HARDWARE 6:
THREE-OUT-OF-FOUR

GENERAL RUBRIC

DEMO RUBRIC

You'll probably want to set aside some time for this one.

At this point in the semester, you are expected to be knowledgeable enough about the concepts involved in this lab to design the implementation largely by yourself. The lab instructions are fairly clear about the process for achieving this. Start with the state diagram, but **do NOT attempt to represent the sequence itself as the index of each state**. This lab can and should be done with just 3 registers for all 7 states (1 initial with no data, 3 stages of repeated zeros, 3 stages of repeated 1s).

The transition table should be based off of the state diagram and the Karnaugh-maps based on the transition table. Note that you will have to design four K-maps: one for each register and then the output. Fortunately, these are all four-variable maps (Q2Q1Q0A). Perform your computations very carefully to reduce backtracking.

The circuit should first be designed in LogicWorks, but we also HIGHLY recommend that you draw up your Protoboard layout on a piece of paper so that you remember what goes where, because the final product will be quite large. If you haven't already, try to strip a USB cable for at-home testing. A debouncer is **required** for this lab (to function as clock). You should probably show TAs your progress intermittently to make sure that you're on the right track.

Testing Procedure:

1. Serially input an arbitrary number of ones (at least 3), then zero. At this point, the sequence should have been detected and the output (B) LED should be on.
2. Continue by inputting a single zero. The light should turn off.
3. Input zero, then one. The light should turn on, as we just gave the circuit the second sequence.

REPORT RUBRIC

Scoring (out of 3 points):

- ✓ **[1 point]** Theory/ Questions:
  - [0.4] What's the difference between sequential logic and combinational logic?
  - [0.6] In this lab, the behavior of our D flip-flops is determined by the logic that we ultimately derive from the state diagram, but you have also dealt with (or learned about) counters and shift registers in other labs. For each of these paradigms, give an example of where they might be useful.

- ✓ **[1.6 points]** Deliverables:
  - ○ [0.4] Include a tidy state diagram. Label each state by its ID and also the sequence that it represents.
  - ○ [0.4] Include the transition table. This table should include all possible states, not just those that are used. If you have three registers (as you should), then you will have columns Q2, Q1, Q0, A (input), Q2+, Q1+, Q0+, and B (output).
  - ○ [0.8] Completed Karnaugh maps and reduced equations. Deductions will be made if these are not optimally reduced.

- ✓ **[0.4 points]** Discussion section. Should conform to standard lab report guidelines.