ECE 320 - Homework #8

Comparitors and Schmitt Triggers, Term Project Part 1: Due Monday, March 7th

Assume a light sensor has the following resistance vs. light relationship

$$R \approx \frac{100{,}000}{Lux}$$

1) Design a circuit which outputs

- 5V when the light level is less than 10 Lux
- 0V when the light level is more than 10 Lux

Step 1: Determine the resistance at 10 Lux

$$R = 10k\Omega$$

Step 2: Convert resistance to a voltage with a voltage divider.

Assume a 10k resistor and a 5V source

$$V = \left(\frac{R}{R+10k}\right)5V = 2.5V$$

Step 3: Determine whether you connect to the + or - input.

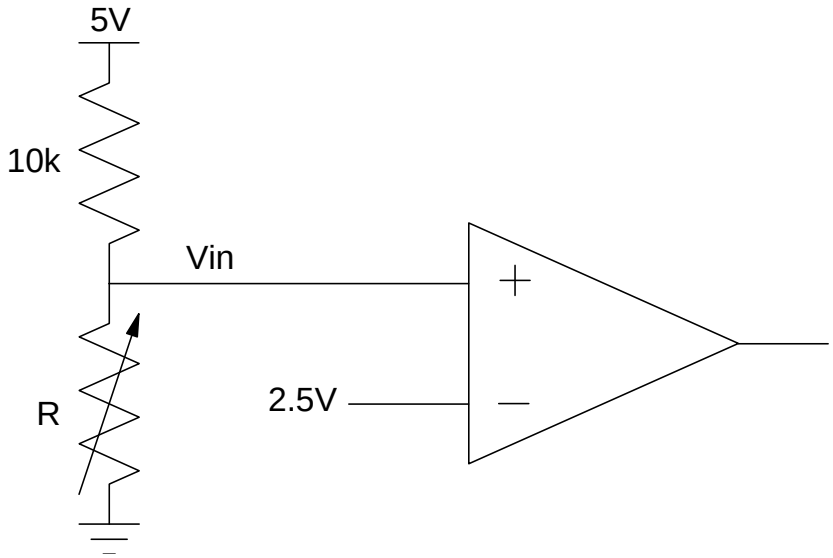
When it's really dark (0 Lux)

R = infinity

Vin = 5V

Vout = 5V

Connect to the + input



2) Design a circuit with hysteresis which outputs

- 5V when the light level exceeds 15 Lux
- 0V when the light level drops below 10 Lux, and

No change (remains 0V or 5V) for light levels between 10 and 15 Lux

Step 1: Calculate the restance at 10 Lux and 15 Lus

10 Lux: R = 10k

15 Lux: R = 6667

Step 2: Convert to a voltage. Assume a 10k resistor

10 Lux: Vin = 2.5V

15 Lux: Vin = 2.0V

Step 3: Choose the + or - inputs

When dark

R = infinity

Vin = 5V

Vout = 0V

Connect to the - input

Step 4: Compute the gain

$$gain = \frac{\text{change in output}}{\text{change in input}} = \frac{5V - 0V}{2.5V - 2.0V} = 25$$

Pick resistors with a 25:1 ratio (100k and 2.5M)

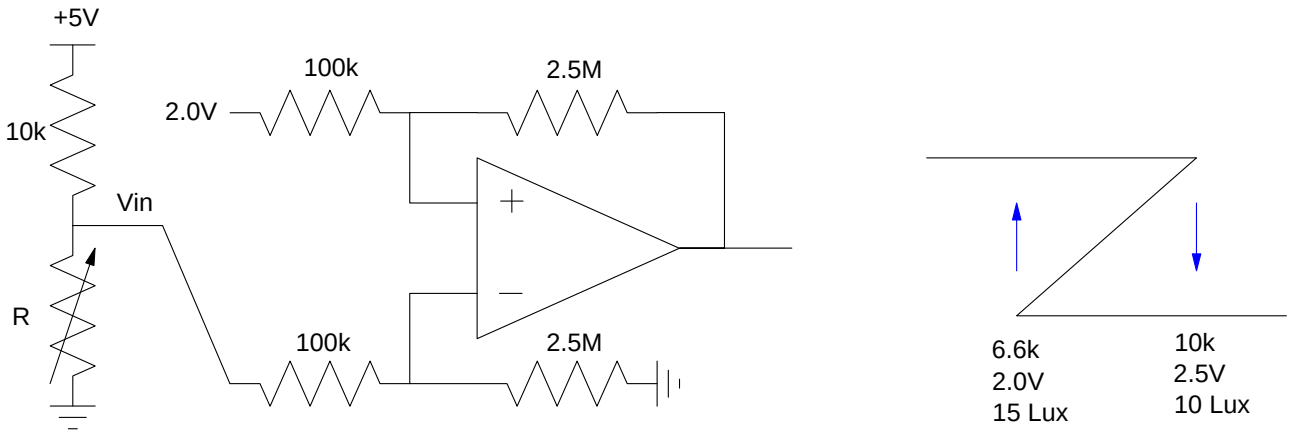
Step 5: Determine the offset

When the output is 0V (dark), you're on the verge of switching when

Light = 15 lus

V = 2.0V

The offset is 2.0V



Term Project (part 1)

Your term project must have two sections which include (total for the whole project) at least one diode, one transistor, and one op-amp.

3) Requirements: Specify the requirements for the first part of your term project

Inputs

Outputs

How they relate

4) Analysis: Show your calculations for your circuit design relating to meeting the requirements

5) Test: Check your analysis with a PartSim (or similar simulation)

6) Validation: Build your circuit in lab and collect data to verify you meet your requirements.