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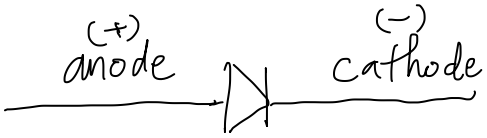
Week 3: LEDs, Phototransistors and Motor Control

It is *HIGHLY RECOMMENDED* that you read through this week's lab and familiarize yourself with all the material before attending the lab session—there is a lot of content in this week's lab and all these materials are closely related to the underlying control and sensing mechanism of your line-following robot project starting from the next lab!

Week 3 Prelab

1. Draw the circuit schematic symbol of a diode and label the anode and cathode.



2. When a diode is forward biased, the anode is at a (circle one) higher / lower voltage than the cathode.

3. When looking at the diode itself, what are the two methods for telling which side of an LED is the anode and which side is the cathode?

+ The longer leg is the anode, the shorter leg is cathode
+ The rounded area is the anode and the cathode is marked with a flat area

4. Fill in the blank: When a positive voltage relative to the emitter is applied to the base (p) of an NPN transistor, current is allowed to flow from the collector to the emitter

5. What is the unit of the RC time constant (in SI unit)? Why? Show your reasoning below: The RC time constant is the time it takes for $v_c(t)$ to complete 63.2% of its journey. In the other words, it is the time needed to charge a capacitor to 63.2% maximum charge. So the RC time constant $\tau = RC$ is expressed in seconds (time). Besides, we can prove by using equation. In charging capacitor in RC circuit, $v_c(t) = V_s(1 - e^{-t/RC}) = V_s(1 - e^{-t/\tau})$

$\Rightarrow e^{-t/\tau} = \left(1 - \frac{v_c(t)}{V_s}\right) \Rightarrow -\frac{t}{\tau} = \ln\left(1 - \frac{V_c(t)}{V_s}\right)$ Because $V_c(t)$ & V_s has the same unit in voltage $\Rightarrow$ t & τ have to have the same unit in time

Week 3 Prelab End