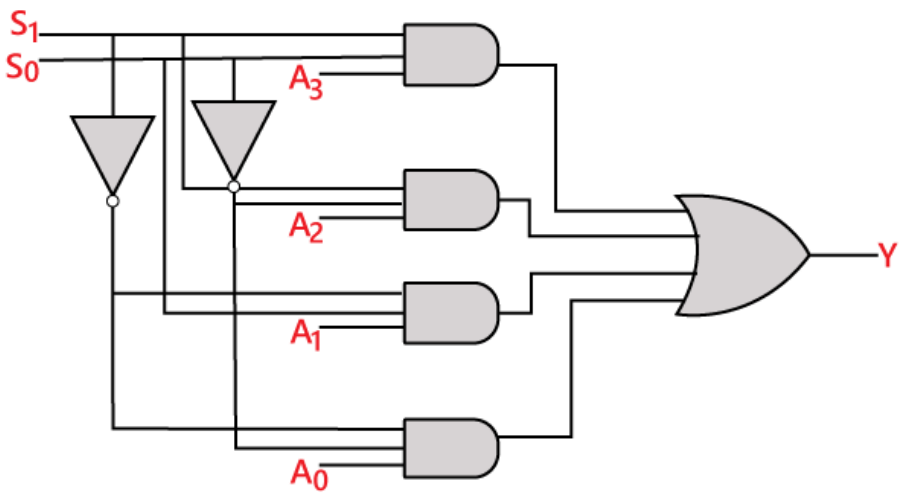


FIGURE 4.21
Implementation of a full adder with a decoder

MULTIPLEXER

- A multiplexer is a combinational circuit that has 2n input lines and a single output line.
- The binary information is received from the input lines and directed to the output line. On the basis of the values of the selection lines, one of these data inputs will be connected to the output.
- There are n selection lines and 2^n input lines. So, there is a total of 2^N possible combinations of inputs. A multiplexer is also treated as Mux.
- 4×1 Multiplexer:

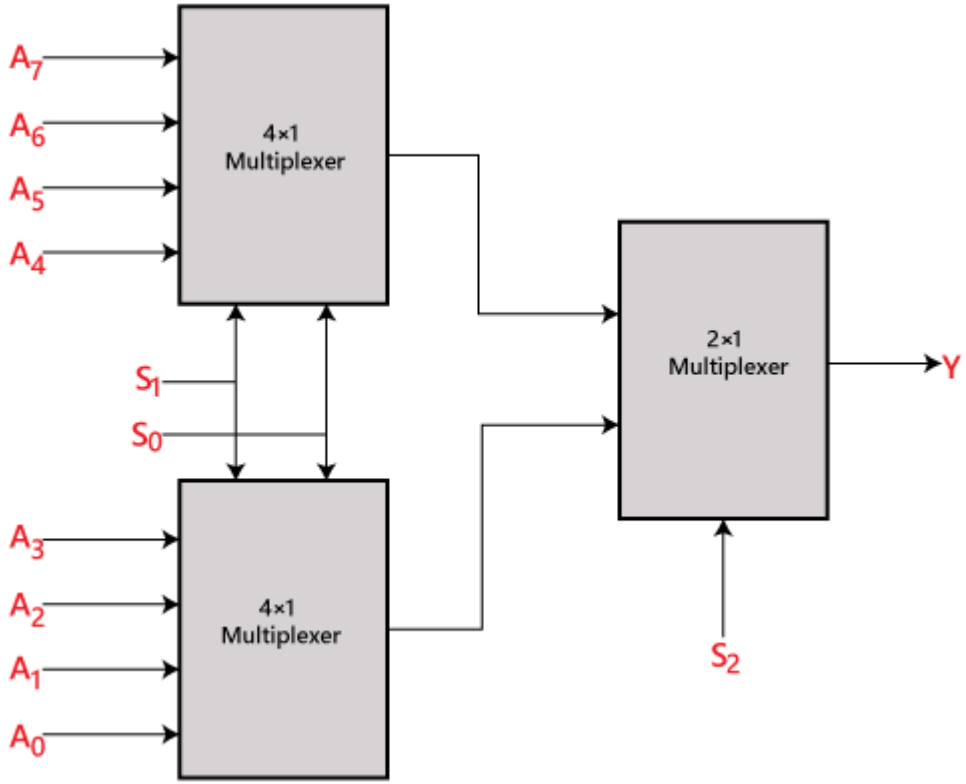




INPUTS		Output
S_1	S_0	Y
0	0	A_0
0	1	A_1
1	0	A_2
1	1	A_3

Ref: https://www.javatpoint.com/

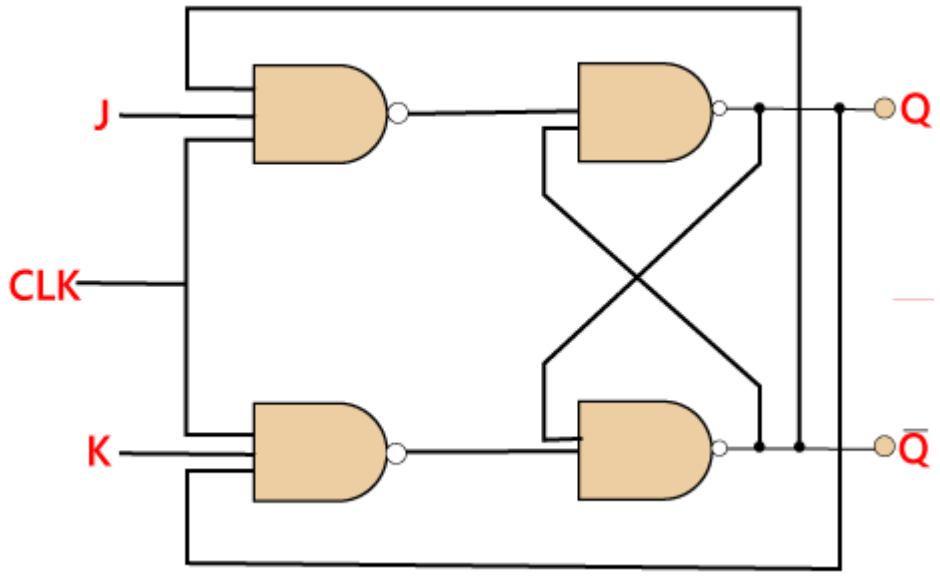
8 ×1 MULTIPLEXER USING 4×1 AND 2×1 MULTIPLEXER



SEQUENTIAL CIRCUITS

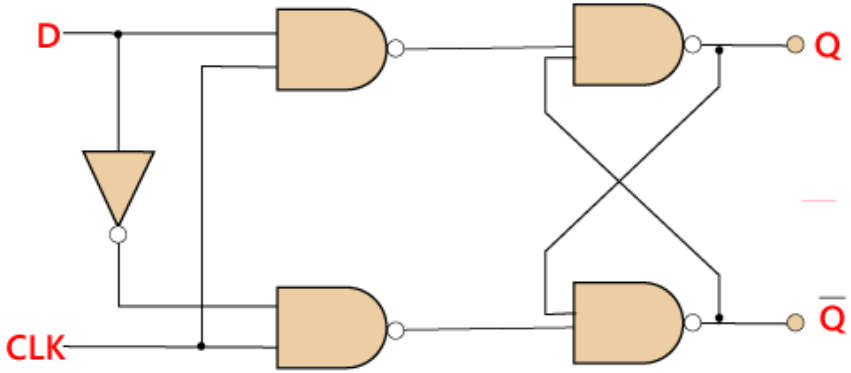
BASICS OF FLIP FLOP

- A circuit that has two stable states is treated as a flip flop. These stable states are used to store binary data that can be changed by applying varying inputs.
- JK Flip Flop

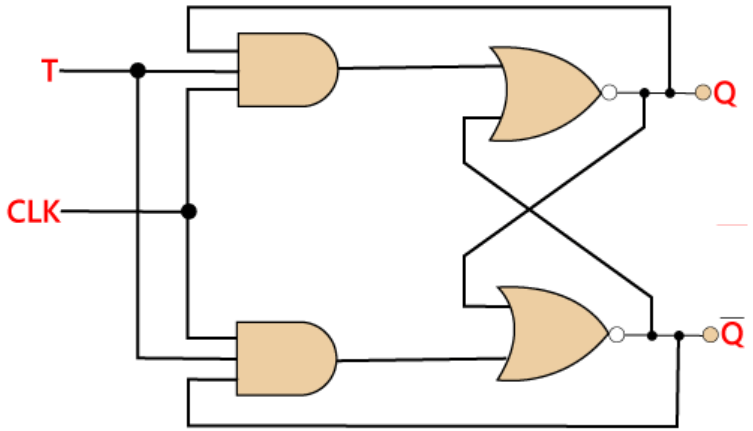


BASICS OF FLIP FLOP

- D Flipflop

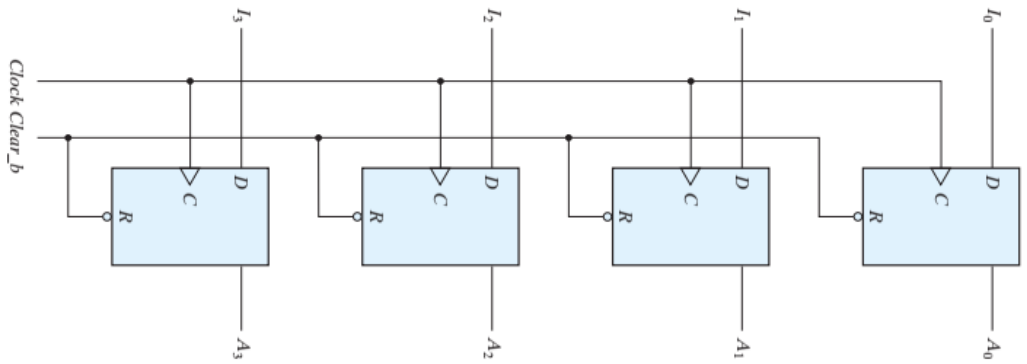


- T Flipflop



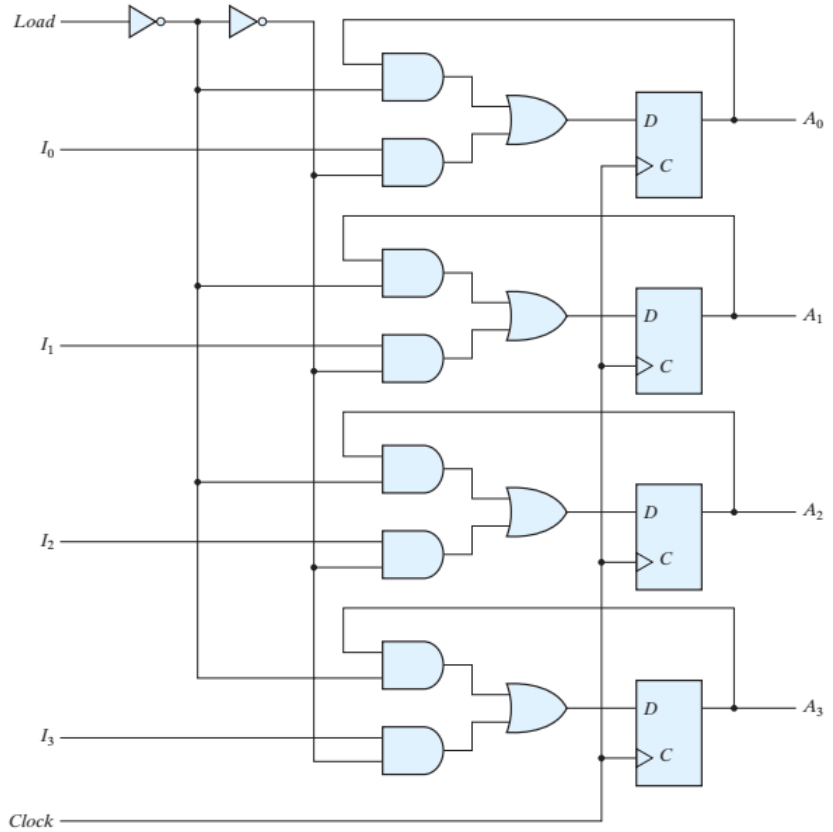
REGISTERS

A Register is a collection of flip flops. A flip flop is used to store single bit digital data. For storing a large number of bits, the storage capacity is increased by grouping more than one flip flops. If we want to store an n-bit word, we have to use an n-bit register containing n number of flip flops. Following is an example of 4 bit register:



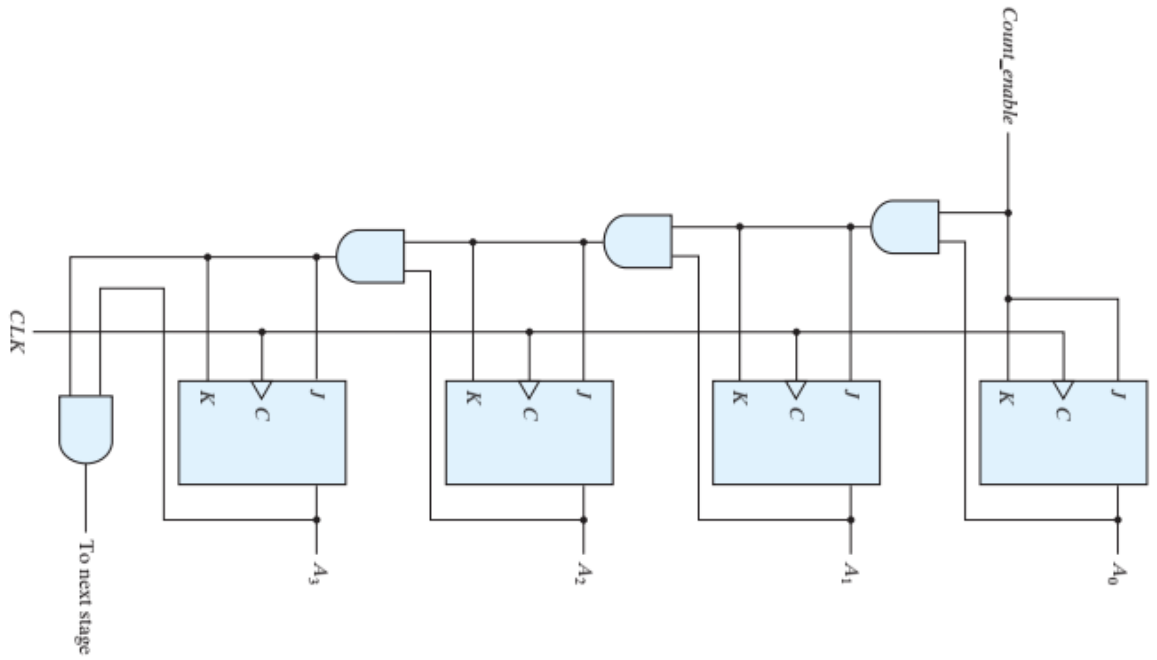
REGISTER WITH PARALLEL LOAD

- Registers with parallel load are a fundamental building block in digital systems.
- The transfer of new information into a register is referred to as loading or updating the register. If all the bits of the register are loaded simultaneously with a common clock pulse, we say that the loading is done in parallel.



COUNTER

Synchronous COUNTERS : Synchronous counters are different from ripple counters in that clock pulses are applied to the inputs of all flip-flops. A common clock triggers all flip-flops simultaneously.



RANDOM - ACCESS MEMORY (RAM)

- Random Access Memory (RAM) is a type of computer memory that stores data temporarily while a computer is running. It's called "random access" because the computer can access any part of the memory directly and quickly.
- The binary storage cell is the basic building block of a memory unit

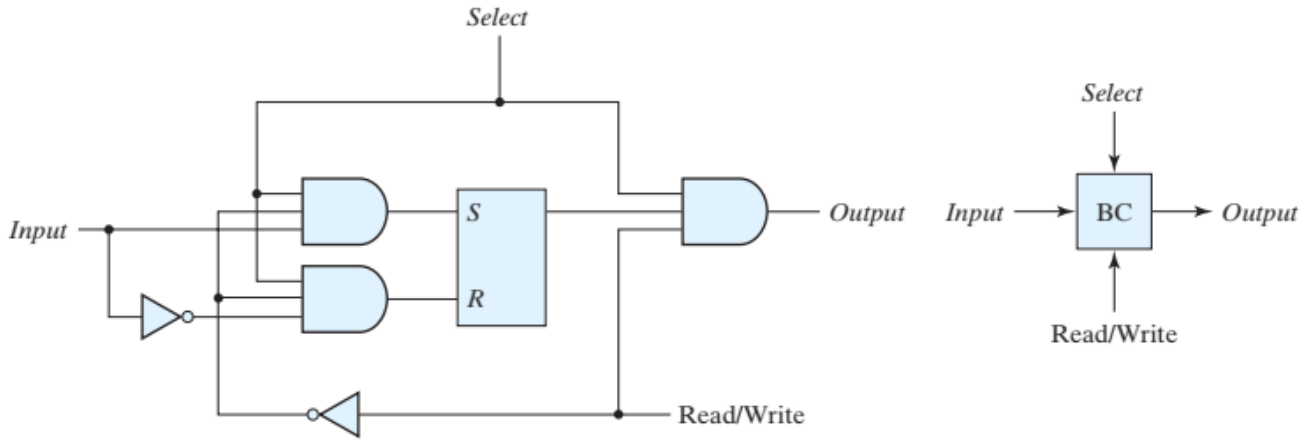
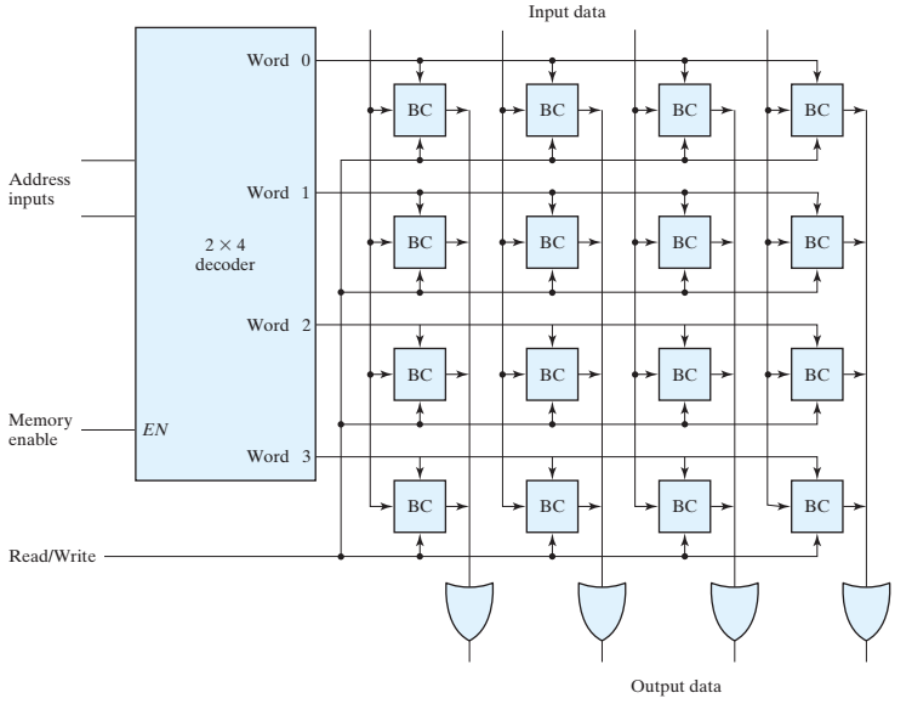


FIGURE 7.5
Memory cell

RANDOM - ACCESS MEMORY (RAM)

- The logical construction of a small RAM is shown.
- This RAM consists of four words of four bits each and has a total of 16 binary cells. The small blocks labeled BC represent the binary cell with its three inputs and one output



READ ONLY MEMORY (ROM)

- A read-only memory (ROM) is essentially a memory device in which permanent binary information is stored.
- A block diagram of a ROM consisting of k inputs and n outputs and one output.
- The inputs provide the address for memory, and the outputs give the data bits of the stored word that is selected by the address. The number of words in a ROM is determined from the fact that k address input lines
- Example, a 32 * 8 ROM