NAME (please print) ____

STUDENT (SID) NUMBER ___________________________

UNIVERSITY OF CALIFORNIA, BERKELEY

College of Engineering
Electrical Engineering and Computer Sciences

EECS 145M: Microcomputer Interfacing Lab

LAB REPORTS:

1 ________	2 ________	3 ________
8 ________	9 ________	10 ________
21 ________	22 ________	23 ________
24a ________	24b ________	

Total of top 4 Long Lab Grades ____________ (400 max)

Total of top 4 Short Lab Grades ____________ (100 max)

Lab Participation ____________ (100 max)

Mid-Term #1 ____________ (100 max)

Mid-Term #2 ____________ (100 max)

Final Exam ____________ (200 max)

Total Course Grade ____________ (1000 max)

COURSE LETTER GRADE

Spring 2008 FINAL EXAM (May 16)

Answer the questions on the following pages completely, but as concisely as possible. The exam is to be taken ***closed book***. Use the reverse side of the exam sheets if you need more space. Calculators are OK.

Partial credit can only be given if you show your work.

FINAL EXAM GRADE :

1 __________ (50 max) 2 __________ (24 max) 3 __________ (40 max)

4 __________ (40 max) 5 __________ (40 max) 6 __________ (6 max)

TOTAL __________ (200 max)

Initials ____

PROBLEM 1 (total 50 points)

1.1 (10 points) List the essential handshaking steps for the reliable transfer of data from one circuit or computer to another.

1.2 (6 points) Briefly describe the operation of the sample and hold amplifier.

Initials ____

1.3 (6 points) Briefly describe the cause of glitches in the output of the D/A converter.

1.4 (8 points) Describe how you would determine whether the averages of two sets of measurements are statistically different (include formulas).

1.5 (10 points) Use the Fourier Frequency Convolution theorem to describe how a rectangular sampling window can produce spectral leakage in the Fourier transform of a waveform.

1.6 (10 points) Use the Fourier Frequency Convolution theorem to describe how sampling at a rate less than the twice the highest frequency in the waveform results in aliasing.

Initials ____

PROBLEM 2 (24 points)
In this course we studied several types of A/D converters:

TR Tracking
SA Successive Approximation
DS Dual Slope or Integrating
FL Flash
HF Half-flash
SD Sigma-delta

2.1 (4 points) Which produce their output in a continuous manner?

2.2 (4 points) Which require a "start conversion" command?

2.3 (4 points) For N-bit conversion, which perform the conversion in N steps or less?

2.4 (4 points) For N-bit conversion, which require many more than N steps?

2.5 (4 points) Which have an accuracy that does not depend on the accuracy of internal resistors or capacitors?

2.6 (4 points) Which require a sample-and-hold amplifier for full accuracy at their maximum conversion rate?

PROBLEM 3 (total 40 points)

Determine the frequency response [i.e. voltage gain A(f)] of an amplifier from f = 1 to 32,768 Hz in steps of 1 Hz, using the following components:

- A pseudo-random noise generator that produces an analog waveform that (i) repeats with a period of exactly 1 second, and (ii) contains frequency components from 1 Hz to 32,768 Hz
- the amplifier being tested
- a computer with an analog input port and software controlled sampling rate

3.1 (20 points) Sketch a block diagram of your circuit

3.2 (20 points) List the procedures that you need to determine the frequency response of the amplifier. Include the steps where you take Fourier transforms and derive an explicit formula for A(f).

PROBLEM 4 (total 40 points)

Design a digital filter that compensates for the limited frequency response of the amplifier in the previous problem, using the following components

- the amplifier being considered
- a computer with a analog input and analog output ports

4.1 (20 points) Sketch a block diagram of your circuit.

4.2 (20 points) List the procedures that you need to determine the compensating digital filter. Include the steps where you take Fourier transforms and derive an explicit formula for the digital filter.

Initials ____

PROBLEM 5 (total 40 points):

Design a system for automatically tuning a stringed musical instrument, such as a guitar or violin. Normally these instruments are tuned by plucking a string and turning a knob that adjusts the tension on the string until a note of the correct frequency is produced. The components you will use are:

- A microphone and amplifier to sense the acoustic waveform
- A microcomputer with analog input and output ports small enough to fit inside the instrument
- Motors connected to each tension adjustment knob
- A control circuit for each motor that responds to positive and negative analog voltages by increasing and decreasing the string tension
- A list of frequencies that each string should produce when it is in tune
- Battery power

Assume the following:

- There is a switch to select “tune” and “play” modes, but don’t worry about that
- The strings are plucked manually during the tuning operation
- Each note contains its fundamental frequency and higher harmonics

5.1 (20 points) Sketch a block diagram of your circuit.

5.2 (20 points) Describe how your system operates to tune a single string.

PROBLEM 6 (total 6 points):

Zigbee, Bluetooth, and Wi-Fi are the most commonly used technologies in wireless interfacing.

6.1 (2 points) Which has the lowest power consumption?

6.2 (2 points) Which has the highest baud rate?

6.3 (2 points) Which has the biggest network size (>60,000) and therefore is most suitable for wireless monitoring and control?