ECE 320: Quiz #6 Name _____

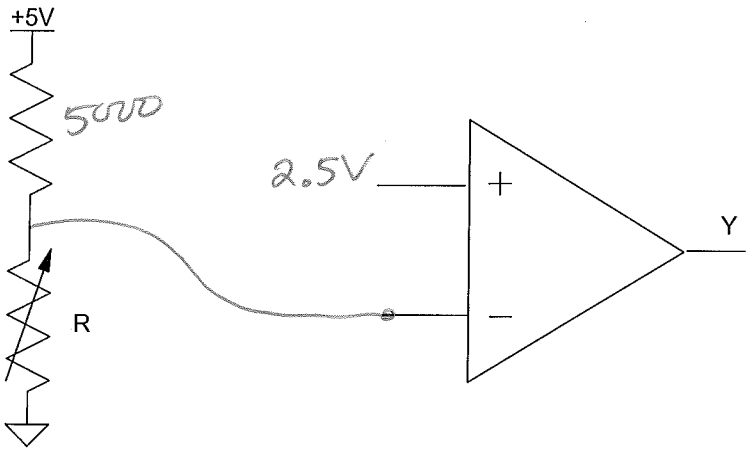
Comparitors, Schmitt Triggers - March 10, 2016

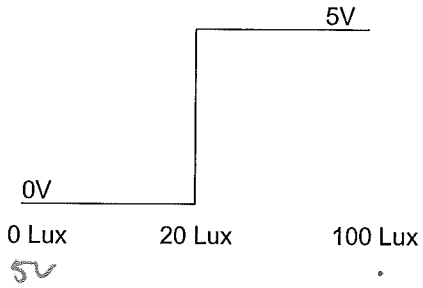
1) Assume a light sensor has the following resistance vs. light relationship:

$$R = \frac{100{,}000}{Lux}\ \Omega$$

Design a circuit so that the output is

- 0V when the light level is less than 20 Lux 5000 Ω
- 5V when the light level is more than 20 Lux



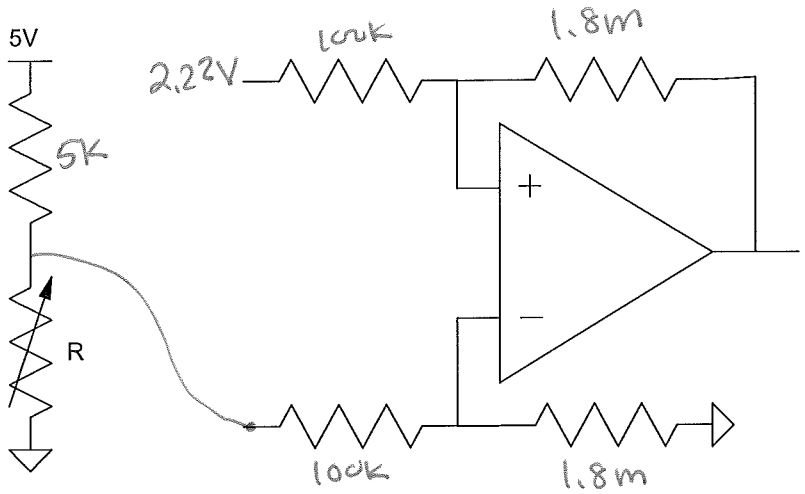


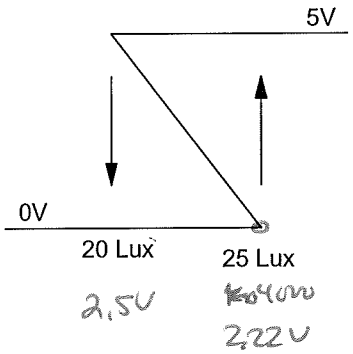
2) Assume a light sensor has the following resistance vs. light relationship:

$$R = \frac{100{,}000}{Lux}\ \Omega$$

Design a circuit so that the output is

- 0V when the light level is less than 20 Lux 5000
- 5V when the light level is more than 25 Lux 4000

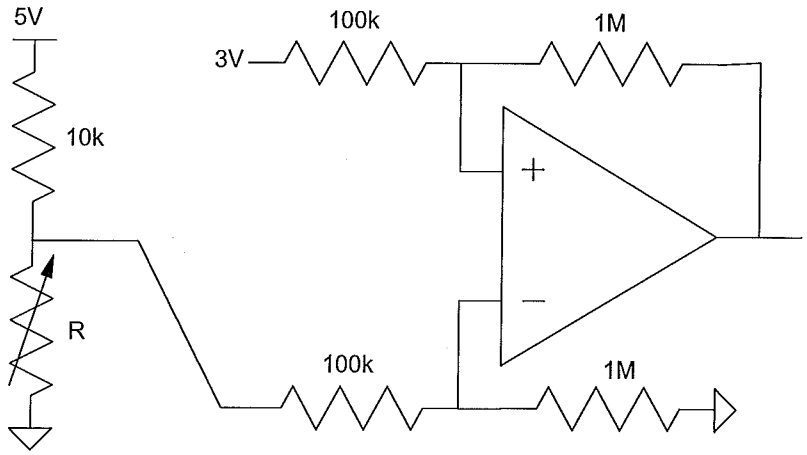


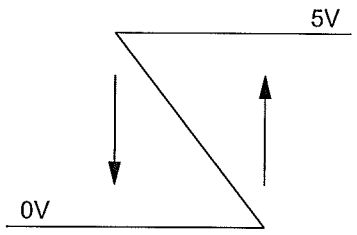


gain = 18

3) Determine light levels that the following circuit switches on and off

X (Volts)	X (Lux)	Y (Volts)	Y (Lux)
3.5V	4.28	3V	6.67



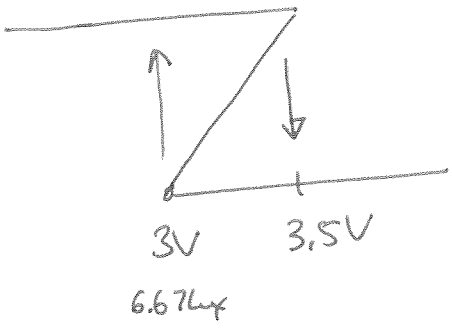


gain = 10

3V

$R = \left(\frac{3/5}{1-3/5}\right) \cdot 10k = 15k$

$Lux = \frac{100\,cm^2}{15k} = 6.67$



3.5V

$R = \left(\frac{3.5/5}{1-3.5/5}\right) \cdot 10k = \left(\frac{3.5}{5-3.5}\right) \cdot 10k = 23.33k$

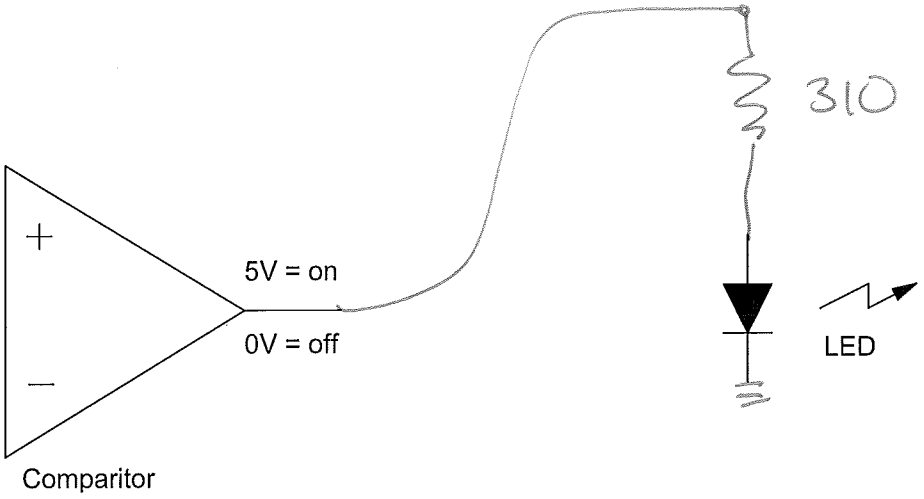
4.28 lux

4) Assume a comparitor output 0V or 5V, capable of 20mA. Design a circuit so that the comparitor can drive a red LED at

- 0mA when the output is 0V
- 10mA when the output is 5V

Assume the specifications for the LED are

- Vf = 1.9V @ 20mA
- 8000 mcd @ 20mA



$R = \frac{5 - 1.9}{10mA} = 310$

RD
3/a

$y = Cx + Du$

$u = -K_x \underset{1\times 1}{X_{3\times 1}}$

$C = -K_x$

$C = [1 \quad 0 \quad 0 \quad \cdots]$

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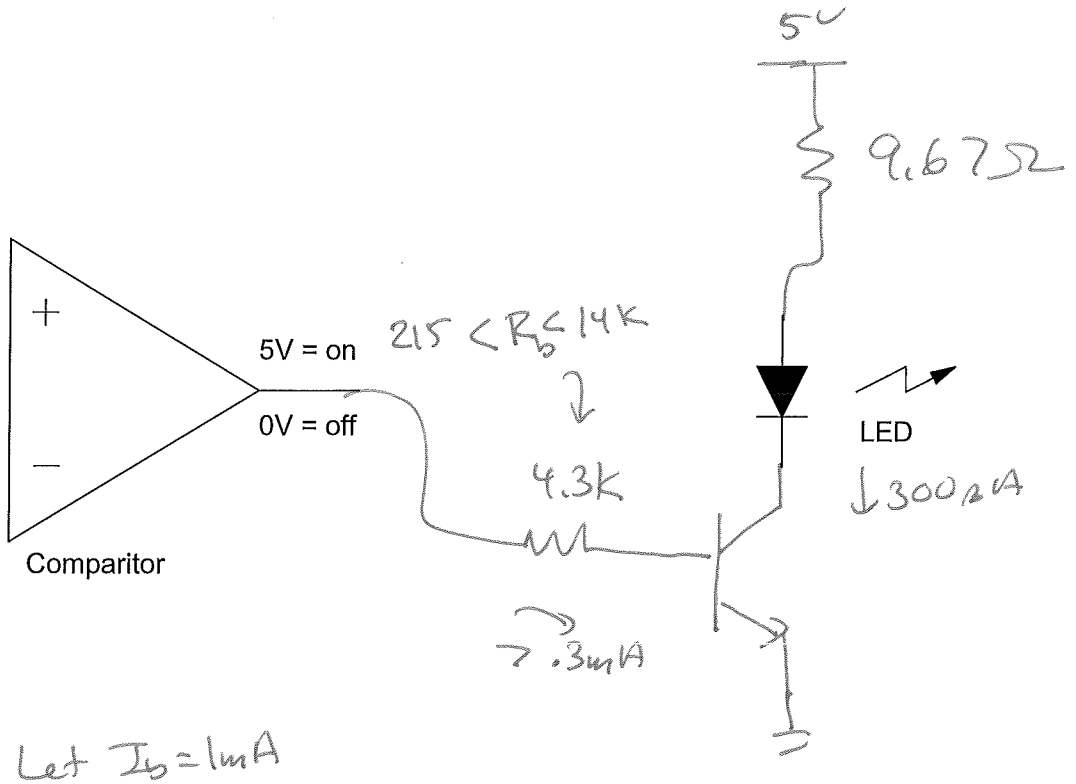
A) Assume a comparitor output 0V or 5V, capable of 20mA. Design a circuit so that the comparitor can drive a 1W red LED at

- 0mA when the output is 0V
- 300mA when the output is 5V

Assume the specifications for the LED are

- Vf = 1.9V @ 20mA
- 8000 mcd @ 20mA

Also assume a transistor (NPN or PNP, your choice) which has $\beta = 1000$



Let $I_b = 1mA$

$\frac{5 - .7}{I_b} = R_b$

$R_b = 4.3K$

$R_c = \frac{5 - 1.9 - .2}{300mA}$

$= 9.67\Omega$

Geothermal Energy Bonus! Germany wants to be carbon neutral by 2050. One way to get there is to require that all new houses include geothermal heaters, which reduce the energy consumption for heating and cooling by approximately 80%.

How much does adding geothermal heating increase the cost of a new home in Fargo?

$20K to $25K