Sairam INSTITUTIONS

Sri SAI RAM ENGINEERING COLLEGE
INSTITUTE OF TECHNOLOGY
West Tambaram, Chennai - 44

YEAR	SEM
II	III

CS 8351

DIGITAL PRINCIPLES AND SYSTEM DESIGN
(Common to CSE & IT)

UNIT NO. 2

2.8 DECODERS

Version: 1.0

4 QUALITY EDUCATION

NBA NATIONAL BOARD OF ACCREDITATION

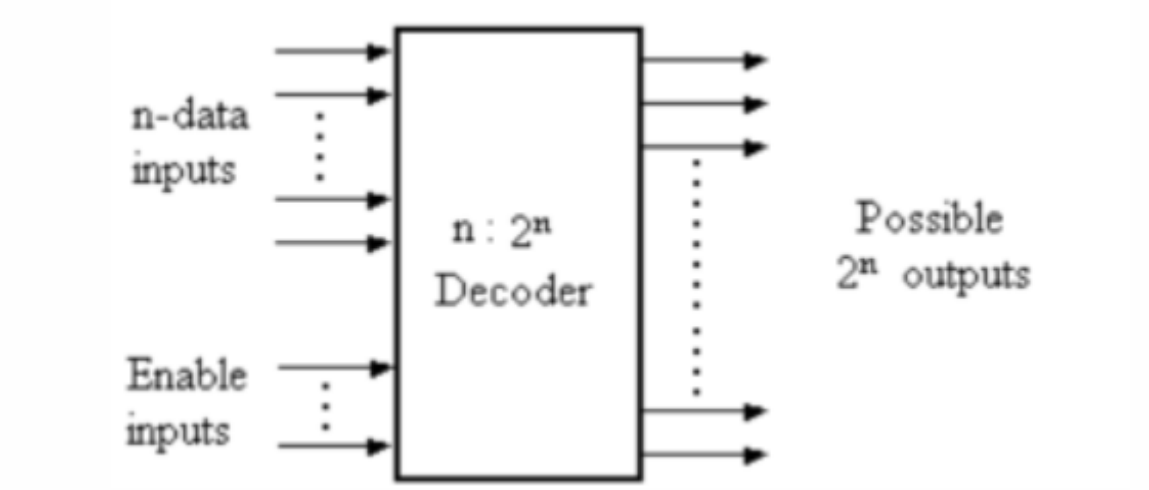
NAAC NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL A+

nirf NATIONAL INSTITUTIONAL RANKING FRAMEWORK

ISO 9001 : 2015 BUREAU VERITAS Certification

DECODERS

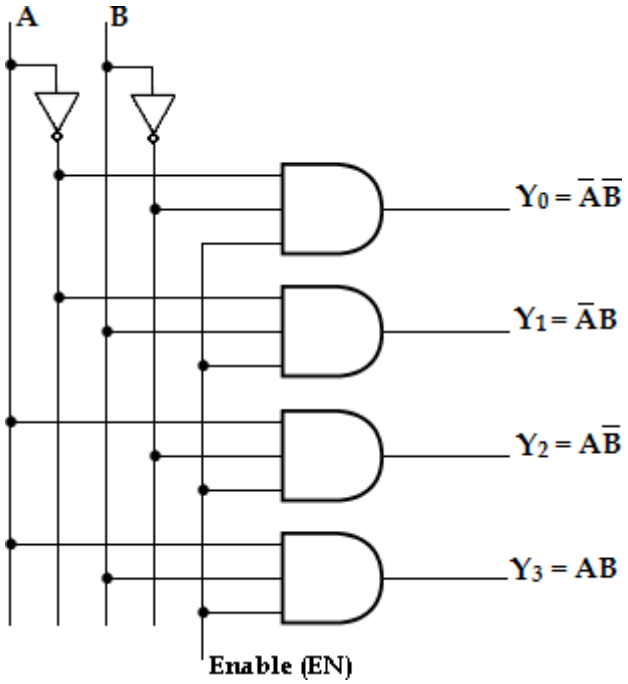
- A decoder is a combinational circuit that converts binary information from ‗n' input lines to a maximum of ‗2n' unique output lines. The general structure of decoder circuit is –



- The encoded information is presented as ‗n' inputs producing ‗2n' possible outputs.
- The 2n output values are from 0 through 2n-1.
- A decoder is provided with enable inputs to activate decoded output based on data inputs.
- When any one enable input is unasserted, all outputs of decoder are disabled.

Binary Decoder (2 to 4 decoder):

- A binary decoder has ‗n' bit binary input and a one activated output out of 2n outputs.
- A binary decoder is used when it is necessary to activate exactly one of 2n outputs based on an n-bit input value.



2-to-4 Line decoder

- Here the 2 inputs are decoded into 4 outputs, each output representing one of the minterms of the two input variables.

Inputs			Outputs			
Enable	A	B	Y_3	Y_2	Y_1	Y_0
0	x	x	0	0	0	0
1	0	0	0	0	0	1
1	0	1	0	0	1	0
1	1	0	0	1	0	0
1	1	1	1	0	0	0

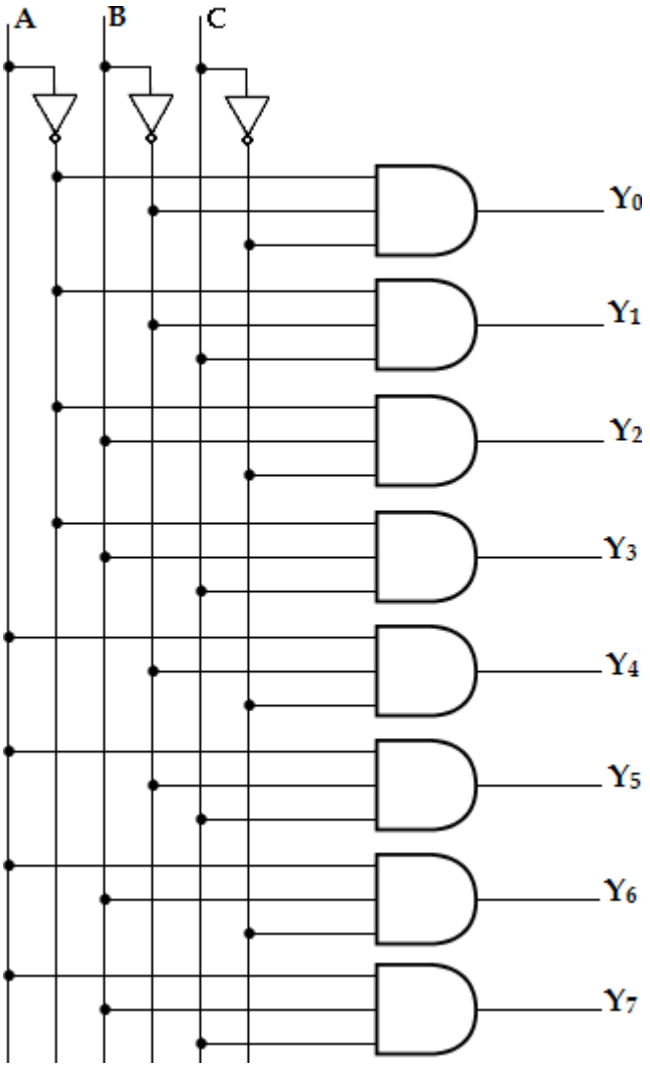
- As shown in the truth table, if enable input is 1 (EN= 1) only one of the outputs (Y0 – Y3), is active for a given input.
- The output
- Y0 is active, ie., Y0= 1 when inputs A= B= 0,
- Y1 is active when inputs, A= 0 and B= 1,

- Y2 is active, when input A= 1 and B= 0,
- Y3 is active, when inputs A= B= 1.

3-to-8 Line Decoder:

- A 3-to-8 line decoder has three inputs (A, B, C) and eight outputs (Y0- Y7). Based on the 3 inputs one of the eight outputs is selected.
- The three inputs are decoded into eight outputs, each output representing one of the minterms of the 3-input variables.
- This decoder is used for binary-to-octal conversion.
- The input variables may represent a binary number and the outputs will represent the eight digits in the octal number system.
- The output variables are mutually exclusive because only one output can be equal to 1 at any one time.
- The output line whose value is equal to 1 represents the minterm equivalent of the binary number presently available in the input lines.

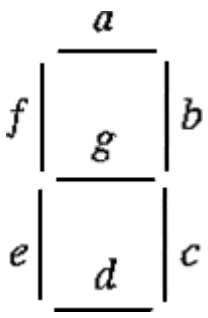
Inputs			Outputs							
A	B	C	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1



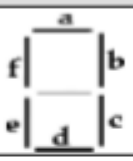
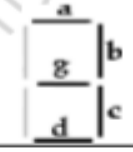
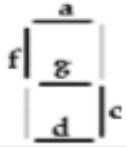
3-to-8 line decoder

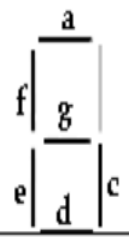
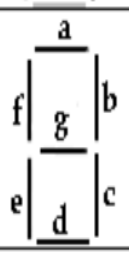
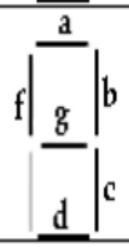
BCD to 7-Segment Display Decoder

- A seven-segment display is normally used for displaying any one of the decimal digits, 0 through 9.
- A BCD-to-seven segment decoder accepts a decimal digit in BCD and generates the corresponding seven-segment code.



- Each segment is made up of a material that emits light when current is passed through it.
- The segments activated during each digit display are tabulated as—
-

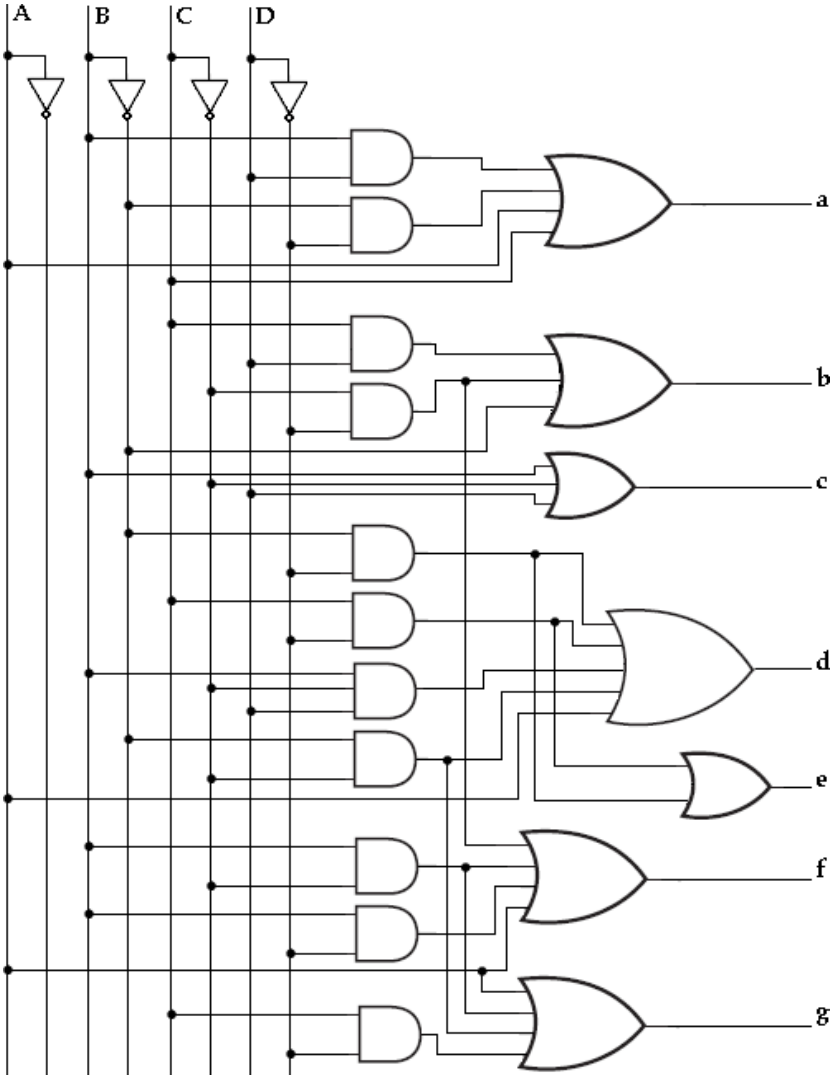
Digit	Display	Segments Activated
0		a, b, c, d, e, f
1		b, c
2		a, b, d, e, g
3		a, b, c, d, g
4		b, c, f, g
5		a, c, d, f, g

6		a, c, d, e, f, g
7		a, b, c
8		a, b, c, d, e, f, g
9		a, b, c, d, f, g

TRUTH TABLE:

	BCD code				7-Segment code						
Digit	A	B	C	D	a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	1	1

Logic Diagra



Applications of decoders:

- Decoders are used in counter system.
- They are used in analog to digital converter.
- Decoder outputs can be used to drive a display system.