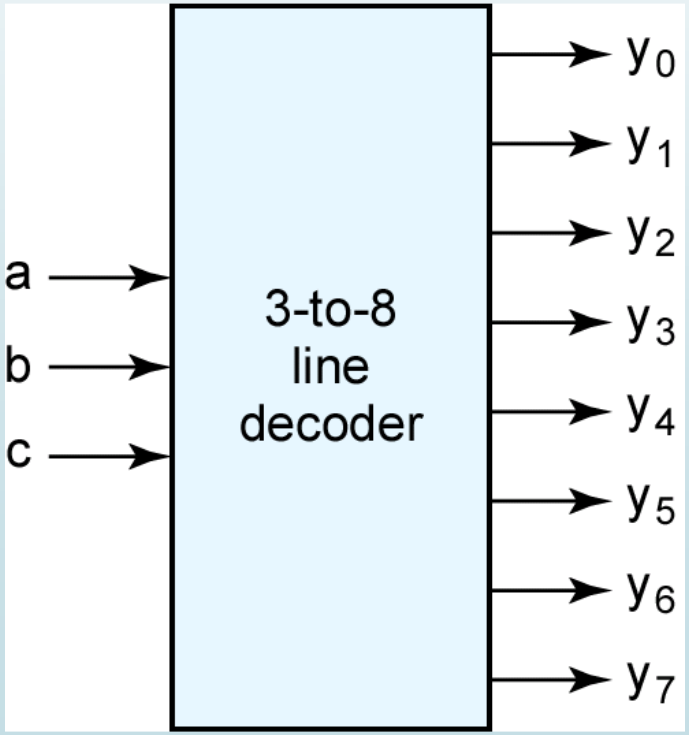
Part A

Decoder

Binary Decoder

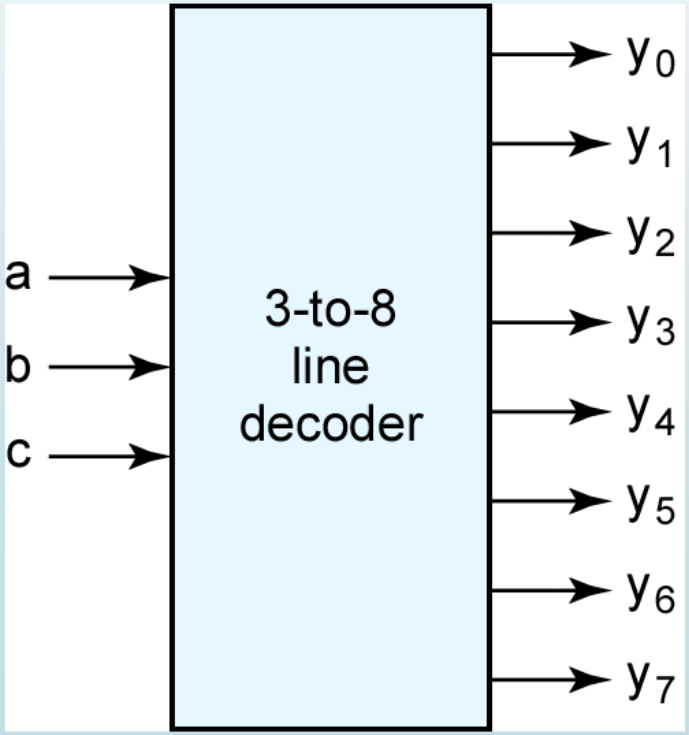
- Convert the binary input value into decimal.
- Exactly one of the output lines will be 1 for each combination of the three input variables. The others are 0's.



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

Binary Decoder

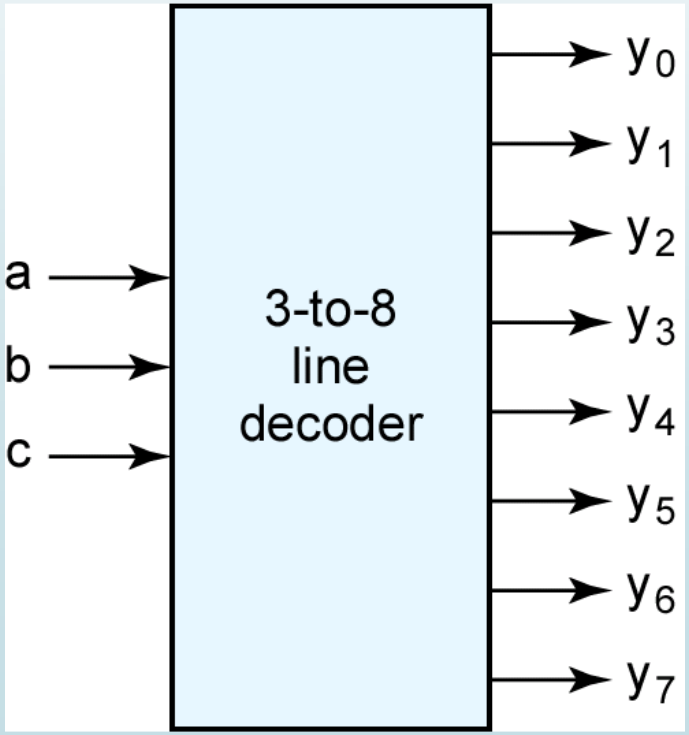
- From truth table, find the equation of y_0??



a	b	c	y_0	y_1	y_2	y_3	y_4	y_5	y_6	y_7
			0	0	0	0	0	0	0	
			1	0	0	0	0	0	0	
			0	1	0	0	0	0	0	
			0	0	1	0	0	0	0	
			0	0	0	1	0	0	0	
			0	0	0	0	1	0	0	
			0	0	0	0	0	1	0	
			0	0	0	0	0	0	1	

Binary Decoder

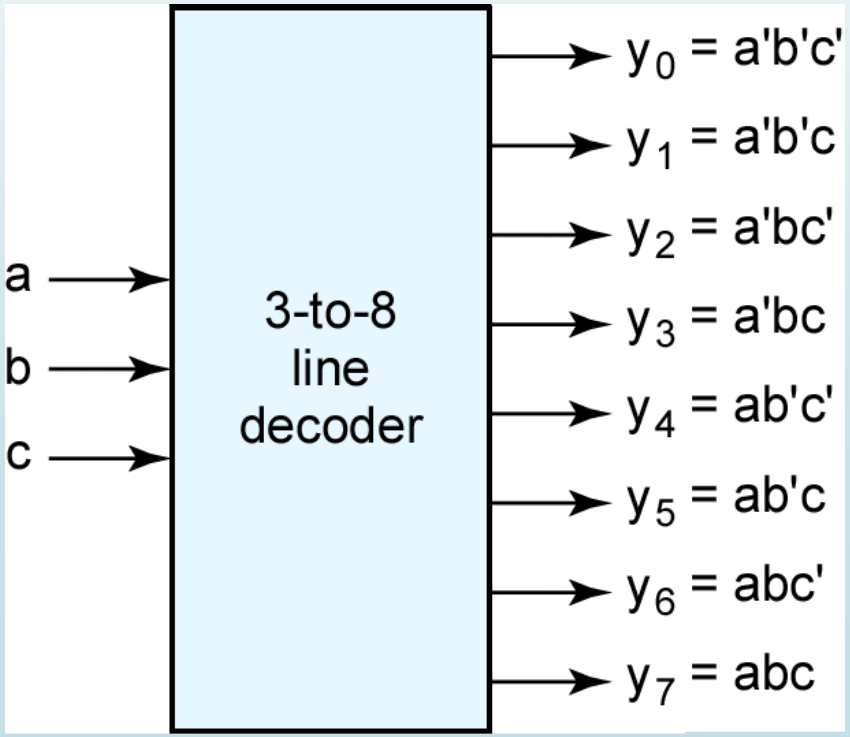
- From truth table, find the equation of y_0 = a'b'c'
- From truth table, find the equation of y_4??



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	1	0	1	0	0		0	0	0
0	1	0	0	0	1	0		0	0	0
0	1	1	0	0	0	1		0	0	0
1	0	0	0	0	0	0		0	0	0
1	0	1	0	0	0	0		1	0	0
1	1	0	0	0	0	0		0	1	0
1	1	1	0	0	0	0		0	0	1

Binary Decoder

- Decoder generates all the minterms of the inputs.
- The minterm $m_i = y_i$



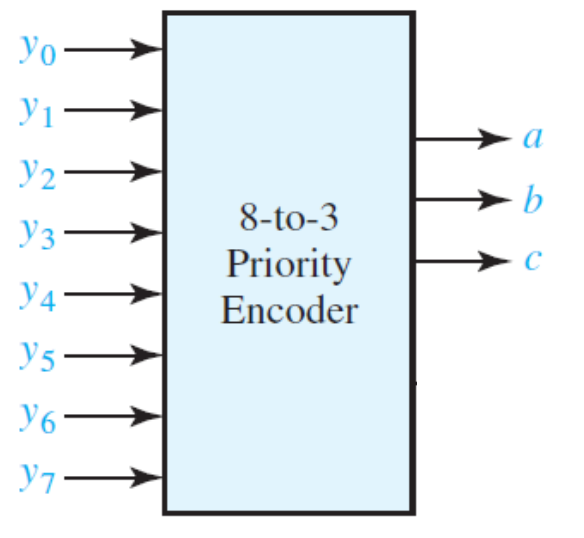
a	b	c	y_0	y_1	y_2	y_3	y_4	y_5	y_6	y_7
0	0	0	1	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0	1	0	0
1	1	0	0	0	0	0	0	0	1	0
1	1	1	0	0	0	0	0	0	0	1

Part B

Encoders

Binary Encoder

- A binary encoder performs the inverse function of a binary decoder: Converts the input line decimal number into binary.
- If input y_i is 1 and the other inputs are 0, then abc output represents the binary number equal to i.
- For example, if y3= 1, then abc= 011.



y_0	y_1	y_2	y_3	y_4	y_5	y_6	y_7	a	b	c
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

Generally

- Binary encoder is 2^n-to-n encoder.
  - Example: 4-to-2 encoder, 8-to-3 encoder.

- Encoder the encoder converts encoded input into encoded output where the output bits are fewer than the input bits.