



# Decoders and Encoders

Digital Design CSF215

Made by:

Raj Rahul

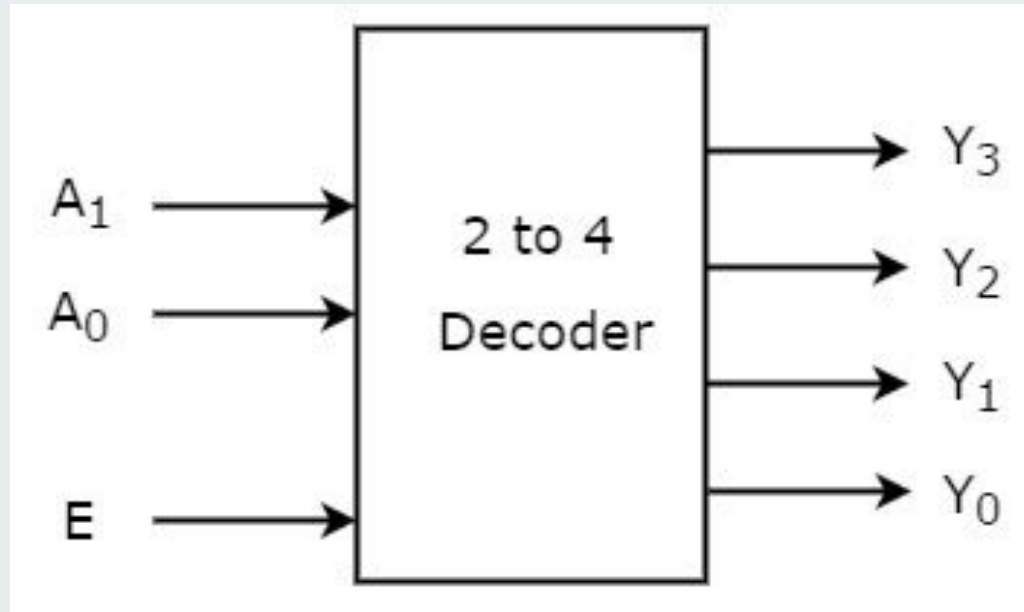
Harshit Negi

# Decoder

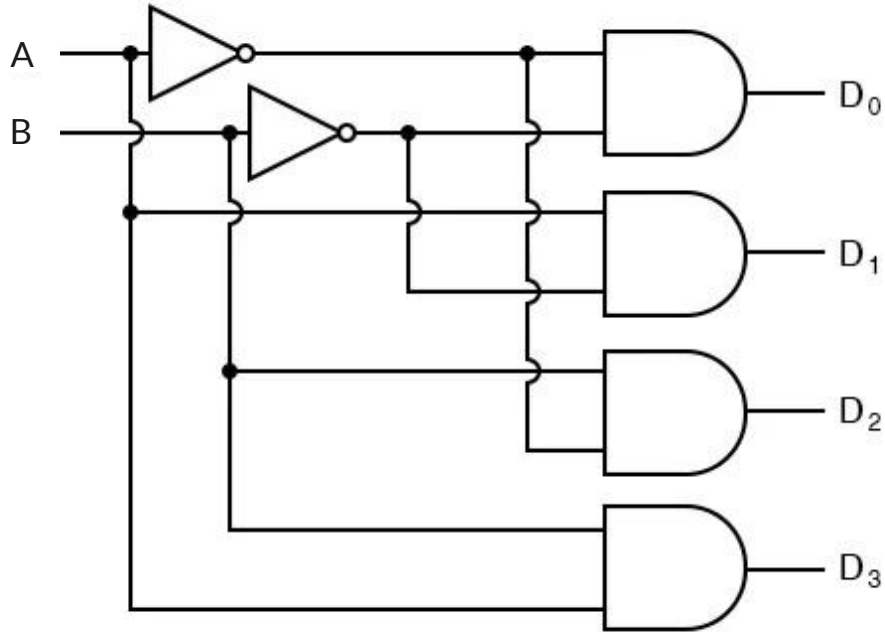


- A decoder is a digital circuit that converts coded inputs (like binary data) into a specific output pattern.
- It takes  $n$  input lines and activates one of  $2^n$  output lines, often used in memory addressing, instruction decoding, or data routing.
- Provides a mapping from input to output

## 2 to 4 Decoder



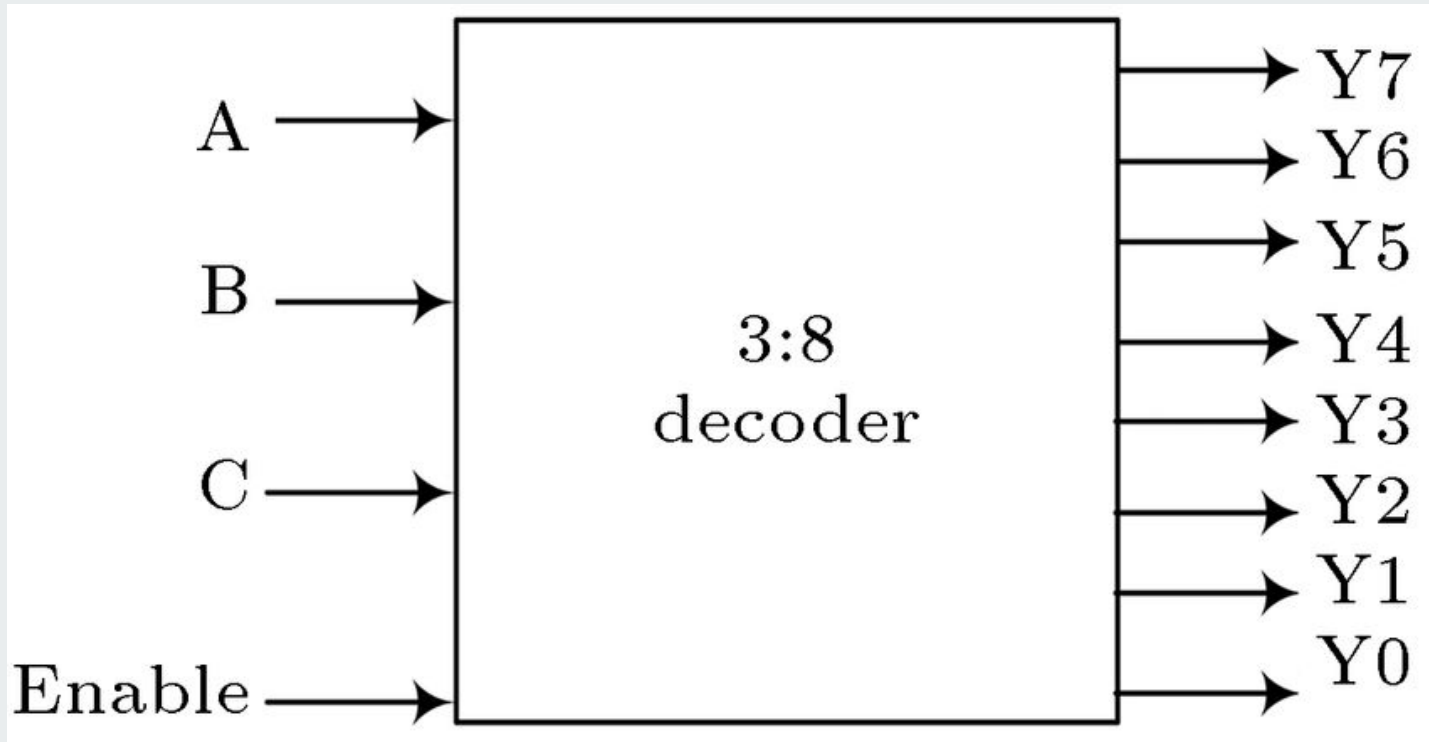
## 2 to 4 Decoder



- $D_0 = A'B'$
- $D_1 = A'B$
- $D_2 = AB'$
- $D_3 = AB$

\* If Enabler (E) bit is given, AND each of the D<sub>i</sub> expression with E (if active high) or E' (if active low).

## 3 to 8 Decoder

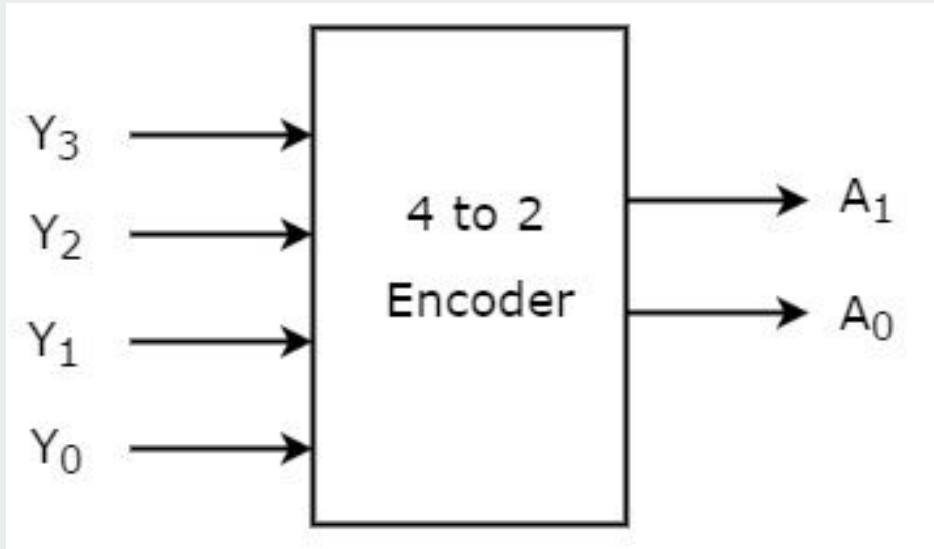


# Encoder



- Encoder: A combinational circuit that converts  $2^n$  input lines into an n-bit binary code. **Only one input is active at a time.**
- Priority Encoder: An encoder that assigns priority when multiple inputs are active, outputting the code of the highest-priority active input.

# 4 to 2 Encoder



- $A_0 = Y_1 + Y_3$
- $A_1 = Y_2 + Y_3$

\* If Enabler (E) bit is given, AND each of the  $A_i$  expression with E (if active high) or  $E'$  (if active low).

# 4 to 2 Priority Encoder

Inputs				Outputs		
$D_0$	$D_1$	$D_2$	$D_3$	$x$	$y$	$V$
0	0	0	0	X	X	0
1	0	0	0	0	0	1
X	1	0	0	0	1	1
X	X	1	0	1	0	1
X	X	X	1	1	1	1

- $x = D_2 + D_3$
- $y = D_3 + D_1 D_2'$
- $V = D_0 + D_1 + D_2 + D_3$



# Passing vectors, slicing and concatenation

```
2
3 module pass(input[7:0] in, output[3:0] out);
4
5     wire w1;
6     assign w1 = in[5];
7     func f1(in[5:2], out); // slicing -> passing larger to smaller
8     func f1({w1, in[4:2]}, out); // concatenation
9     func f1({1'b0, in[4:2]}, out);
10
11 endmodule
```



**THANK YOU**