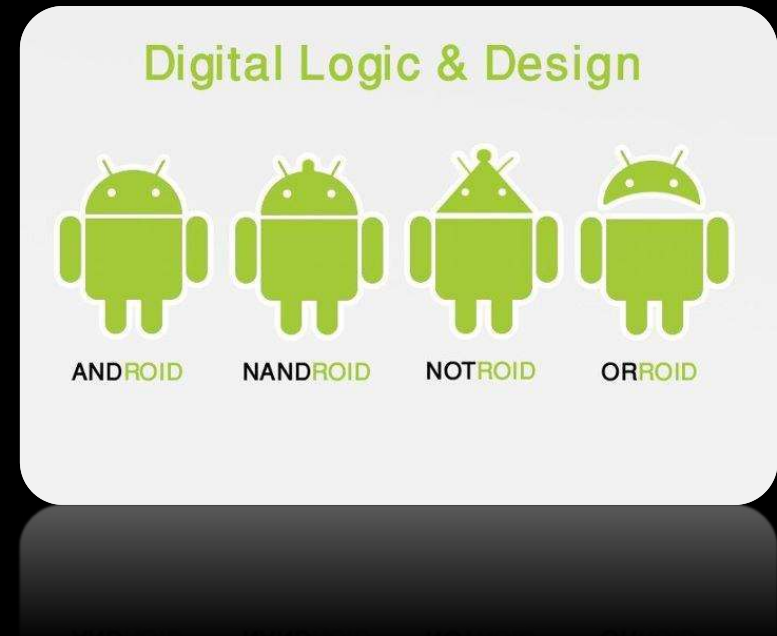




Week 2 Review

Week 2 review

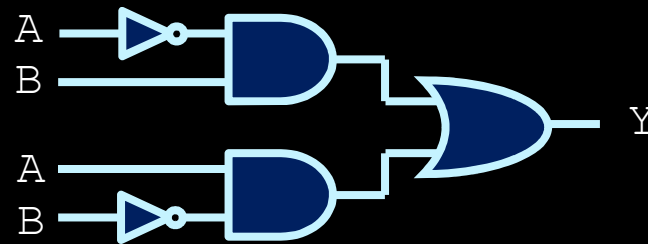
- Using logic gates
 - Combinational circuits
 - Circuit reduction
 - Karnaugh maps



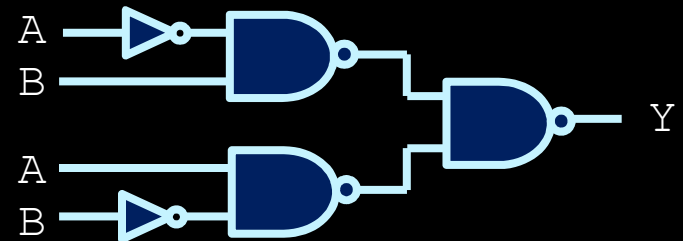
Question #1

- How can you express a two-input XOR gate as a combination of NAND and NOT gates?
 - Draw the circuit using only these two logic gates.

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

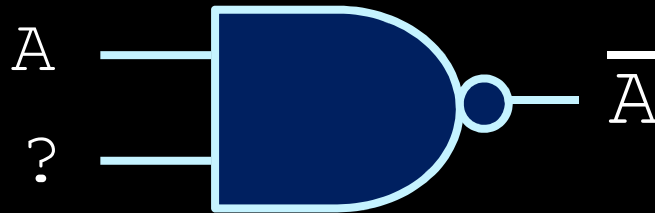


- Remember De Morgan's!
 - $(W' + Z') = (WZ)'$



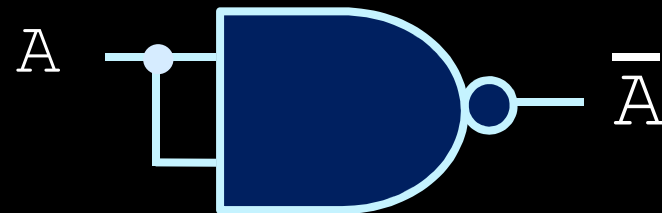
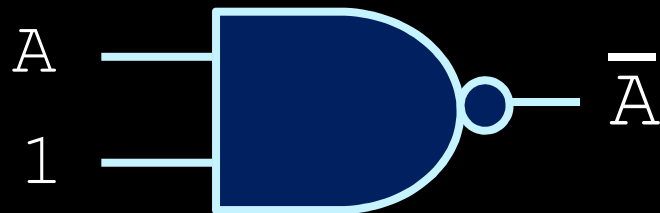
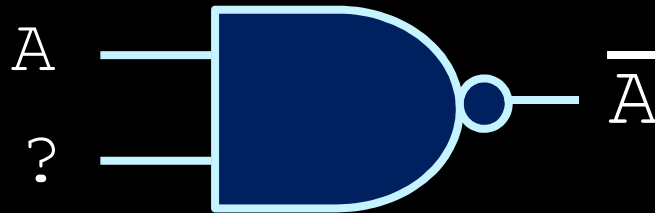
Question #2

- How can you implement a NOT gate from a 2-input NAND gate?



Question #2

- How can you implement a NOT gate from a 2-input NAND gate?



Question #2 - Minterms

- Write Y in SOM (Sum Of Minterms) form.

$$Y = \bar{A} \cdot \bar{B} \cdot C + \bar{A} \cdot B \cdot \bar{C} + A \cdot \bar{B} \cdot \bar{C} + A \cdot B \cdot C$$

$$Y = m_1 + m_2 + m_4 + m_7$$

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Question #3

- Given the minterms below, can you fill in the truth table on the right?

$$Y = m_2 + m_3 + m_7 + m_9 \\ + m_{12} + m_{14}$$

A	B	C	D	Y
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

Question #3

- Given the minterms below, can you fill in the truth table on the right?

$$Y = m_2 + m_3 + m_7 + m_9 \\ + m_{12} + m_{14}$$

A	B	C	D	Y
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Question #4

- What is the most reduced form, in sum of products form, of the function from the truth table on the right?

$$Y = m_0 + m_1 + m_2 + m_5 \\ + m_7 + m_8 + m_9 \\ + m_{10} + m_{13} + m_{15}$$

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Question #4 (cont'd)

	$\overline{C} \cdot \overline{D}$	$\overline{C} \cdot D$	$C \cdot D$	$C \cdot \overline{D}$
$\overline{A} \cdot \overline{B}$	1	1	0	1
$\overline{A} \cdot B$	0	1	1	0
$A \cdot B$	0	1	1	0
$A \cdot \overline{B}$	1	1	0	1

$$Y = \overline{C} \cdot D + B \cdot D + \overline{B} \cdot \overline{D}$$

Question #4 (alternative)

- An alternative grouping:

	$\bar{C} \cdot \bar{D}$	$\bar{C} \cdot D$	$C \cdot D$	$C \cdot \bar{D}$
$\bar{A} \cdot \bar{B}$	1	1	0	1
$\bar{A} \cdot B$	0	1	1	0
$A \cdot B$	0	1	1	0
$A \cdot \bar{B}$	1	1	0	1

$$Y = \bar{B} \cdot \bar{C} + B \cdot D + \bar{B} \cdot \bar{D}$$

Helpful Hint

A Karnaugh map for a 4-variable function with variables A, B, C, and D. The map is a 4x4 grid with rows labeled AB (00, 01, 11, 10) and columns labeled CD (00, 01, 11, 10). The values in the cells are as follows:

AB \ CD	00	01	11	10
00	1	1	0	1
01	0	1	1	0
11	0	1	1	0
10	1	1	0	1

Groupings are indicated by green brackets:

- A**: A vertical bracket on the left side of the map, grouping the rows AB=11 and AB=10.
- B**: A horizontal bracket on the right side of the map, grouping the columns CD=11 and CD=10.
- C**: A horizontal bracket above the top two columns, grouping CD=11 and CD=10.
- D**: A horizontal bracket below the bottom two columns, grouping CD=11 and CD=10.

The cells (AB=11, CD=11) and (AB=10, CD=11) are highlighted in yellow.