ME 120 **Midterm: Part 2** **October 2015**

Print your name: _____

Sign your name: _____

Complete both Questions 1 and 2

Computer Portion: Allowed materials include calculator and computer, Arduino, multimeter, pen or pencil, breadboard, passive components (resistors, LEDs, leads,…).

Please raise your hand after finishing each problem.

Note that problem 2 has the potential of 10 bonus points.

1. (20 points) Complete the following tasks using Excel or another spreadsheet on your laptop
   a. *x* is a variable that can take any integer value between -5 and 5. Enter all the values of *x* in a column labeled "*x*".
   b. In an adjacent column, labeled "*y*", compute *y*. This variable is a function of *x* and behaves as:

      $y(x) = 2x$ $\quad -5 \le x \le 0$

      $y(x) = (x+2)\cdot\log(x)$ $\quad 0 < x \le 5$

      Do not compute the values with a calculator to then enter them into cells in Excel.
   c. Make a plot of *y* versus *x*. The data points should be identified by symbols and *not* connected by lines or smooth curves.
   d. Add labels to the axes of the plot. "*x*" and "*y*" are acceptable labels.

INSTRUCTOR EVALUATION:

- ☐ y values are correct.
- ☐ y values are computed with appropriate formula.
- ☐ Plot is correct.
- ☐ Plot labels are correct.

2. (20 points + 10 bonus points) Build a breadboard circuit and write an Arduino program to complete the following tasks.

   a. Set up a potentiometer with one end at 5V and the other end at ground. Connect your multimeter so that it displays the voltage between the potentiometer wiper and ground.

   (6 points)

   - ☐ Correct components are used.
   - ☐ Circuit appears to be correct.
   - ☐ Voltage reading on the multimeter seems correct and changes when the potentiometer knob is rotated.

   b. *Keep the multimeter connected.* Connect the wiper pin to one of the analog input pins on your Arduino. Write a program to read the input pin and display the value continuously to the Serial Monitor. Convert the input reading to a voltage and display both the raw input reading and the voltage to the Serial Monitor.

   (7 points)

   - ☐ Correct components are used.
   - ☐ Program looks correct.
   - ☐ Raw readings printed to the Serial Monitor appear to be correct and change appropriately when the potentiometer knob is rotated.
   - ☐ Voltage conversion in the code appears to be correct.
   - ☐ Voltage on the Serial Monitor is equal to voltage on the multimeter.

   c. Add an LED circuit which can alter the brightness of the LED in response to a change in the potentiometer setting. The LED should get brighter when the output from the potentiometer increases and dimmer when the potentiometer output decreases.

   (7 points)

   - ☐ Correct components are used.
   - ☐ LED circuit appears to be correct.
   - ☐ LED brightness changes as potentiometer knob is rotated.

   d. *Make sure you save your program without the bonus question.* Replace the potentiometer with a photoresistor and modify your program from part c so that the brightness of the LED increases as the amount of light falling on the photoresistor decreases.

   (10 Bonus Points)

   - ☐ Added photoresistor circuit appears to be correct.
   - ☐ Brightness varies as a function of light on the photoresistor