

# CS175: Chapter 3

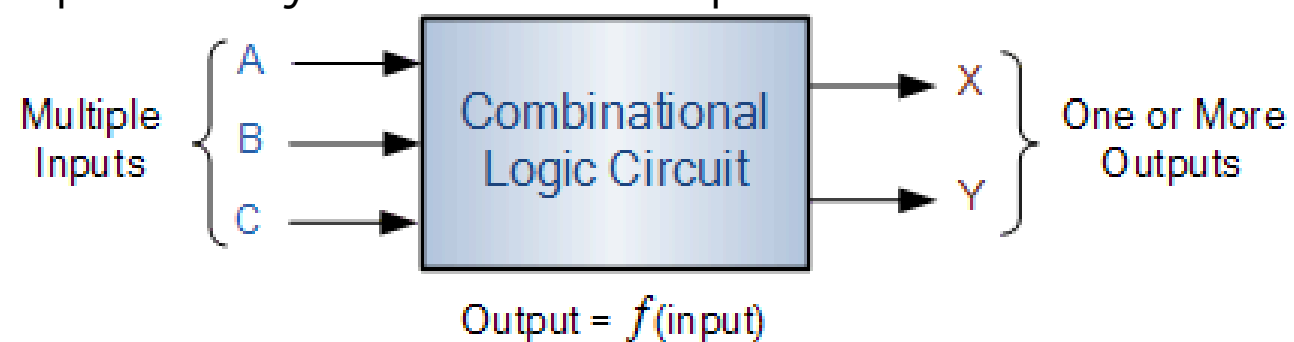
Section: 220

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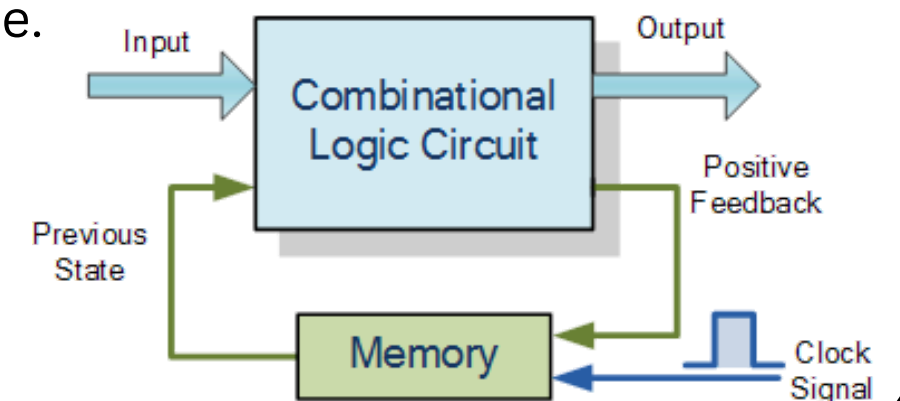
## Combinational Circuit

- A set of  $m$  Boolean inputs,
- A set of  $n$  Boolean outputs, and
- $n$  switching functions, each mapping the  $2^m$  input combinations to an output such that the current output depends only on the current input values



## Sequential Circuit

type of digital circuit whose output depends on both current inputs and past inputs, due to the presence of memory elements. This means it has a notion of time and sequence.

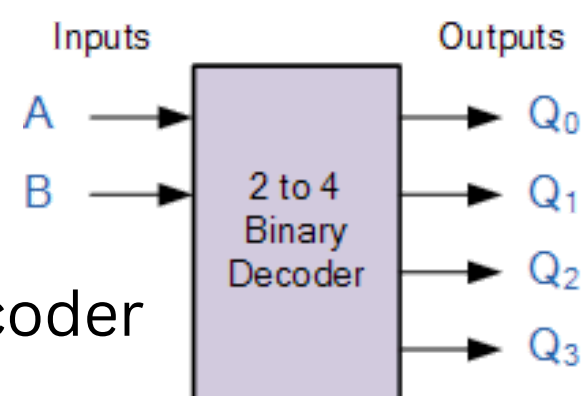


## Decoder

A binary code of  $n$  bits is capable of representing  $2^n$  elements. Decoding - the conversion of an  $n$ -bit coded input to a maximum of  $2^n$  unique outputs.

**Decoder:**  $2^n = m$   
 $n = \text{inputs}, m = \text{outputs}$

**Example:** 2-to-4 Decoder

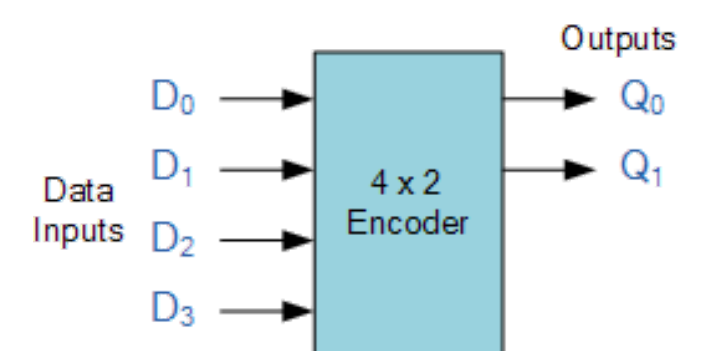


## Encoder

combinational circuit that converts active input signals into a coded output signal. It typically reduces multiple input lines into fewer output lines by encoding the information.

**Encoder:**  $\log_2(n) = m$   
 $n = \text{inputs}, m = \text{outputs}$

**Example:** 4-to-2, Encoder

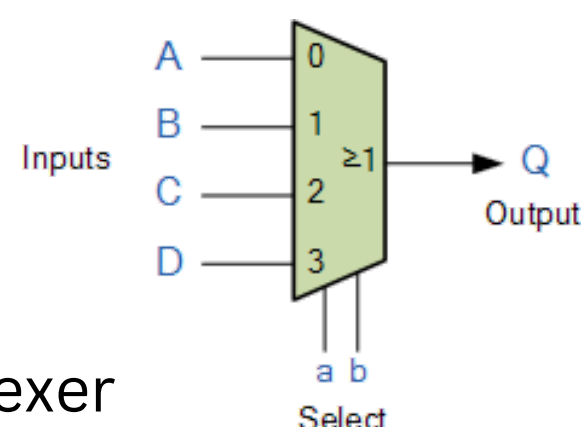


## Multiplexer

A multiplexer selects information from an input line and directs the information to an output line

The selection of the input line is controlled by additional control signals known as select lines

**Example:** 4-to-1 Multiplexer

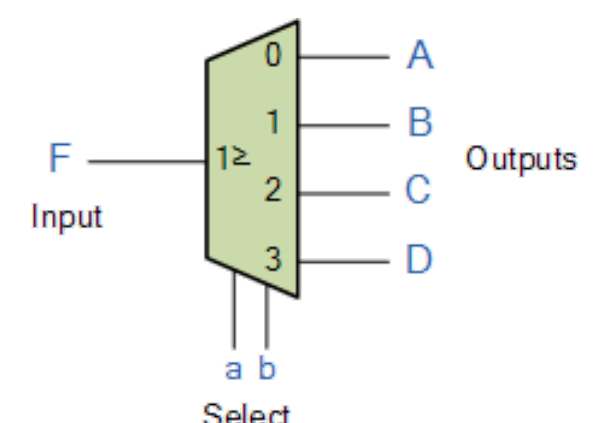


## Demultiplexer

A demultiplexer routes (or connects) the data input to the selected output.

The value of the control inputs determines the output that is selected

**Example:** 1-to-4 Demultiplexer



## Design Procedure

1. **Specification:** Write a specification for the circuit (inputs and outputs)
2. **Formulation:** Derive a truth table or initial Boolean equations that define the required relationships
3. **KMAP:** Apply multiple-level optimization
4. **Technology Mapping:** Map the logic diagram

## References & Sources

Charles Kime & Thomas Kaminski  
2008 Pearson Education, Inc ( Slides on LMS )

Electronic Tutorials website  
URL: <https://www.electronics-tutorials.ws/>

GeekforGeeks website  
URL: <https://www.geeksforgeeks.org/>