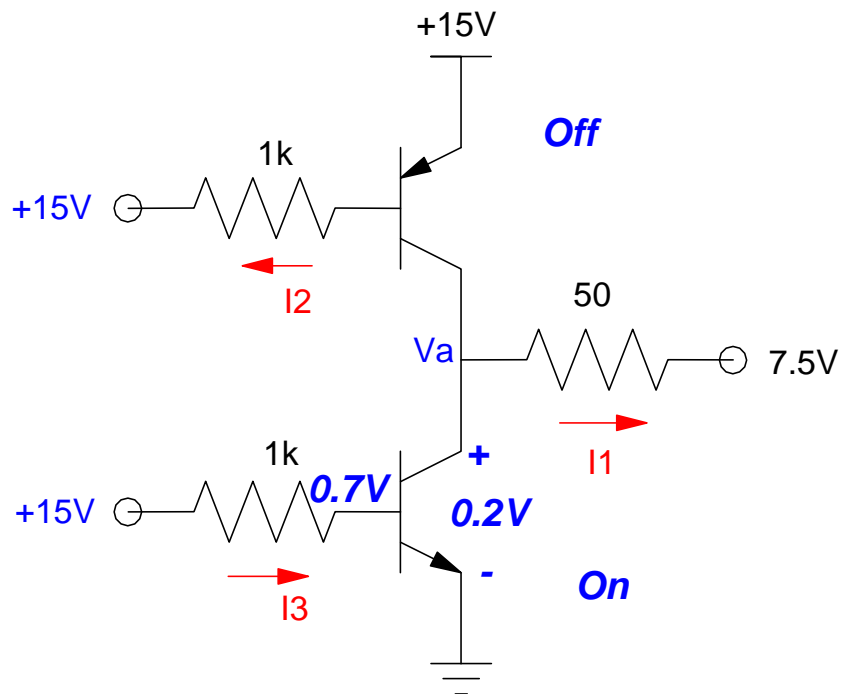


ECE 320 - Quiz 5: Name _____

February 26, 2015 - H-Bridge, DC to AC Converters

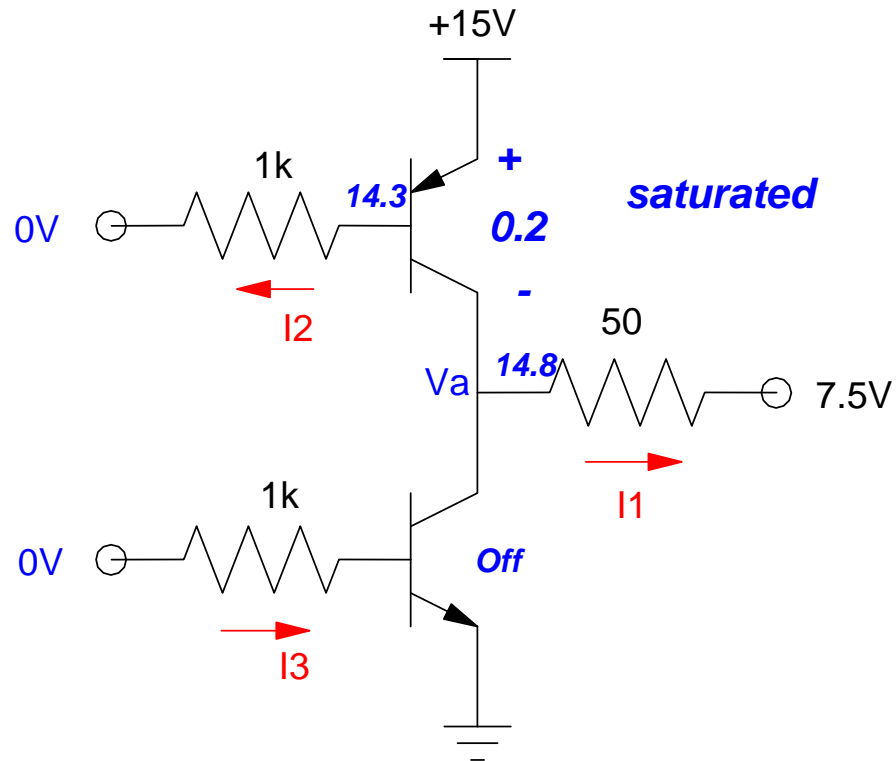
1) For the following half H-bridge, determine the currents and voltages. Assume $\beta = 200$

I1	I2	I3	Va
-146 mA	0mA (off)	14.3mA	0.2V (PNP is saturated)



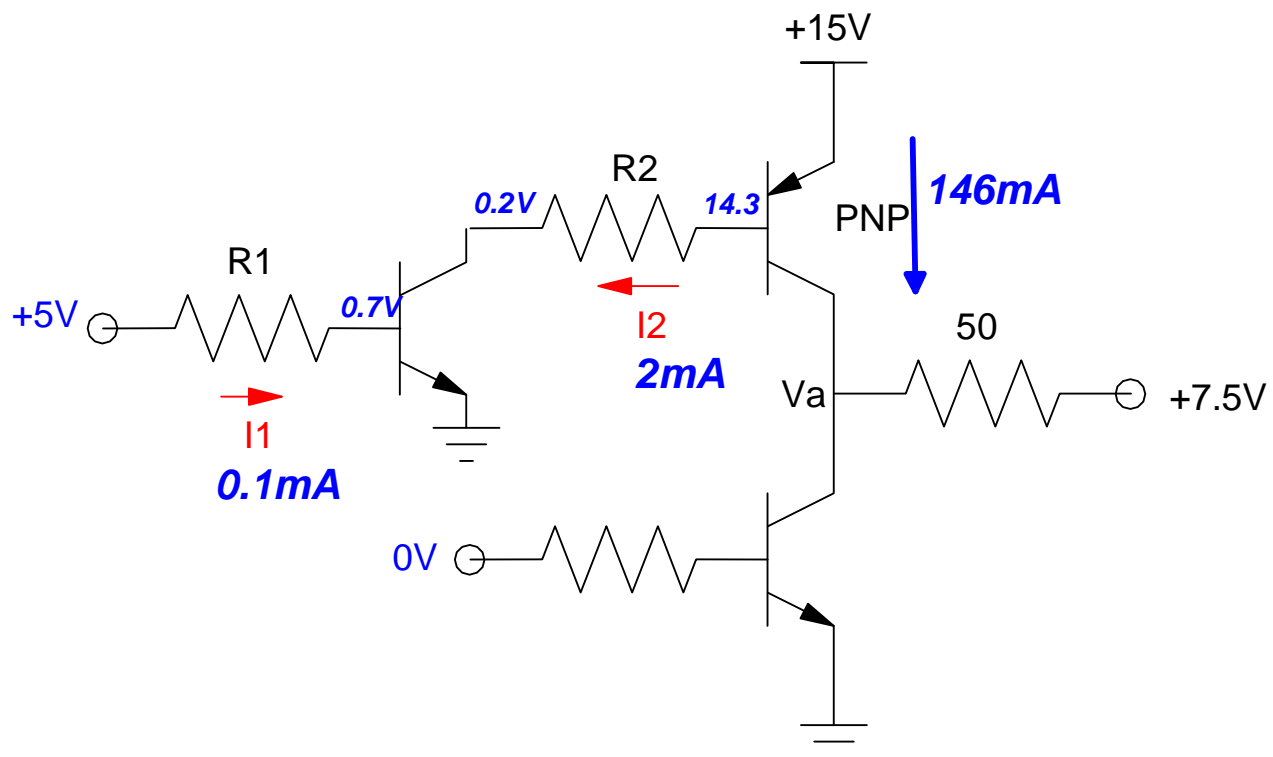
2) For the following half H-bridge, determine the currents and voltages. Assume $\beta = 200$

I1	I2	I3	Va
+ 146 mA	14.3 mA	0mA off	14.8V



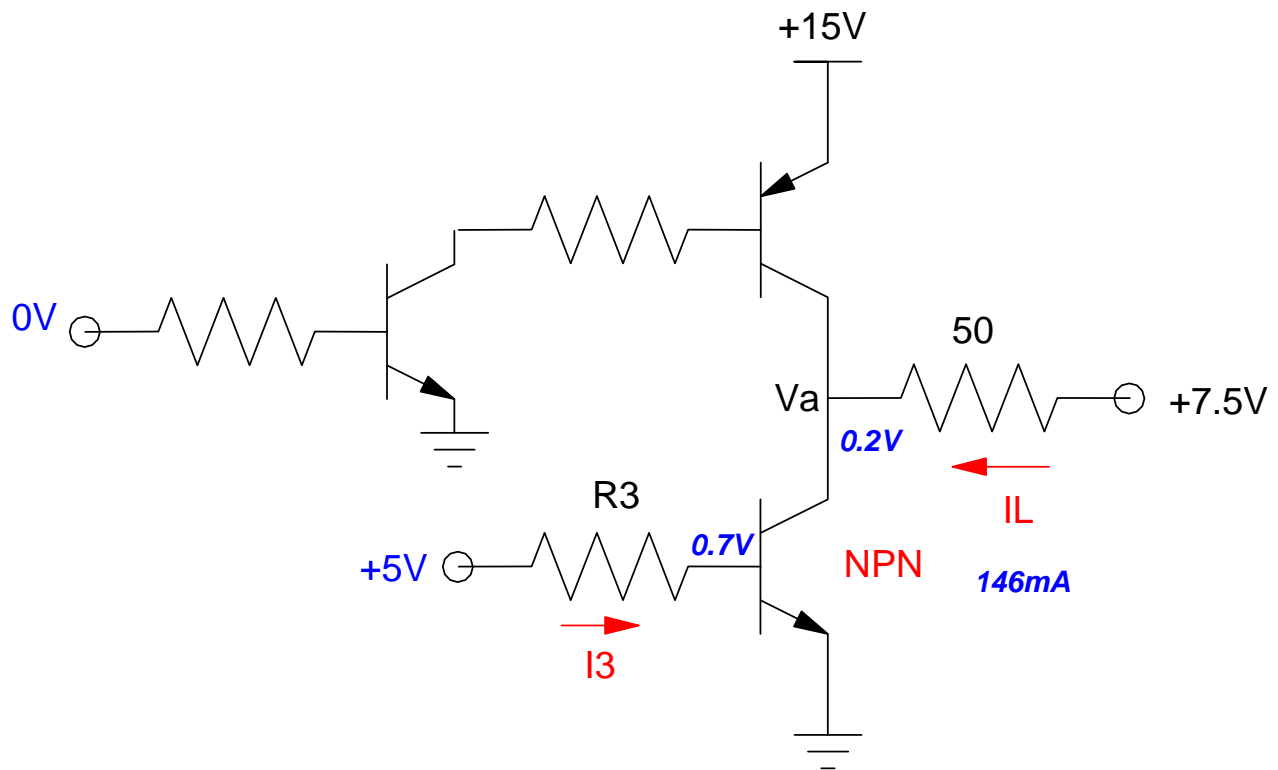
3) For the following half H-bridge, specify R1 and R2 so that the PNP transistor is saturated. Also determine the resulting currents I1 and I2. Assume the current gain is 200 ($\beta = 200$)

R1	R2	I1	I2
43,000	7,050	0.1mA	2mA
$\frac{5-0.7}{I_1}$	$\frac{14.3V-0.2V}{I_2}$	$> \frac{I_2}{\beta}$	$> \frac{146mA}{\beta}$



4) For the following half H-bridge, specify R3 so that the NPN transistor is saturated. Also determine the resulting currents I3 and IL. Assume the current gain is 200 ($\beta = 200$)

R3	I3	IL
2150	2mA	+ 146mA
$\frac{5-0.7}{I_3}$	$> \frac{146mA}{\beta}$	$\frac{7.5V-0.2V}{50\Omega}$



5a) Assume you are using an H-Bridge to drive a DC motor. How do you vary the speed of the motor?

To vary the speed of a DC motor, vary the voltage.

You can do this by turning on and off the H-bridge

- If the bridge is on 100% of the time, the motor is running at 100% speed*
- If the bridge is on 50% of the time, the motor is running at 50% speed*
- If the bridge is on 10% of the time, the motor is running at 10% speed*
- etc*

This is termed Pulse Width Modulation

5b) Assume you are using an H-Bridge to drive an AC motor. How do you vary the speed of the motor?

To vary the speed of an AC motor, you vary the frequency of the AC signal

You can do this by speeding up and slowing down how fast you cycle through the sequence to approximate a sine wave

BONUS!

Is internet gambling legal in North Dakota? Explain your answer.

No. Gambling is prohibited by the North Dakota Constitution

North Dakota Constitution - Article XI - Section 25.¹

"The legislative assembly shall not authorize any game of chance, lottery, or gift enterprises, under any pretense, or for any purpose whatever. However, the legislative assembly shall authorize the State of North Dakota to join a multi-state lottery for the benefit of the State of North Dakota, and, the legislative assembly may authorize by law bona fide nonprofit veterans', charitable, educational, religious, or fraternal organizations, civic and service clubs, or such other public-spirited organizations as it may recognize, to conduct games of chance when the entire net proceeds of such games of chance are to be devoted to educational, charitable, patriotic, fraternal, religious, or other public-spirited uses."

Yes:

- The state of North Dakota sells lottery ticket on-line²
- You can buy and sell stock on-line³ - which is gambling for rich people. Only we call it "investing".

Under rules for the World Trade Organization as well as the North American Free Trade Agreement (federal law), you cannot discriminate against foreign trade in favor of local businesses. By selling lottery tickets on-line, the government of North Dakota has rendered Article XI invalid under U.S. Law (my interpretation at least).

Don't Know:

- State Law says no
- Treaties the Federal Government signed say yes
- A bill in congress is trying to prohibit internet gambling - so no
- Buying and selling stock on-line is legal - so yes
- People have been tried and convicted for internet gambling in North Dakota, so no,
- You can buy lottery tickets on-line, so yes
- So, what is it?

¹ <http://www.gambling-law-us.com/State-Laws/North-Dakota/>

² <http://lottery.nd.gov/>

³ <https://us.etrade.com/home>