ENCODER

Presented by

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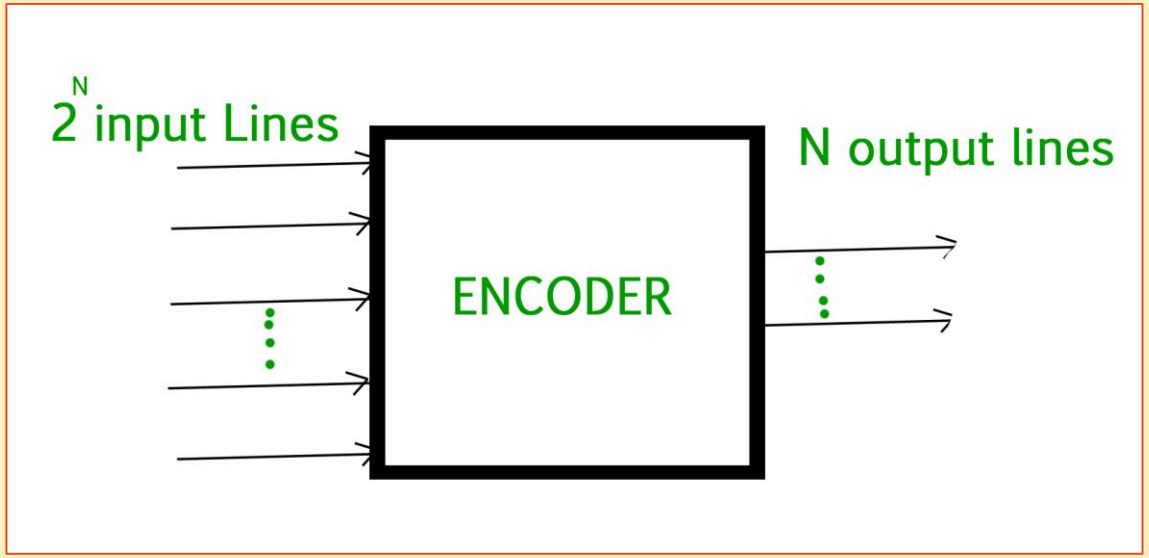
ENCODER

- An Encoder is a combinational logic circuit. It performs the inverse operation of Decoder.
- An Encoder converts an active input signal into a coded output signal.
- It has '2^N' inputs and 'N' outputs.
- An Encoder has '2^N' input lines, only one of which is activated at a given time, and produces an N-bit output code, depending on which input is activated.



INPUTS				OUTPUTS	
D_0	D_1	D_2	D_3	A	B
1	0	0	0	0	0
0	1	0	0	0	1
0	0	1	0	1	0
0	0	0	1	1	1

ENCODER

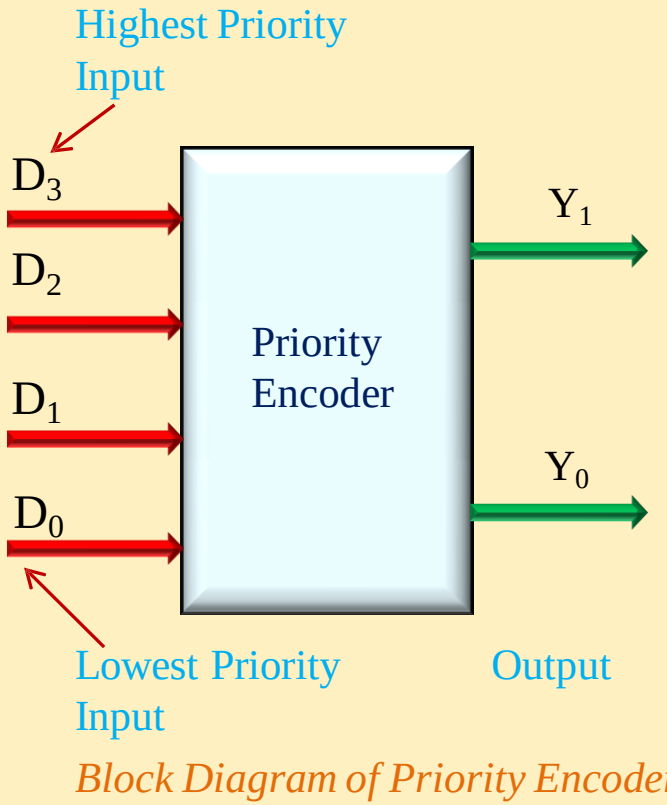
- Encoders are used to translate the rotary or linear motion into a digital signal. Rotary encoders are a type of sensor that measures the rotation of a mechanical shaft.
- The difference between Decoder and Encoder is that Decoder has Binary Code as an input while Encoder has Binary Code as an output.
- Encoder is an Electronics device that converts the analog signal to digital signal such as BCD Code.
- The most common technique to change an analog signal to digital data is called pulse code modulation (PCM). A PCM encoder has the following three processes:
  a.Sampling
  b.Quantization
  c.Encoding

Types of Encoders

i. Priority Encoder
ii. Decimal to BCD Encoder
iii. Octal to Binary Encoder
iv. Hexadecimal to Binary Encoder

PRIORITY ENCODER:

- As the name indicates, the priority is given to inputs line.
- If two or more input lines are high at the same time i.e 1 at the same time, then the input line with high priority shall be considered.
- Block diagram and Truth table of Priority Encoder are shown below.



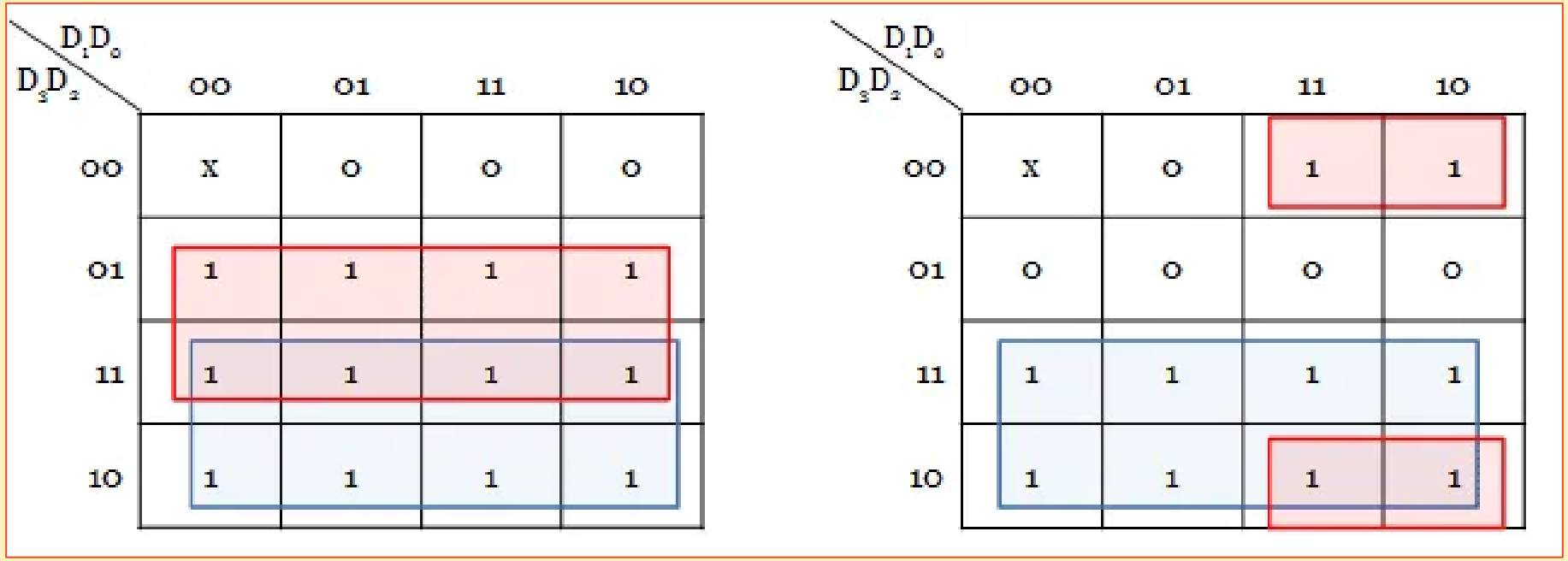
Block Diagram of Priority Encoder

TRUTH TABLE:

INPUTS				OUTPUTS		V
D_3	D_2	D_1	D_0	Y_1	Y_0	
0	0	0	0	x	x	0
0	0	0	1	0	0	1
0	0	1	x	0	1	1
0	1	x	x	1	0	1
1	x	x	x	1	1	1

- There are four inputs D_0, D_1,D_2, D_3 and two outputs Y_1 and Y_2.
- D_3 has highest priority and D_0 is at lowest priority.
- If D_3=1 irrespective of other inputs then output Y_1Y_0=11.
- D_3 is at highest priority so other inputs are considered as don't care.

K-map for Y_1 and Y_0



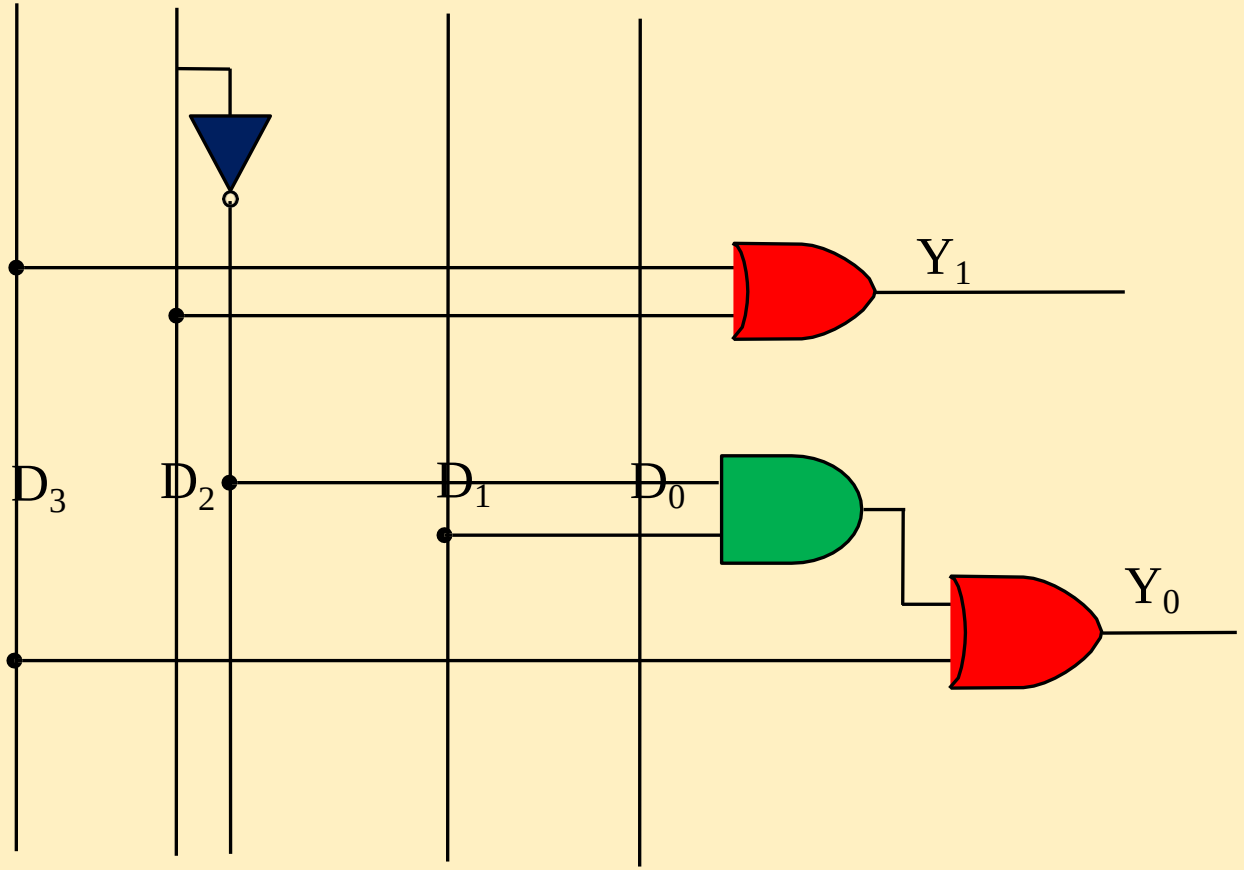
$Y_1 = D_2 + D_3$

$Y_0 = D_3 + \overline{D_2}\, D_1$

LOGIC DIAGRAM OF PRIORITY ENCODER

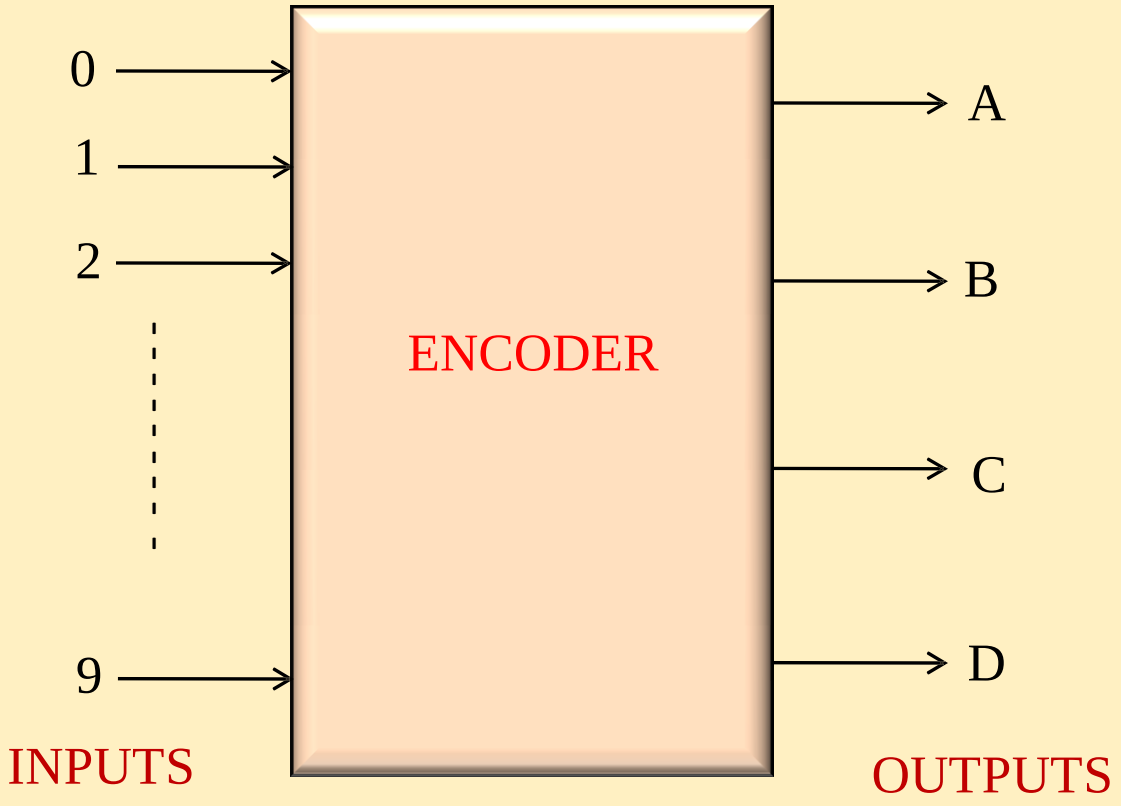
$$Y_1 = D_2 + D_3$$

$$Y_0 = D_3 + \overline{D_2}\, D_1$$



DECIMAL TO BCD ENCODER

It has ten inputs corresponding to ten decimal digits (from 0 to 9) and four outputs (A,B,C,D) representing the BCD.

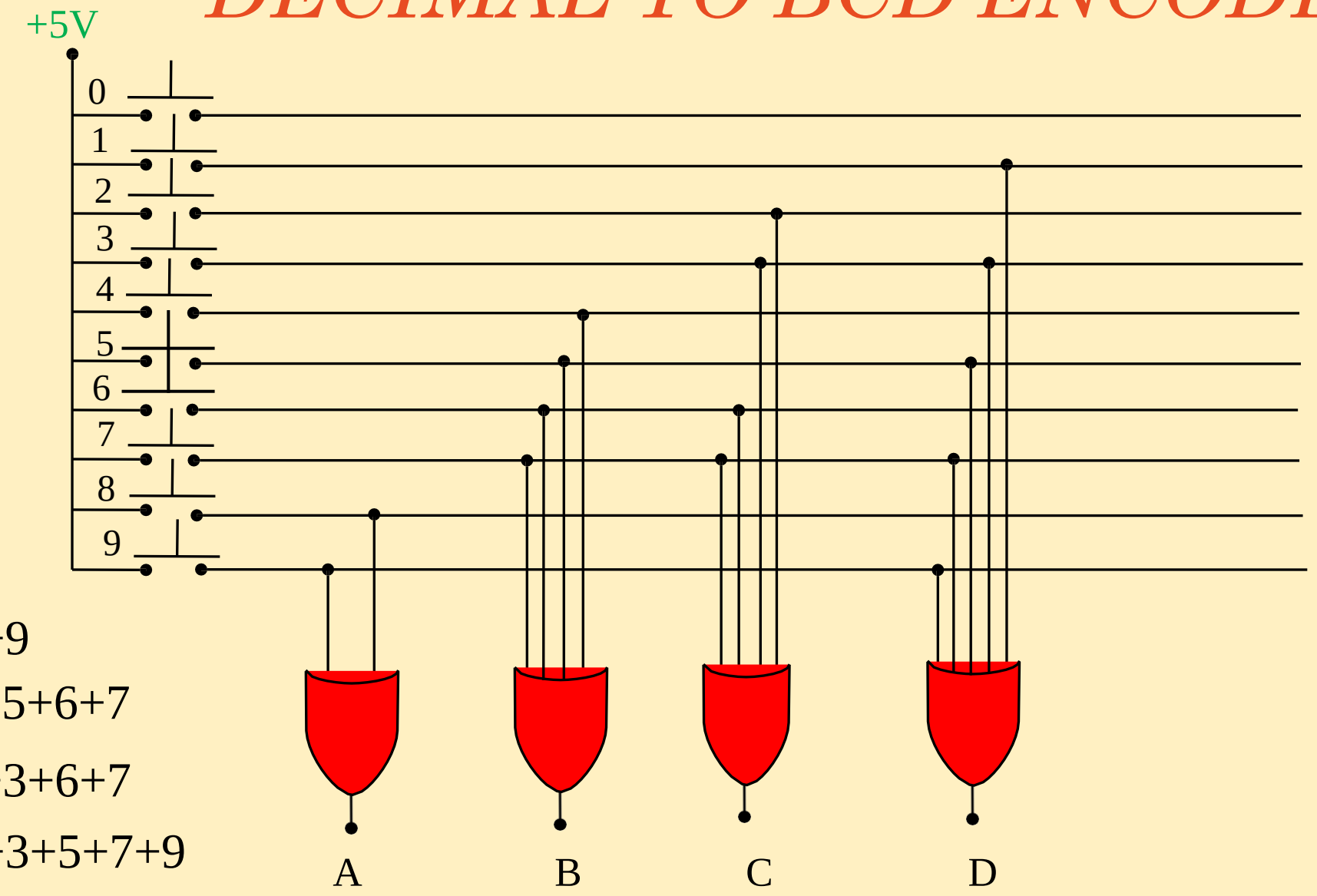


Truth table

INPUTS										BCD OUTPUTS			
0	1	2	3	4	5	6	7	8	9	A	B	C	D
1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	0	0	0	1	0	0
0	0	0	0	0	1	0	0	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0	0	0	1	1	0
0	0	0	0	0	0	0	1	0	0	0	1	1	1
0	0	0	0	0	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	1	1	0	0	1

- From Truth Table it is clear that the output Ais HIGH when input is 8 OR 9 is HIGH
  Therefore A=8+9
- The output B is HIGH when 4 OR 5 OR 6 OR 7 is HIGH Therefore
  B=4+5+6+7
- The output C is HIGH when 2 OR 3 OR 6 OR 7 is HIGH
  Therefore C=2+3+6+7
- Similarly D=1+3+5+7+9

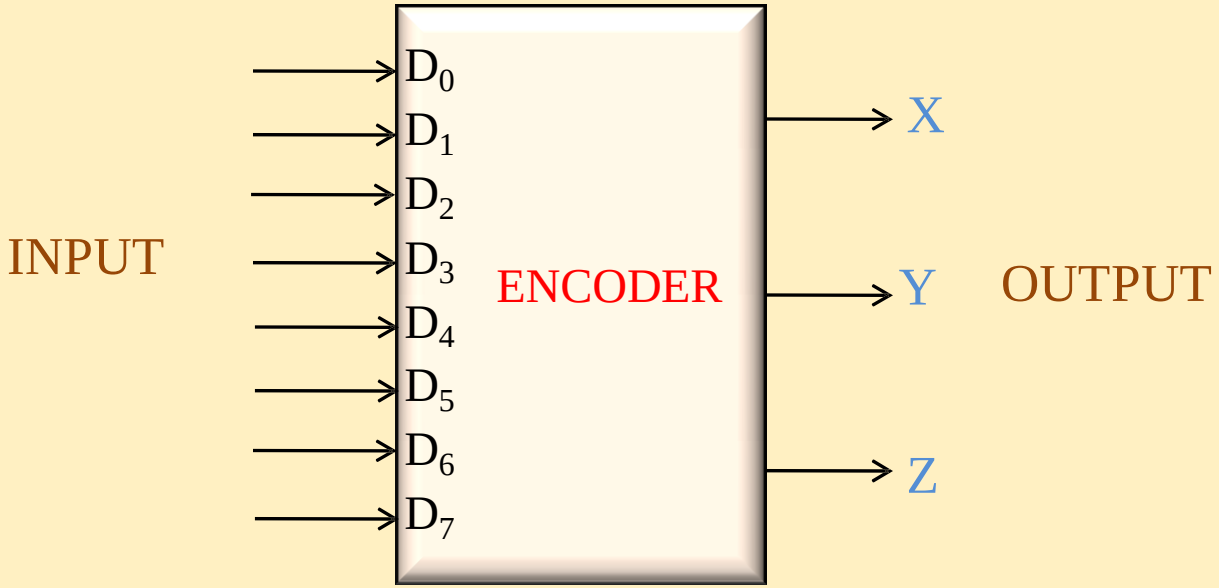
DECIMAL TO BCD ENCODER



- A=8+9
- B=4+5+6+7
- C=2+3+6+7
- D=1+3+5+7+9

OCTAL TO BINARY ENCODER

- It has eight inputs and three outputs.
- Only one input has one value at any given time.
- Each input corresponds to each octal digit and output generates corresponding Binary Code.



TRUTH TABLE

INPUT								OUTPUT		
D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7	X	Y	Z
1	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	1	0	0
0	0	0	0	0	1	0	0	1	0	1
0	0	0	0	0	0	1	0	1	1	0
0	0	0	0	0	0	0	1	1	1	1

From Truth table

$$X = D_4 + D_5 + D_6 + D_7$$

$$Y = D_2 + D_3 + D_6 + D_7$$

$$Z = D_1 + D_3 + D_5 + D_7$$

- It is assume that only one input is HIGH at any given time. If two outputs are HIGH then undefined output will produced. For example D_3 and D_6 are HIGH, then output of Encoder will be 111. This output neither equivalent code corresponding to D_3 nor to D_6.
- To overcome this problem, priorities should be assigned to each input.
- Form the truth table it is clear that the output X becomes 1 if any of the digit D_4 or D_5 or D_6 or D_7 is 1.
- D_0 is considered as don't care because it is not shown in expression.
- If inputs are zero then output will be zero. Similarly if D_0 is one, the output will be zero.

$$X = D_4 + D_5 + D_6 + D_7$$
$$Y = D_2 + D_3 + D_6 + D_7$$
$$Z = D_1 + D_3 + D_5 + D_7$$

LOGIC DIAGRAM: