

Reading Assignment: Chapter 3 in *Logic and Computer Design Fundamentals, 4th Edition* by Mano

Combinational Functions and Circuits

Functions and fundamental circuits are introduced in this chapter which are useful in designing larger digital circuits.

These circuits are presented as ***functional blocks*** – fundamental, reusable circuits. The focus is to develop the functional blocks such that they are reusable, are easily expanded for use with larger functions, and are efficiently designed for implementing via VHDL programming.

Examples of functional blocks to be introduced:

- Decoders
- Encoders
- Priority encoders
- Multiplexers
- De-multiplexers
- Magnitude Comparators
- Programmable Logic (Chapter 6)

Combinational Logic Using MSI and LSI devices

Although our focus will be more on defining functional blocks that are designed to be reusable and to be implemented using VHDL, many of these fundamental circuits are also available as commercially available IC's.

Commercial devices can perform complex functions using perhaps a single IC, thus saving space. They are typically faster than equivalent circuits that we might build using discrete logic gates. It might be a good idea to browse through a *Logic Data Book* to see what is available. A few devices are listed below.

Assortment of commercially available combinational logic devices

TTL Device Number	Description
7483	4-bit adder with fast carry
7485	4-bit magnitude comparator
74139	2-line-to-4-line decoder/demultiplexer
74137	3-line-to-8-line decoder/demultiplexer
74159	4-line-to-16-line decoder/demultiplexer
74145	BCD-to-decimal decoder
74147	Priority encoder
74151	8 x 1 multiplexer
74150	16 x 1 multiplexer
74184	BCD-to-binary converter
7447	BCD-to-7-segment decoder/driver (common anode)
7448	BCD-to-7-segment decoder/driver (common cathode)
74280	9-bit odd/even parity generator

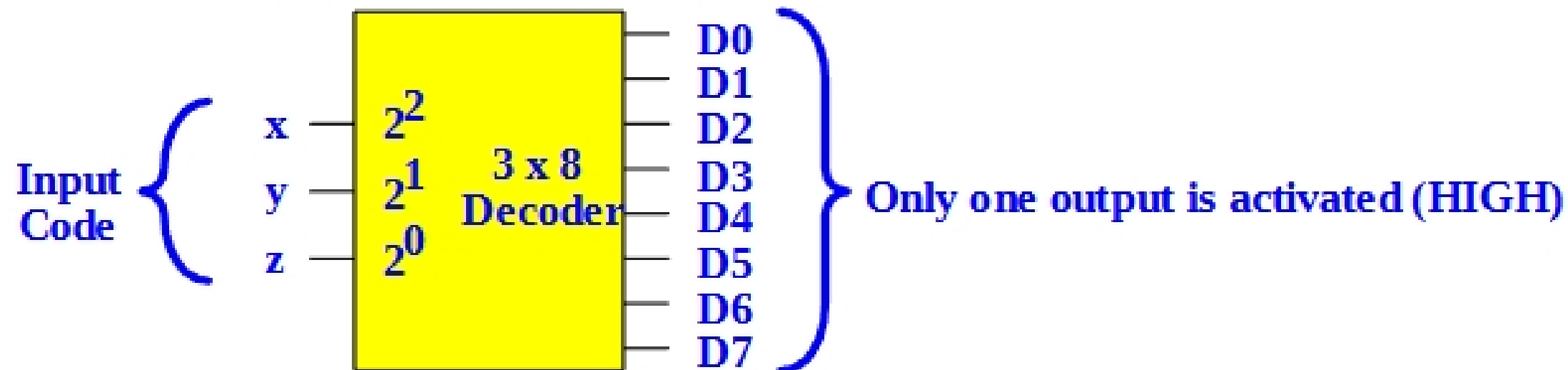
Decoders

An N-bit decoder has 2^N outputs, only one of which may be **activated** at a given time.

If the device is **active-HIGH**, then only one output may be HIGH at any time.

If the device is **active-LOW**, then only one output may be LOW at any time.

Example: A *3-bit decoder* might also be called a *3-line-to-8-line decoder* or a *3x8 decoder*. The block diagram is shown below:



Discuss:

- basic operation
- the truth table