Homework #0
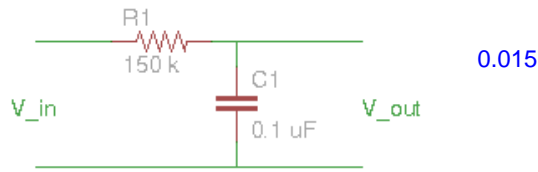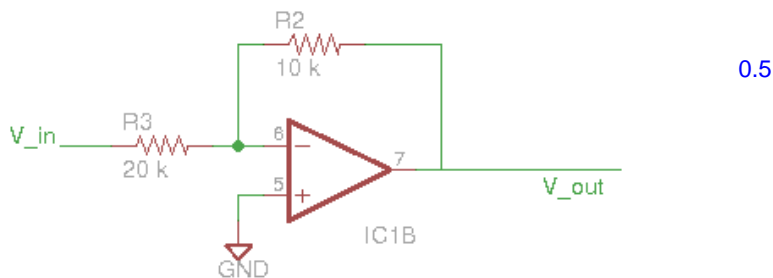**100 Points**

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1) What kind of filter is this? What is the transfer function? What is the cutoff frequency?

0.015

2) What kind of amplifier is this? What is its gain?   Do you expect it to work? (Note: IC1B is an op-amp)

0.5

3) You have a 2kHz sine wave signal with an amplitude of 1v. You pass this signal through a passive high-pass filter with a gain of 2 and a cutoff frequency of of 2kHz. What is the amplitude of the output signal?

4) Write a loop (in C) that prints out the first 10 powers of 2. So we should see the value of 2^0, 2^1, 2^2, 2^3, etc.

5) `bitBang` is an 8-bit char. Write 4 lines of C code: one that tests the value of its 3rd bit, one that sets the 3rd bit, one that clears the 3rd bit, and one that toggles the 3rd bit.

   #define BIT3HI 0x04 // 0000 0100

6) Write a program in C to iterate through a set of integers (1-1000) and output one of four outputs depending on the number: if the number is divisible (no remainder) by 4, then the output is "DEAD." If the number is evenly divisible by 9, then the output is "BEEF." If the output is divisible

by both 4 and 9, then the output should be "DEADBEEF." Lastly, if the output is not divisible by either 4 or 9, then the number itself should be printed. Each entry is on its own line, and you will be submitting both the (commented) code and the output.

7) Trace out your hand twice on a piece of paper. Using a friend try to map out the areas of sensitivity on your hand (front and back). Do this using either two pins or two toothpicks—see how far apart they have to be to be able to distinguish between the two individual points. Write a cogent paragraph explaining the results to accompany your drawings.

8) You close your eyes and someone snaps their fingers. You point to where you hear the snap coming from. When you open your eyes and check, you have an error of 2° at a distance of 10 meters. Assuming the diameter of your head is 15cm, and the speed of sound is 300m/s, calculate the differential time of arrival at the two ears. Assume everything is in the horizontal plane.

9) Blind spot: http://www2.nau.edu/lrm22/lessons/human_senses/images/blind_spot.gif is an image that you can print out to test your blind spot. Print this out at a reasonable scale, hold your left hand over your left eye while staring directly at the upper X with your right eye, and slowly move the page towards you until the black spot disappears (about a foot away from the page). You have found your blind spot. With both eyes open, why can't you find your blind spot? Now repeat this procedure while looking at the "X" in the lower panel. When the mouse disappears, what happens to the bars of the cage? How can you "see" something in what you know is your blind spot? Why do you see the bars but not the mouse?

Write a cogent paragraph or two explaining what you have observed. See if you can explain how you manage to navigate the world with this blind spot without periodically crashing into things or having things pop into view and surprise you. See if you can relate this back to a sensor issue.