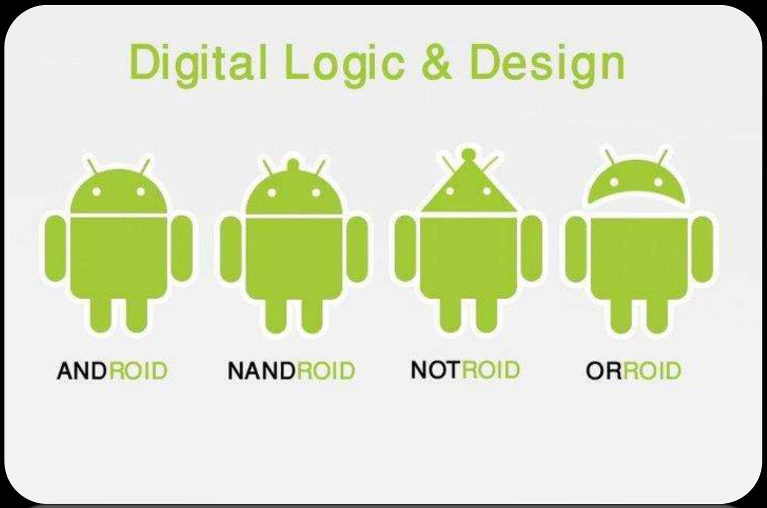
Week 2 review

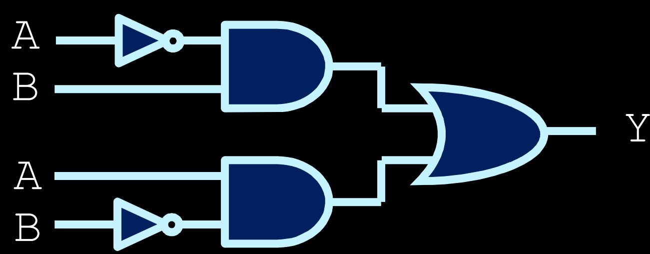
- Using logic gates
  - Combinational circuits
  - Circuit reduction
  - Karnaugh maps

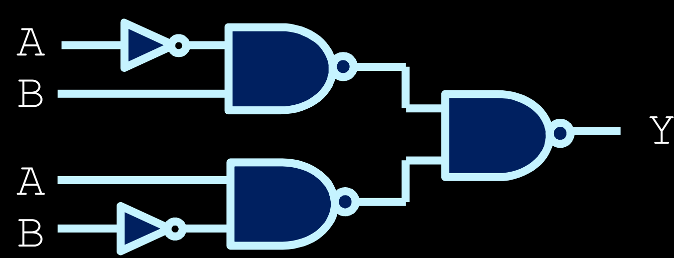


Question #1

- 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

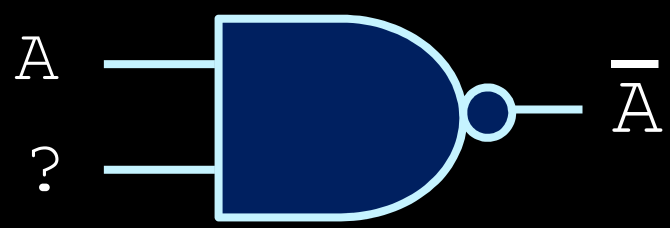




- Remember De Morgan's!
  - (W' + Z') = (W Z)'

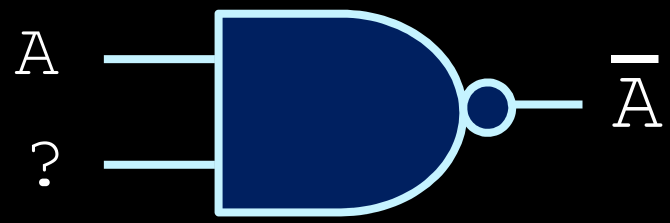
Question #2

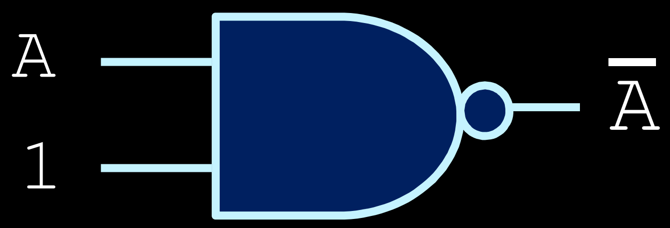
- How can you implement a NOT gate from a 2-input NAND gate?

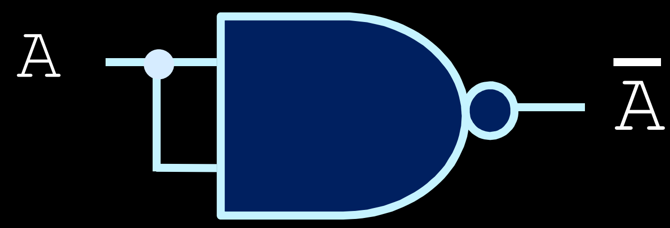


Question #2

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







Question #2 - Minterms

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

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

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

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:

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

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

Helpful Hint

C

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

B

A

D