LABORATORY 9&10

PHYSICS 117, Winter 2017

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Game Time!

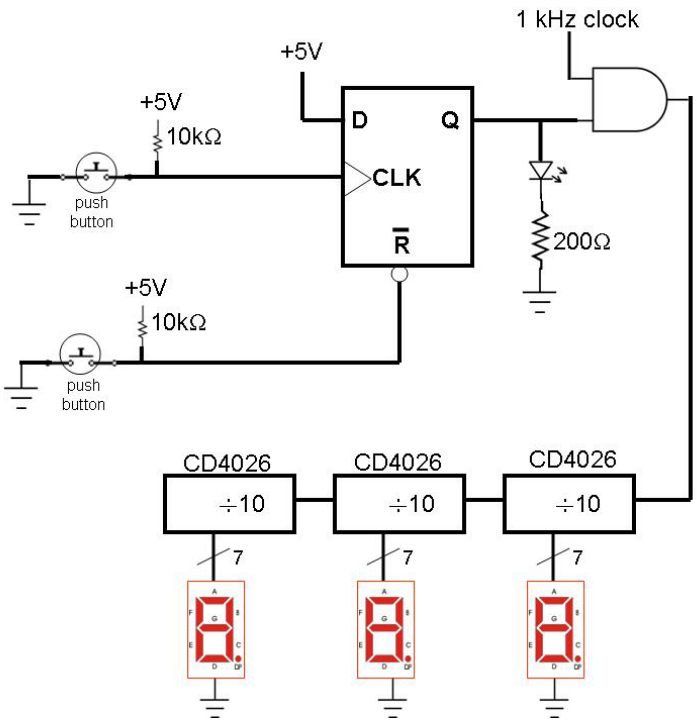
You are going to build a "reaction time" game. The game is that you hit a button that lights an LED, then your friend hits the second button as fast as possible. The display gives the result in milliseconds.

Week 1: You will build this on your usual (reusable) breadboard first. Your "lab report" is a 2-3 page summary of how this works: Make a full schematic *showing every pin number*. Keep a second printed copy for yourself: You will work from this for "week 2".

Week 2: When you have it all working, we can help you solder it to a solder-able breadboard and put it into a box you can keep. **VERY IMPORTANT** When you build with solder it is very hard to debug. So build it in stages, testing every step. Don't try to build it all at once and just turn it on, hoping for the best. For lab 10, instead of a writeup, send the prof. a video of your working game and photo of the board. I will put them on the web for everyone in the class to see.

Lab version

Build the circuit below using your external function generator as the 1kHz clock. This uses a flip-flop to start and stop the counters, which are displayed on the LED 7-segment displays. (Note the standard notation: / through a line with a 7 next to it means 7 wires in parallel.) Note that on the bottom the circuit goes from right-to-left which is usually frowned upon, but makes sense here because that is the order of the digits.



Note: You will also have to add a switch that will "reset" the counters between games. (There is a way to make it work with still only two pushbutton switches.)

*** NOW MAKE ONE TO TAKE HOME, USE THE FOLLOWING STEPS ***

Part 2: (Do this during week 9)

Replace the function generator with an "on board" 1kHz clock. You can build this out of the 555 timer in the lab. The "555 timer" is the most famous timer chip. Look up the datasheet on the web and make it count at 1 kHz and replace the external clock.

Part 3 (Do this during week 9)

Replace the 5V power supply with four 1.5V AA or AAA batteries. We have clips for the batteries. For your week-9 writeup: measure how much current your game draws and compare to the specs for the batteries.

Part 4:

Use a solder-based breadboard to wire it all up. We have been using "22 gauge" wire for our solderless breadboards. You will find it easier to use a smaller "24 gauge" or less, which we have in the lab.

Part 5:

Put connectors on a plastic project box for the pushbutton cables. Put your breadboard in the box and now you have your own game.

Part 6

Send prof. a link to a short video & photos of the board to establish credit for finishing and we'll share it with the rest of the class.