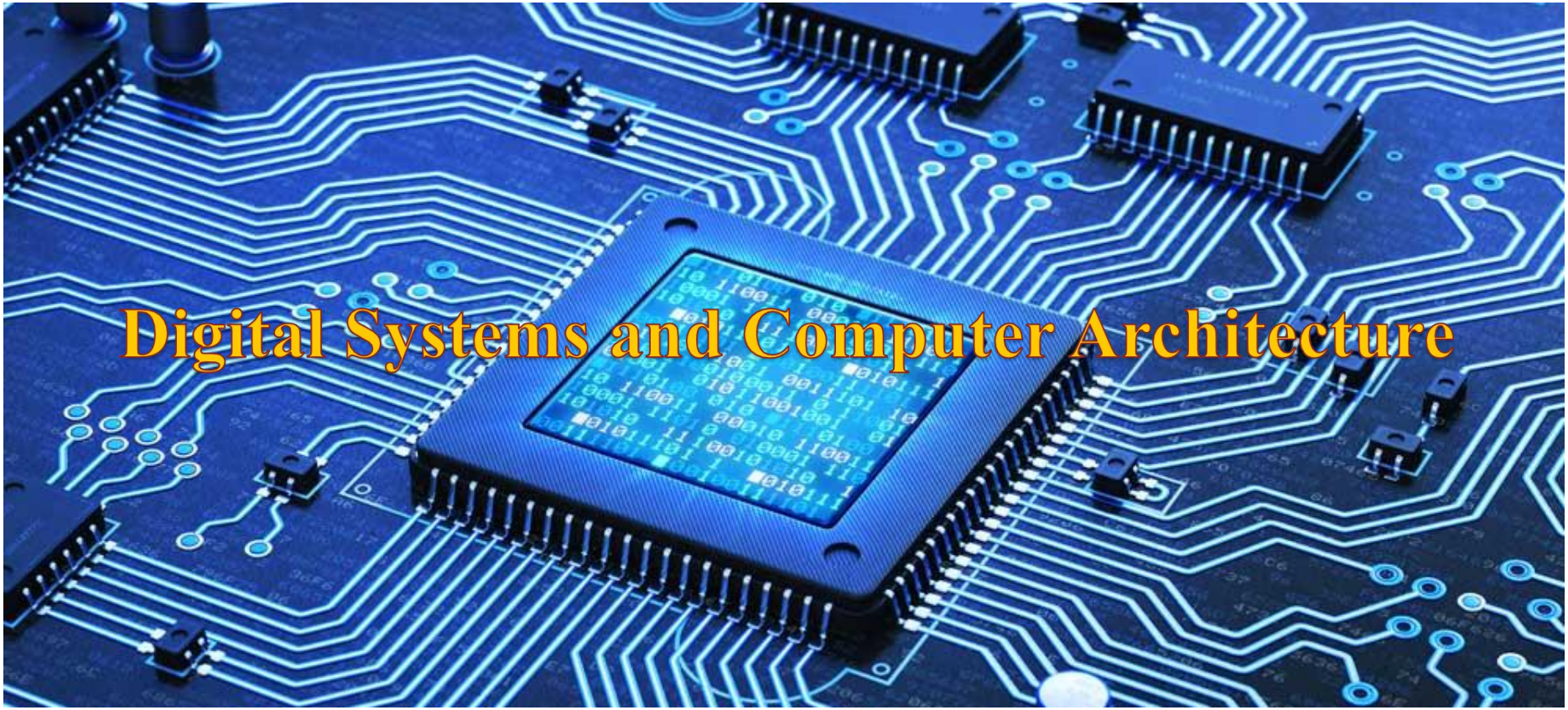


Session 2.7

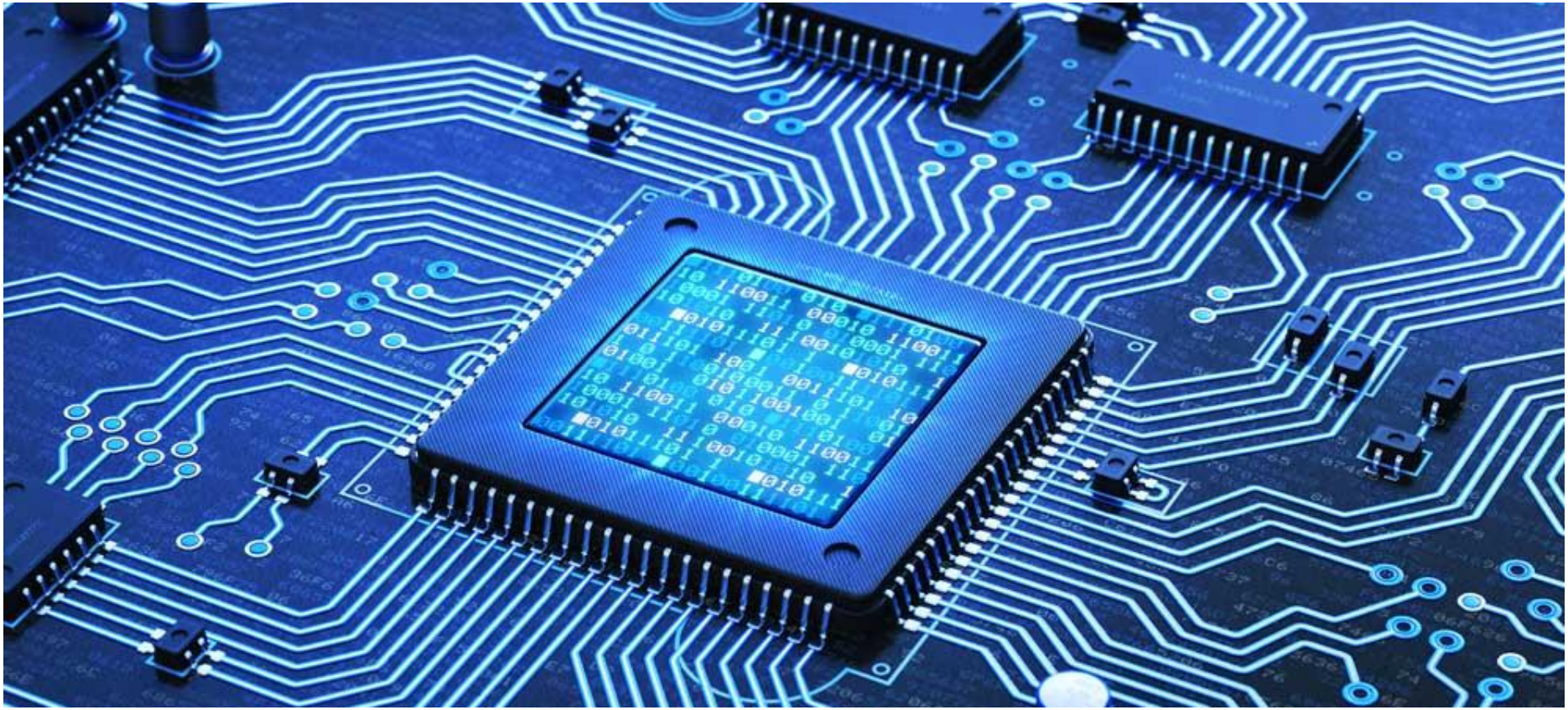
Module 2

Mouli Sankaran

Decoders and Encoders

Session 2.7: Focus

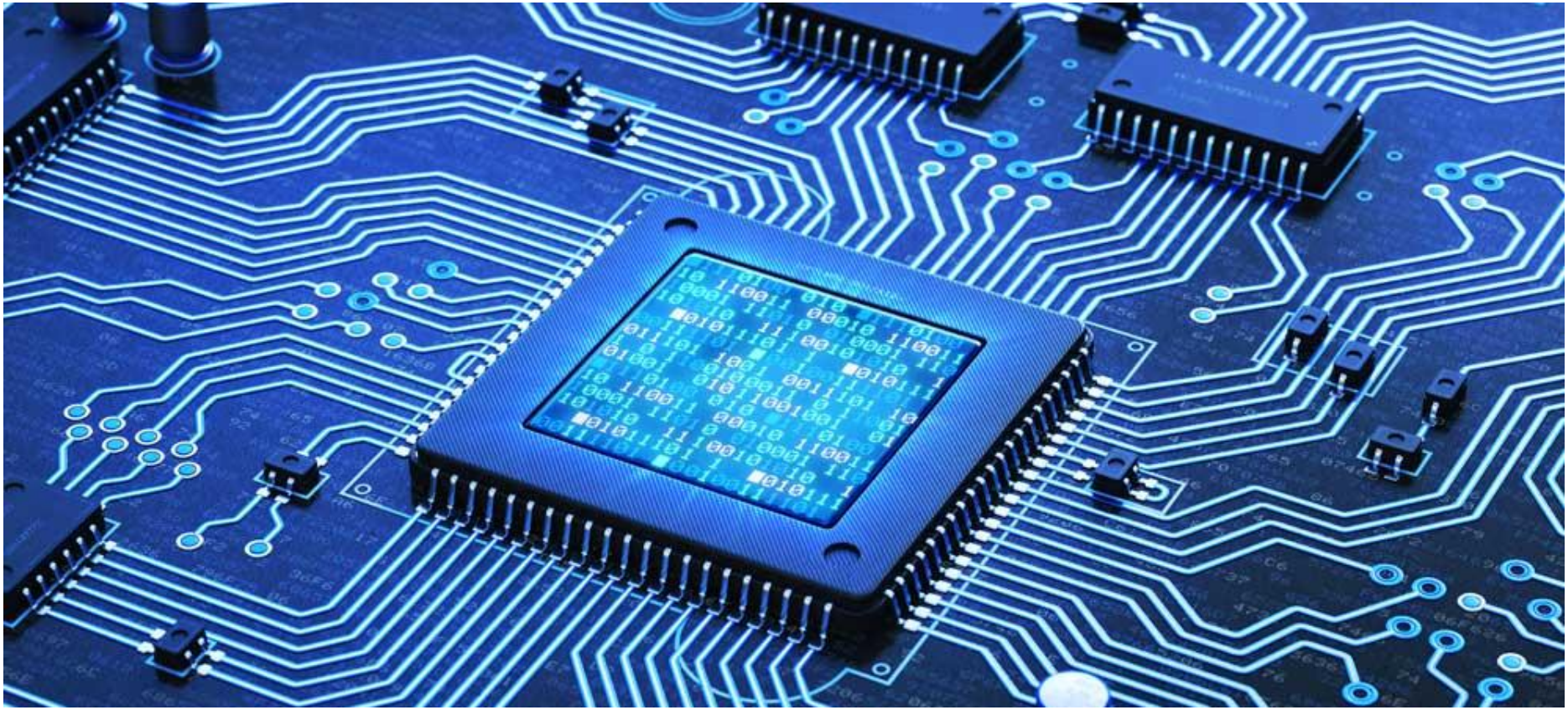
- Decoder
  - Basic Binary Decoding logic
- Different n-to-m Binary Decoders
  - 2-to-4 Decoder
  - Logic Symbols of Decoders
  - Decoder in Use
- Encoder
  - Decimal-to-BCD Encoder



Decoder

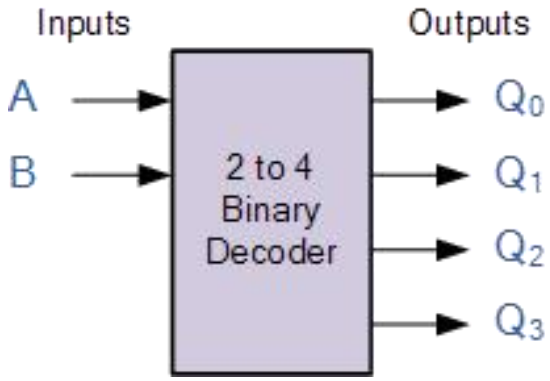
Decoder

- A **decoder** is a digital circuit that detects the **presence** of a specified **combinations of bits** (**code**) on its **inputs** and
  - Indicates the **presence** of that **code** by a **specified output** level
- In its general form, a decoder has **n input** lines to handle **n** bits
  - It has from **one** to **2^n output** lines to indicate the **presence** of **one** or **more n-bit combinations**



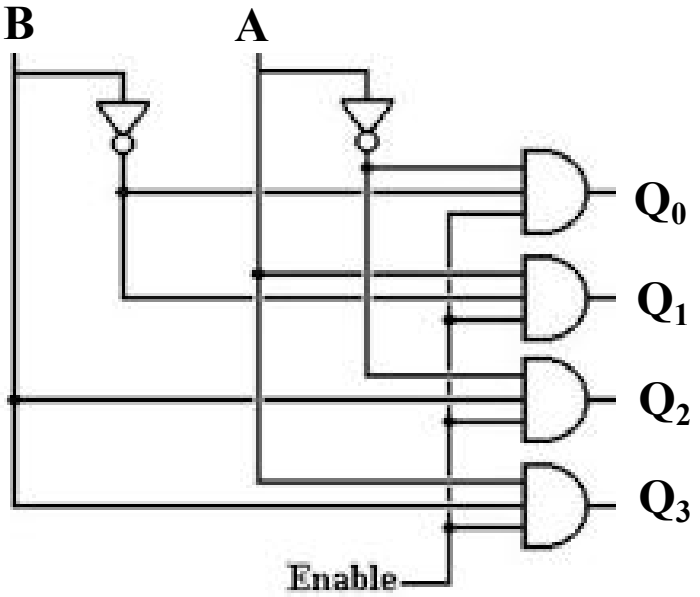
Different n-to-m Binary Decoders

2-to-4 Binary Decoder



Truth Table

B	A	Q_0	Q_1	Q_2	Q_3
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1



Note: **Enable** signal if **LOW**, all outputs are always LOW. Inputs do not affect the outputs.

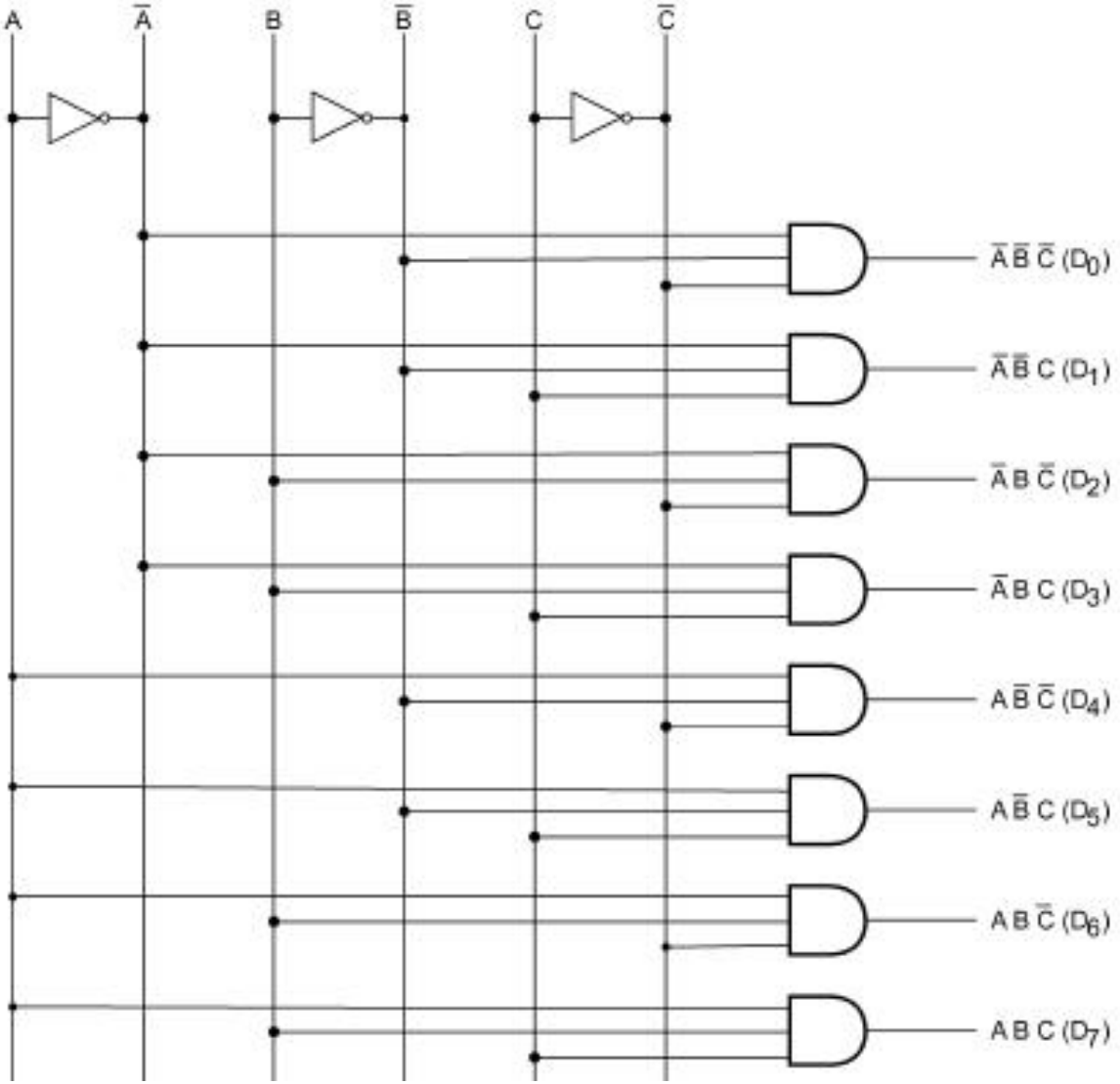
Is it an **active HIGH** or **active LOW** circuit? **Active HIGH**

3-line-to-8-line Decoder – Truth Table

- It has **3 inputs** and **8 outputs**
- **Truth Table** is given below:

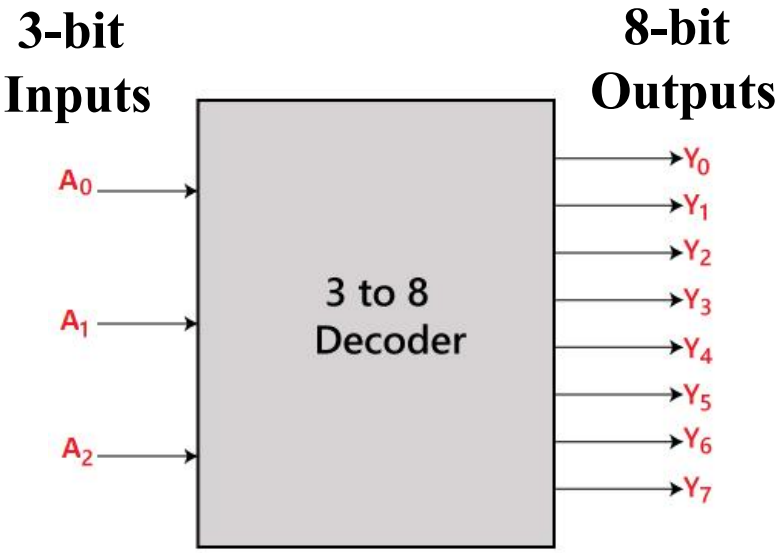
INPUTS			OUTPUTS							
A	B	C	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1

3-line-to-8-line Decoder Implementation

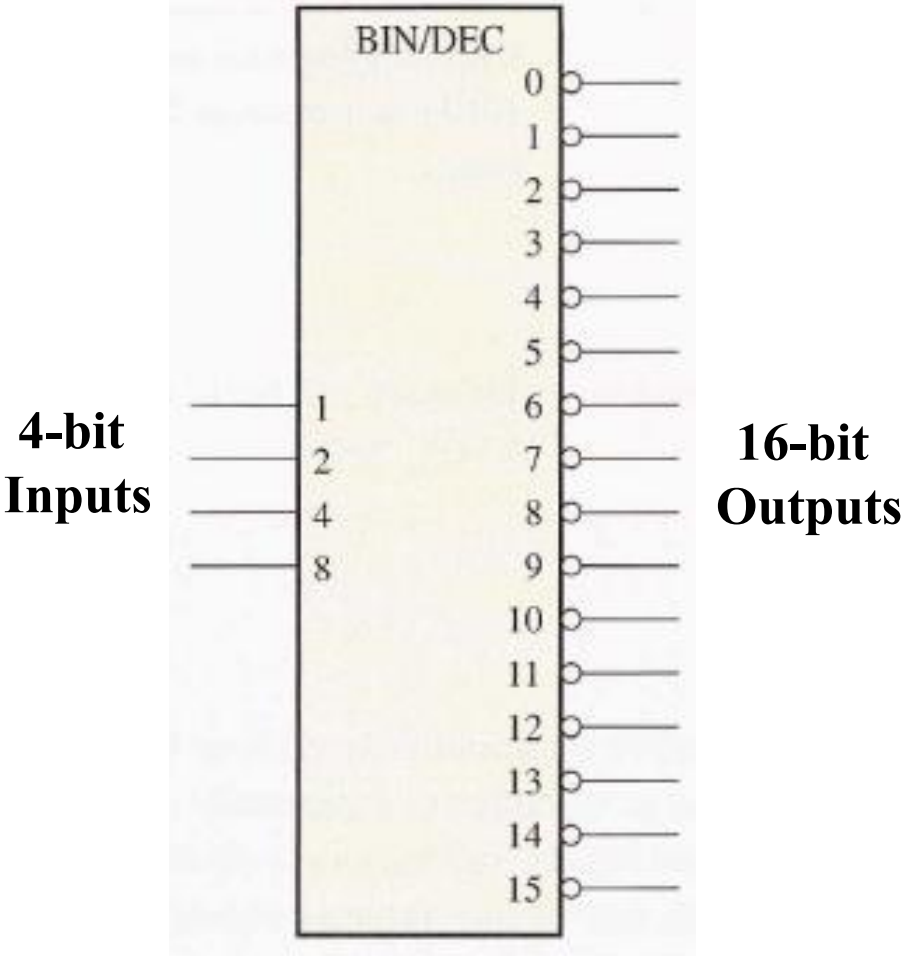


Logic Symbols of Decoders

1-of-8 or 3-to-8 Decoder
(active-HIGH outputs)

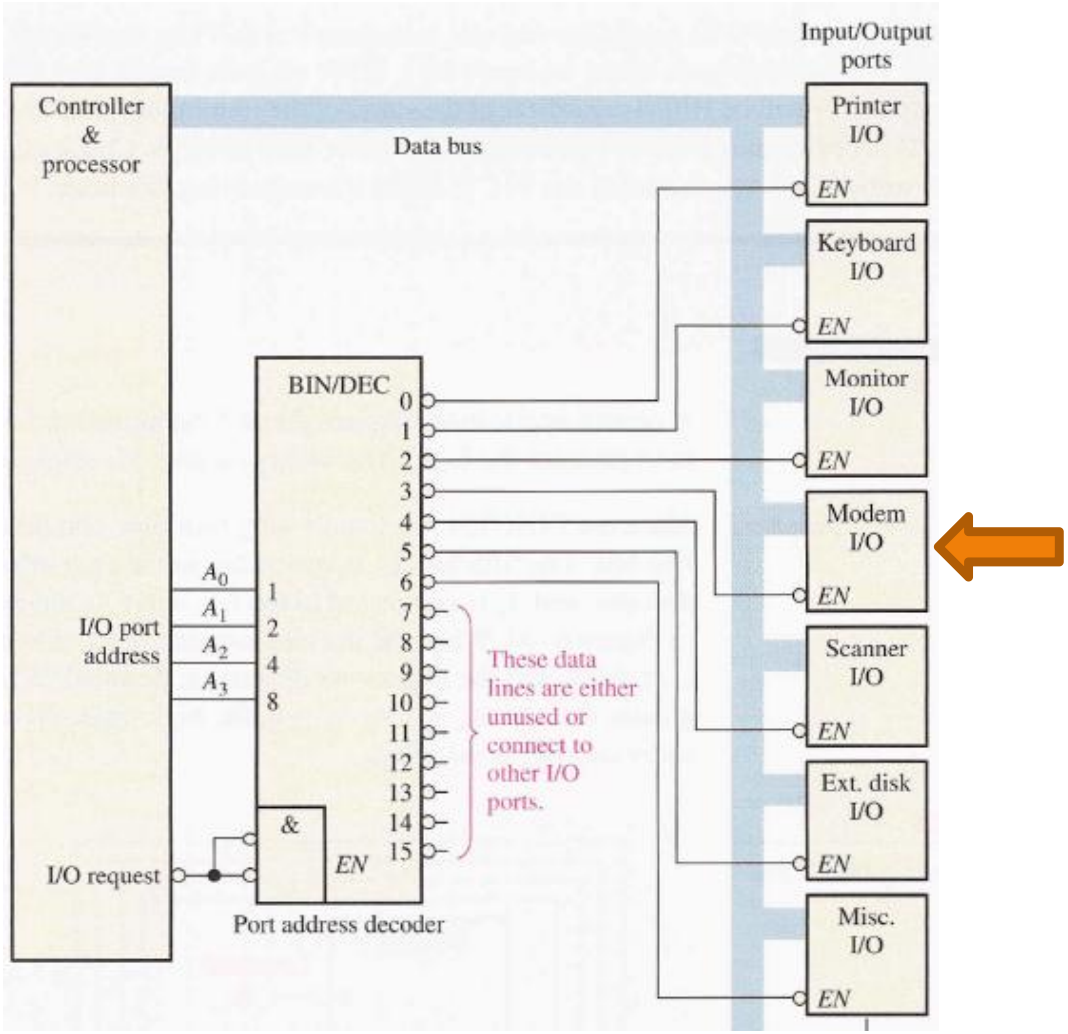


1-of-16 or 4-to-16 decoder
(active-LOW outputs)



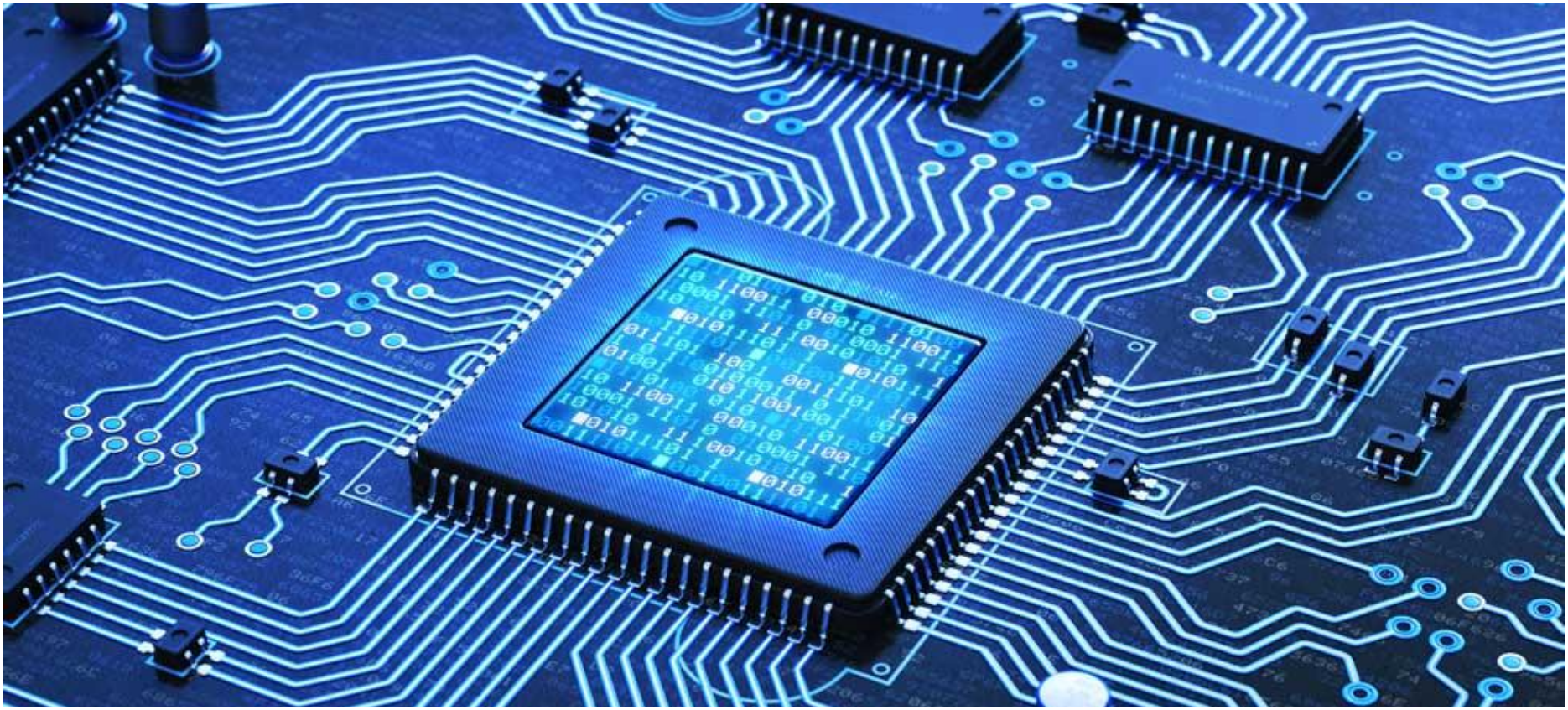
Application of Decoder

- An **I/O Port** address decoder



When will this **Modem I/O** module be **enabled**?
Or
What is the **I/O address** of this **Modem I/O** module?

ANS: 0011 or 3

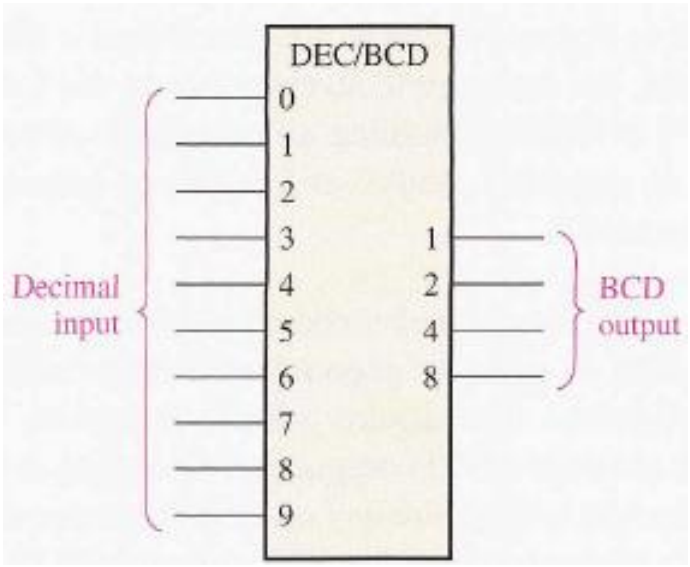


Encoder

Encoder

- An **encoder** is a combinational circuit that essentially performs a **reverse of a decoder** function
- An encoder accepts an active level on one of its inputs representing a digit, such as a decimal, or octal digit, and converts it to a coded output, such as BCD or binary

Decimal-to-BCD Encoder



DECIMAL DIGIT	BCD CODE A_3	A_2	A_1	A_0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Session 2.7: Summary

- Decoder
  - Basic Binary Decoding logic
- Different n-to-m Binary Decoders
  - 2-to-4 Decoder
  - 3-to-8 line Decoder Implementation
  - 4-bit Decoder
  - Logic Symbols of Decoders
  - Decoder in Use
- Encoder
  - Decimal-to-BCD Encoder