Physics 335, Spring Quarter 2013
The Common Project for the lab 21-24 May
A 2-Person Jeopardy Game

INTRODUCTION

Once you can communicate with and program a microcontroller, you are only limited by your time and imagination. Simple controllers like the PIC are limited by their spare instruction set, small program and data memory and restricted range of peripherals. However, even this small PIC controller is very useful. It is used, for example, for lighting controls, relay drivers, motor controllers, and consumer electronics.

This lab is meant to demonstrate some capabilities of the PIC processor and get you more used to PIC programming. In this lab, you'll assemble the hardware and develop a computer program that performs the following task:

A "COUNT-DOWN" 2-PERSON GAME

You have a job: You're the chief engineer for a game show. The host wants you to design and build a quiz reaction timer, loosely based on the game show Jeopardy, that works as follows.

The game has two players. Each player has a button and an LED. After the host resets the game, the two players' LEDs are off and a 9-second countdown shows on a 7-segment LED display. After the last count, there's a final 1-second delay. At the end of the final delay, the first player to push their button has their LED continuously lit, and the other player's LED remains unlit. You could also have something displayed on the 7-segment display to flag the winner. Obviously, a second player pushing their button after the first won't win and the lights won't change. Now, if a player pushes their button before the count is over, then that player's LED flashes to indicate a fault, and the other player's LED is solidly on—a win by default.

There are many ways to realize this game with our microcontroller hardware and software. You might want to use the following parts from your parts-bin to build this game.

- PIC microcontroller
- Resistors
- 7-segment LED display (no BDC-t0-7-segment decoder)
- LEDs
- Switches

Here is how your software could be organized:

- Arrange hardware and software for the game reset/start
- Have a counter in the PIC count down from 9
- Turn that counter value into LED segments.
- If there's a fault (cheat), indicate this on the LEDs.
- Otherwise, wait to see who's first and indicate this on the LEDs.

Once you have designed this common project, download the template for homework #6 and complete that assignment.

POTENTIALLY USEFUL TIDBITS

Be sure to initialize all registers, counters, variables, ports, etc. You'll need to convert the PIC binary counter to a LED segment display. Keep in mind that you can represent a segment as on or off by a binary 1 or 0. Hence the 7 LED segments can be represented by 7 binary ones or zeros. For example, if you want all segments lit or off, you send H'00' or H'FF' to the output port. The conversion of the counter value to the 7-segment output is a look-up table; you might therefore find the DT assembly directive and the RETLW instructions of use.

HOW THIS IS GRADED

Homework #6 is your proposal for this game. You need to submit and pass this homework assignment before you can proceed with this common lab. For the lab, you and your lab partner need to demonstrate operability of your common project to your TA. You'll likely need to consult data sheets for the processor and perhaps the

assembler as well. You are responsible for debugging your code, so code carefully and have a code-development plan.

You and your lab partner submit a common lab writeup; both your names are on the writeup. For your writeup, include the as-built circuit diagram and brief description of how your circuit and software works. Also include a printout of your assembly code. The TA will quickly look at this printout and see if it's a mess, or understandable on its own. The TA may grant an incentive of 10% for particularly tidy and readable code, or subtract 10% for particularly obscure and unreadable code. Full credit is given only to fully functional circuits.

Finally, you should have the circuit drawn and the software blocked out before you come into lab. Otherwise, you're unlikely to finish.

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