Name (Last, First) _____ Student ID number _____

UNIVERSITY OF CALIFORNIA

College of Engineering
Electrical Engineering and Computer Sciences Department

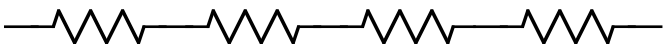
EECS 145M: Microcomputer Interfacing Laboratory

Spring Midterm #1 (Closed book- equation sheet provided- calculators OK)
Full credit can only be given if you show your work.
Wednesday, February 23, 2005

PROBLEM 1 (25 points)

You have a large batch A of resistors that are supposed to have the same resistance but due to variations in manufacturing, the individual resistor values vary. The resistor values have a Gaussian distribution with an average value R_A and standard deviation σ_A.

You create another large batch B of resistors by soldering resistors from batch A in groups of four in series:



1a (5 points) How are the resistance values of batch B distributed?

1b (5 points) What is the average value R_B of the resistors in batch B?

1c (10 points) What is the standard deviation σ_B of the resistor values in batch B?

1d (5 points) In terms of fractional uncertainty in resistance (standard deviation/average), which batch (A or B) is more accurate, and by how much?

Problem 2 (20 points)

A colleague (who has never taken 145M) has just designed a digital data acquisition system using a microcomputer, a digital input port with Edge-triggered flip-flop registers, and the following handshaking protocol:

1 When the program is ready for data, it sets "ready for input data" TRUE.

2 When the external circuit detects "ready for input data" TRUE, it pulses the clock input of the Edge-triggered flip-flops

3 The external circuit asserts data on the input of the Edge-triggered flip-flops and makes "input data available" TRUE

4 The program detects "input data available" TRUE and reads the output of the Edge-triggered flip-flops

5 The program sets "ready for input data" FALSE, processes the data, and then returns to step 1

Your colleague complains that his design does not work, and that the values read during step 4 have nothing to do with the digital input data asserted in step 3. After carefully examining his steps, you find that two serious errors were made. What are these errors, and how would you fix them?

PROBLEM 3 (25 points)
Based on what you learned in Laboratory Exercises 2 and 3, how would you use electronic components, a computer with a digital I/O port, and statistical analysis to determine whether racecar drivers or jet fighter pilots have the faster reaction time? List all the steps that you need to accomplish to make a valid determination.

PROBLEM 4 (25 points)
Design a system for controlling four furnaces

- Each furnace requires a 12-bit digital input to set its temperature.
- You use a computer with a 16-bit digital output port to provide the digital input to the four furnaces (furnace does not require handshaking)
- Your program writes new 12-bit data D1[i], D2[i], D3[i], and D4[i], i = 1 to N to the four furnaces once each minute for N minutes
- Your program can read a 1 kHz system clock
- Your program can read these data from a disk file

4a. (15 points) Draw a block diagram of your system, showing and labeling all essential components, connections, and signals. Use any digital components discussed in this course.

4b. (10 points) List the steps (hardware and software) to send the sequence of digital values to the four furnaces