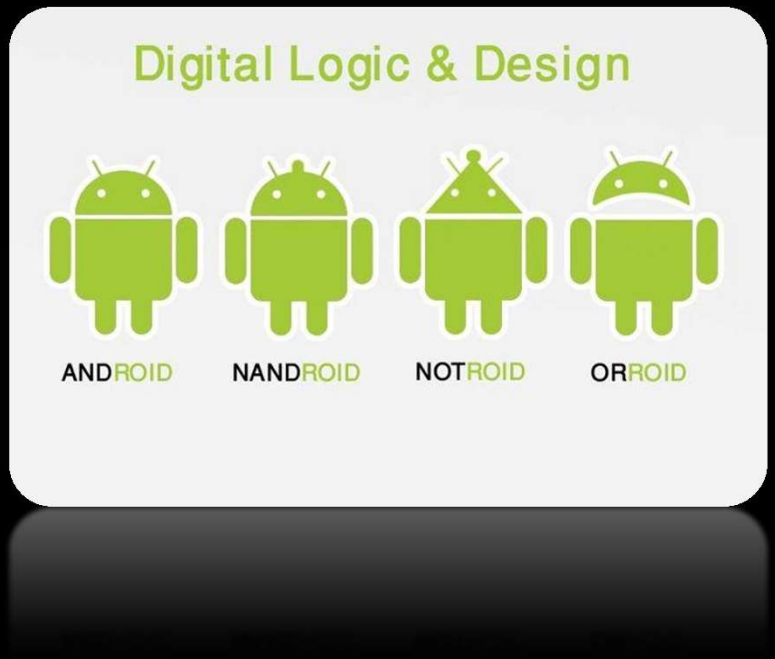
# Week 2 Review

# Week 2 review

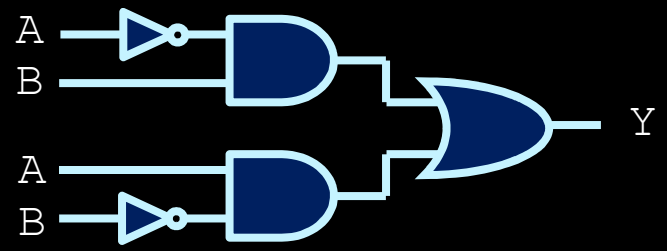
- Using logic gates
  - Combinational circuits
  - Circuit reduction
  - Karnaugh maps



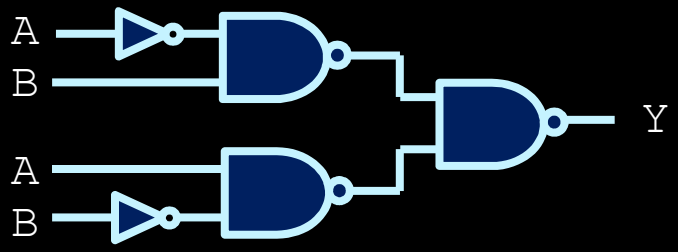
# Question #1

- 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 |

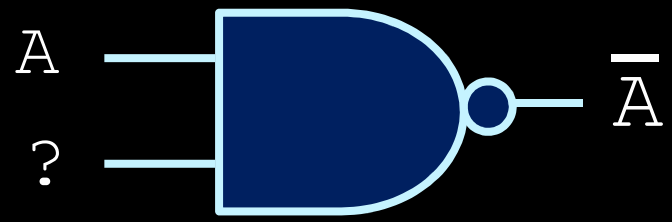



- Remember De Morgan's!
  - (W' + Z') = (W Z)'



# Question #2

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



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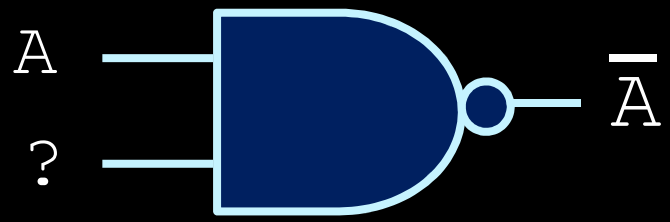


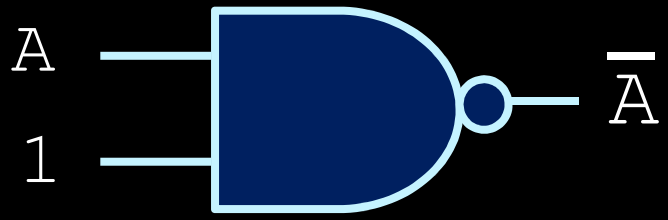


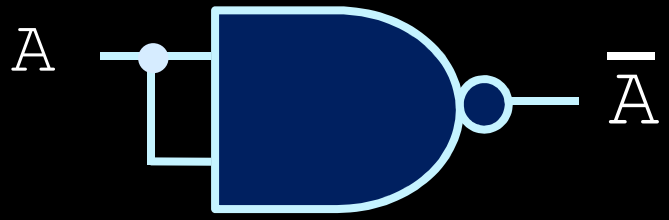

# Question #3

- 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 | |

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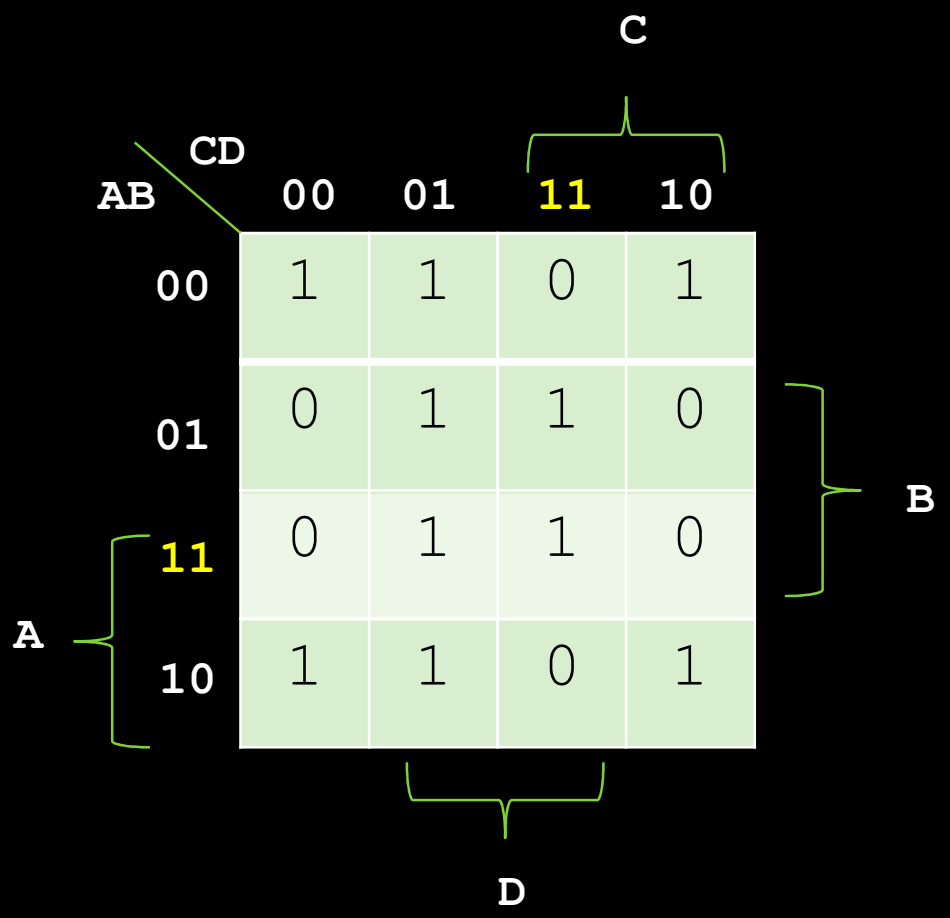
| A | B | C | D | Y |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 0 |

# Helpful Hint



# Problem Set 02

# Questions

1. Minimize the K-Map in POS terms:

| | C′D′ | C′D | CD | CD′ |
|---|---|---|---|---|
| A′B′ | 0 | 0 | 1 | 1 |
| A′B | 1 | 1 | 0 | 0 |
| AB | 1 | 1 | 0 | 0 |
| AB′ | 0 | 0 | 0 | 0 |

F = (A′+C′) . (B + C) . (B′+C′)

# Questions

2. Reduce F(A,B,C) = ∑(1,4,5,6,7) to the most minimum Boolean expression

   F = A′B′C + AB′C′ + AB′C + ABC′ + ABC

   Simplifying:

   F = A′B′C + A(B′C′ + B′C + BC′ + BC)

   F = A′B′C + A(B′(C′+C) + B(C′=C))

   F = A′B′C + A(B′+B)

   F = A′B′C + A

   F = B′C + A

# Questions

3. Draw the K-map for the following Boolean expression:

$$F = AB'C'D' + A'BC' + A'D + BD$$

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

# Questions

4. What is the Boolean expression for G as given in the K-Map below:

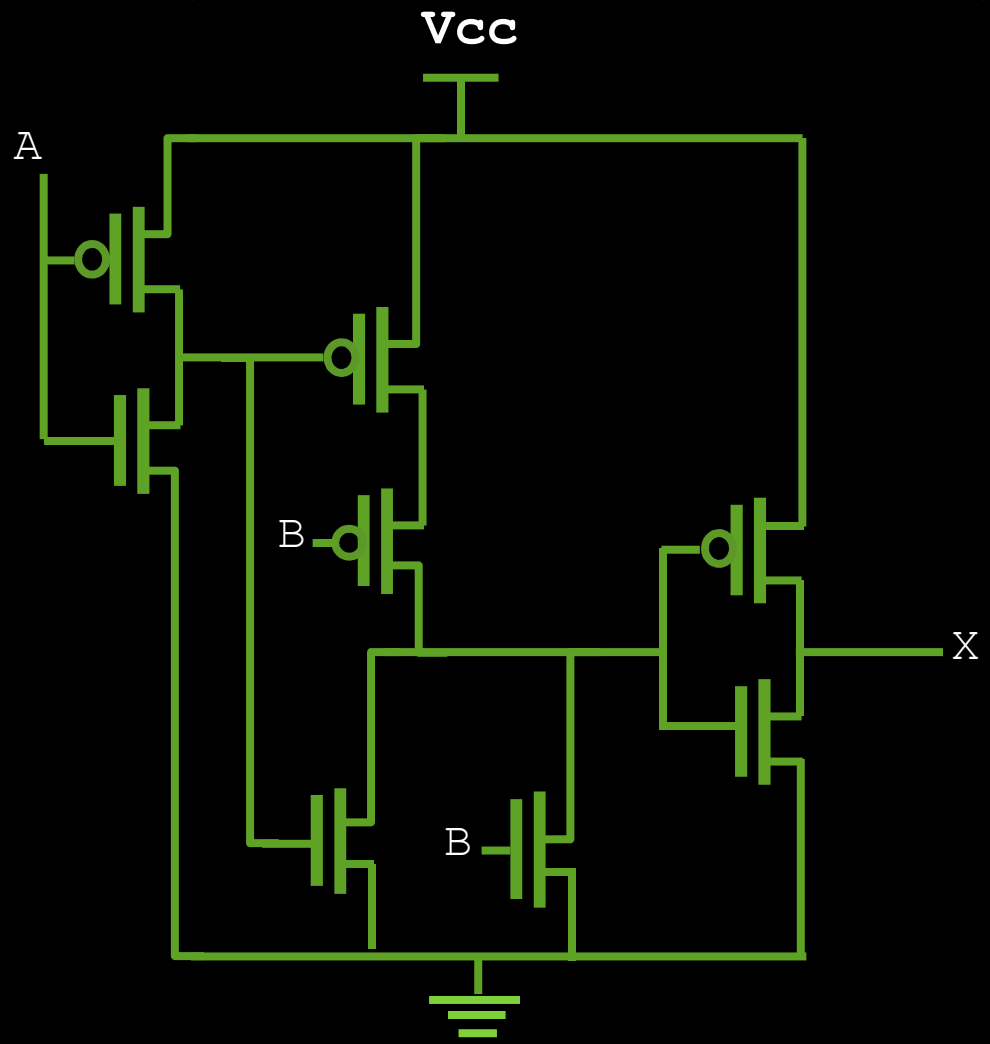
| | **B·C** | **B·C** | **B·C** | **B·C** |
|---|---|---|---|---|
| **A** | X | 0 | 0 | 1 |
| **A** | X | 0 | 1 | 1 |

$F = C' + AB$

# Problem Set 03

# Question 1

What gate is created by the following?



# Question 2 - Minterms

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

| 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

- 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 | |
| 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 | |