Physics 261
Homework # 9
Remember to show your work.

1. For questions a & b, select the appropriate answer(s) from among the four given possibilities. In the fish tank comparator example, which quality or qualities of the comparator makes it possible to...

   (a) Power the pump? High input impedance Low input impedance
   (b) Not electrocute the fish? High output impedance Low output impedance

   (c) The input resistor I used for the water sensor was 1 MΩ. If this value is chosen wisely, what other resistance should it be greater than? What other resistance should it be less than?

2. Consider the inverting Schmitt trigger (the same type as in lecture, and in Faissler figure 34-5). Given $V_L = 0$ V, $V_H = 3$ V, and $R_2 = 2$ kΩ, choose $V_b$ and $R_1$ so that the thresholds are at 1 V and 2 V.

3. The illustration below shows a non-inverting variant of the Schmitt trigger. Assume that the op amp is ideal.

   (a) Find $V_+$ in terms of $V_{in}$, $V_{out}$, and the resistors.
   (b) Assuming $V_+ > V_b$, find $V_{out}$ and the corresponding range of $V_{in}$ in terms of $V_H$, $V_L$, $V_b$, and the resistors.
   (c) Assuming $V_+ < V_b$, find $V_{out}$ and the corresponding range of $V_{in}$ in terms of $V_H$, $V_L$, $V_b$, and the resistors.
   (d) Sketch the relationship between $V_{out}$ and $V_{in}$, including arrows on the vertical parts of the hysteresis loop.