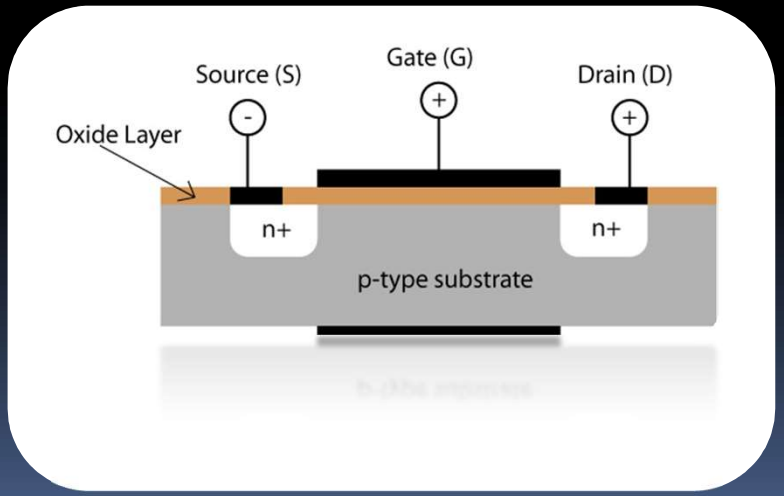
Week 1 Review

Textbook

- In case you don't want to purchase a full-price textbook but want access to it for reference:
  - Check the book out first in the library (it's under course reserves).
  - Look for a used copy
- If you have a different edition:
  - You can find the table of contents of the 4th edition under Course Materials -> General Course Information.

Week 1 Review

- Properties of electricity
- Semiconductor materials
  - Doping (n-type and p-type)
- p-n junctions
- Transistors
  - MOSFETs



How CSC258 tutorials work

- Each week has three hours of classroom time.
  - Two hours of lectures,
  - One hour of tutorials.
- The tutorial is split into two halves:
  - The first half hour at the beginning, reviewing last week's material and potential exam questions.
  - The second half hour is later in the week, reviewing what you need to know for the upcoming lab.

Let's review

- Logic gates are built from

Let's review

- Logic gates are built from transistors.

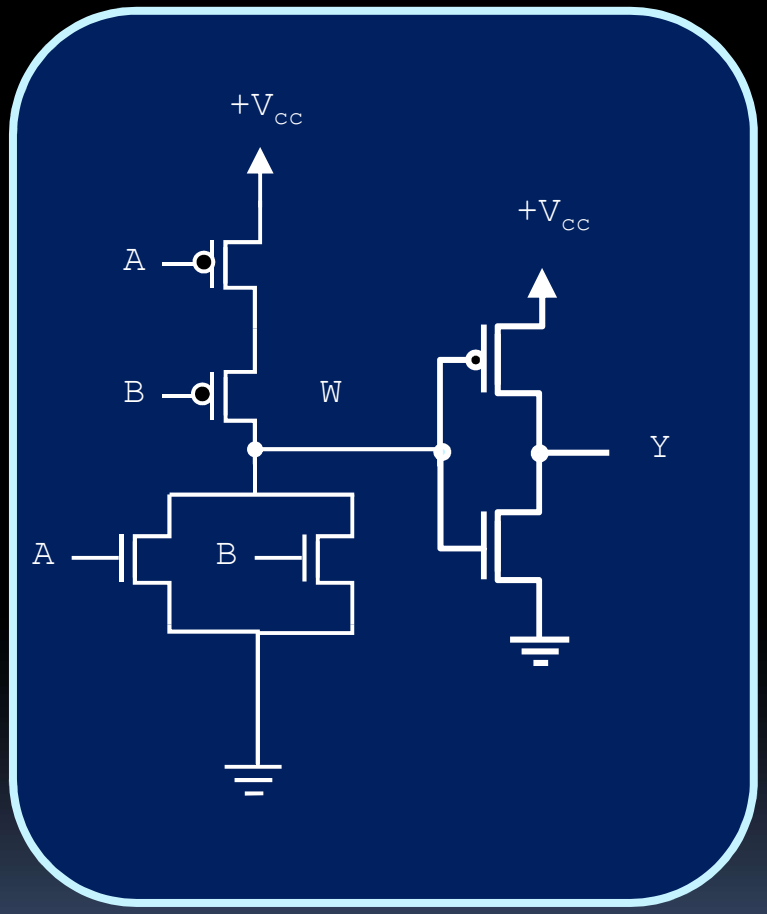
This transistor is called nMOS.

It conducts (i.e., acts as a closed switch) if we apply 5 Volts (logic-1) at its gate.

This transistor is called pMOS

It conducts (i.e., acts as a closed switch, if we apply 0 Volts (logic-0 , Gnd) at its gate.

Which gate is this one?



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

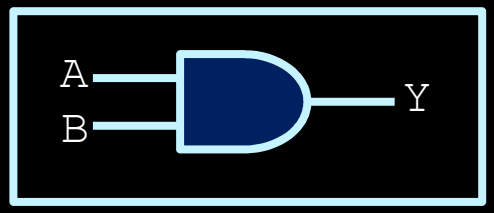
W =

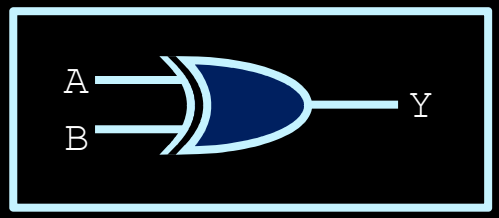
Y =

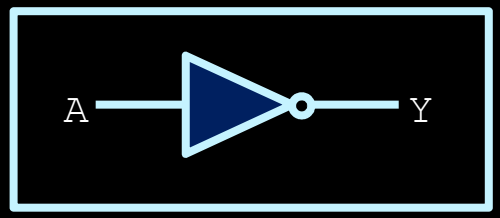
Basic Logic Gates: Symbols and Truth Tables

- What are the names and truth table values for the following gates?

How many transistors do you need to build a NOT gate?







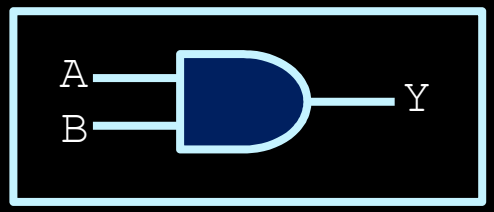
A	B	Y
0	0	
0	1	
1	0	
1	1	

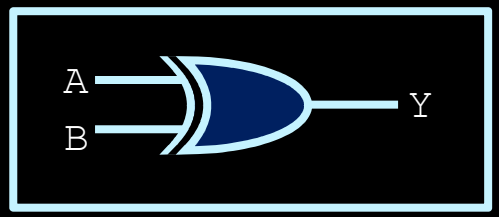
A	B	Y
0	0	
0	1	
1	0	
1	1	

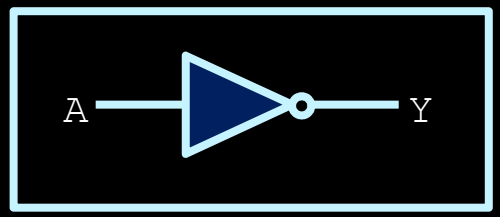
A	Y
0	
1	

Basic Logic Gates: Symbols and Truth Tables

- What are the names and truth table values for the following gates?







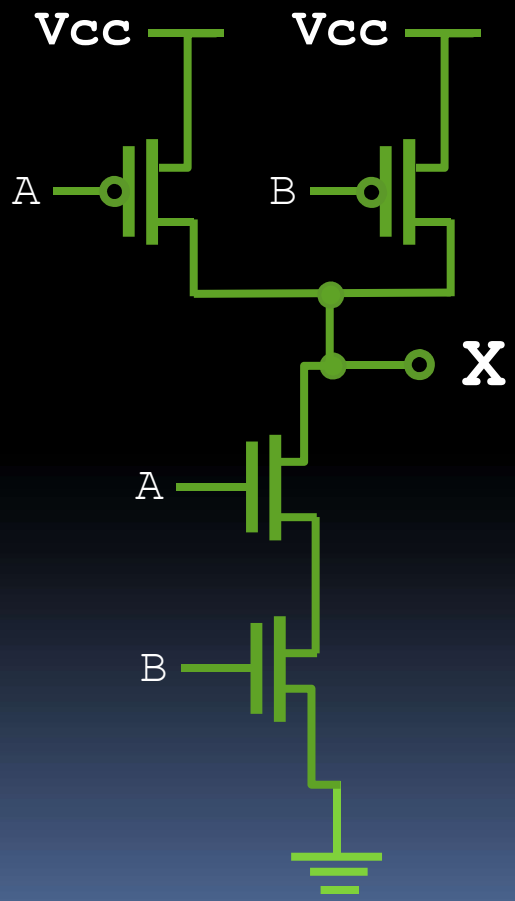
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

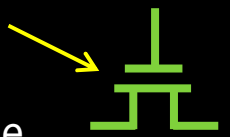
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

A	Y
0	1
1	0

More Questions

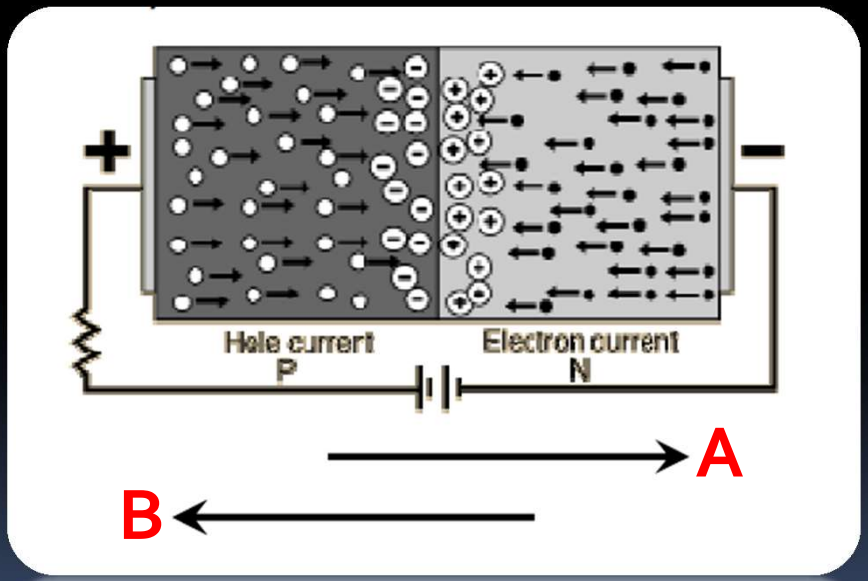
- What gate is created by the following?



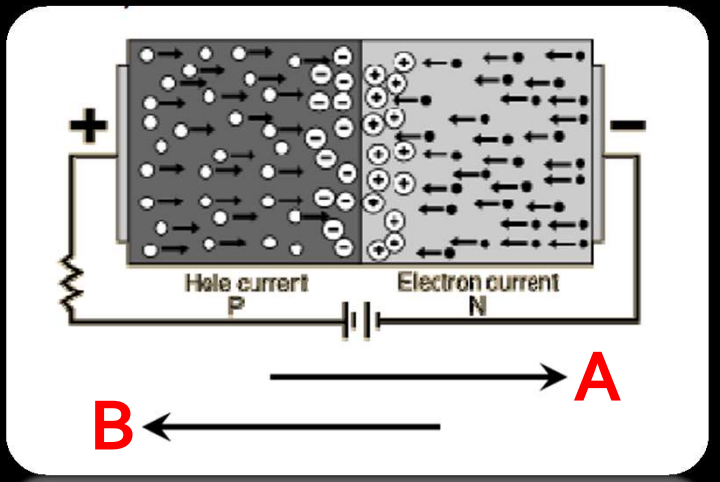
Remember: transistors that look like  are activated when the gate input is high, whereas transistors that look like  are activated when the gate input is low.

Kinds of current

- What is the name of currents A and B, and how are they produced?



Question 2



- Two things to note here:
  - Need to determine which electrons are moving from high concentration to low concentration (diffusion), and which are moving because of the electric field (drift).
  - Note: Current is measured in the opposite direction of electron flow (i.e. as *the flow of positive charge* through the material)
  - A → diffusion B → drift

Week 1 - Problem Set

Questions

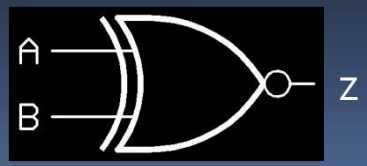
1. Name all the gates that produce a HIGH Output when all the Inputs are LOW

   NAND, NOR, NOT

2. What is the decimal representation of the hexadecimal value 0x2A?

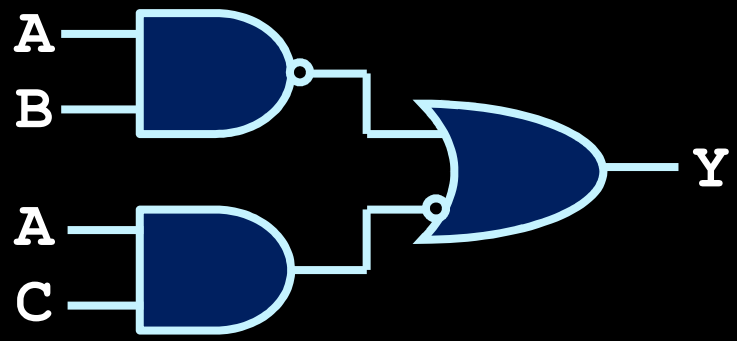
   42

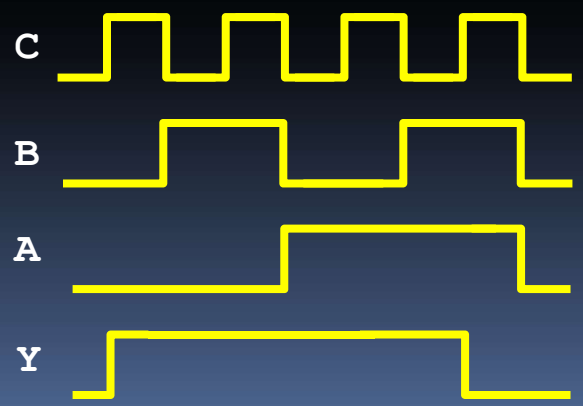
3. Draw a 2-input XNOR gate and the truth table for it.



Inputs		Outputs
X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	1

Q4: Complete the truth table



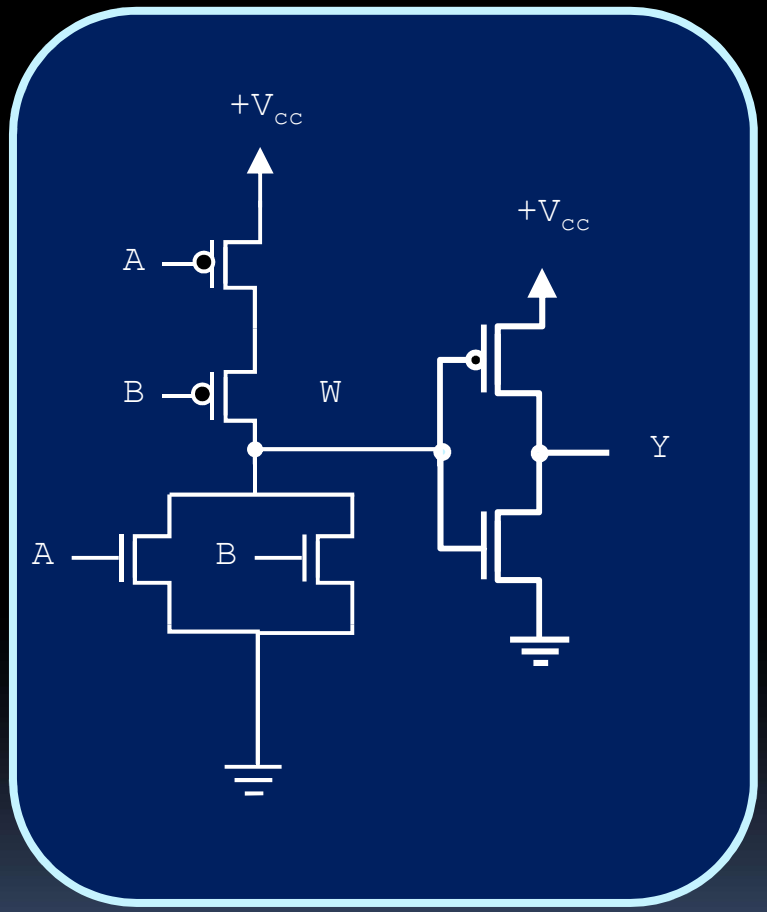


A	B	C	Y
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Questions

5. True or False? Doping gives a semiconductor an overall positive or negative charge. **False**
6. What kind of bias on a pn junction causes the depletion layer to expand? **Reverse bias**
7. Phosphorus has 5 electrons in its outer valence shell. When added in small amounts to silicon, the result is a _____ semiconductor. **Doped or N-Type**

Q8: Which gate is this one?



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

$$W = \overline{(A + B)}$$

$$Y = (A + B)$$