EAS 199A: Homework 6 **Due 14 or 15 November 2011**

Use the Direct Format for all five problems. Problems 1 and 2 are to be completed by a team of two students. Problems 3, 4 and 5 are individual assignments and must be submitted individually.

The fan project is 10 percent of the course grade. Components of the fan project are worth a total of 60 points. There is potential of up to 20 bonus points. The point distribution for the fan project is as follows. The in-class demonstration and final documentation are due for Homework 6.

20 points	Solidworks drawing for the laser cutter
20 points	In-class demonstration of fan operation
20 points	Documentation/presentation of fan design and operation
20 points	Bonus point potential for creative fan design and/or strong technical implementation.

A design with strong technical implementation (for bonus points) would have minimal use of glue, duct tape or other ad hoc fastening measures. It would have easy-to-use controls, and a modest about of bling (e.g. LEDs). The best bling is tied to necessary function.

A grading rubric will be posted before class on November 14.

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1. In a team of two, complete the desktop fan. Bring the completed fan to class and be prepared to demonstrate it at the start of the class period. Give your fan a product name and include this name on the cover sheet of your report (see below).
2. Prepare a report up to five pages long on the design and control of your fan. The listing of Arduino code should not be included in the page count. The report should include
   - A cover page with the course number, due date, team name, and names of team members;
   - A one-page executive summary of the design and implementation that is written for a hypothetical commercial customer who asked you to design and build a prototype. Your customer's goal is to have an interesting toy to give to its favorite clients. The fan should be effective at making a breeze. It also should be memorable or entertaining so that the customer (the person giving away the fan) makes a positive impression on its clients.
   - A copy of the hand sketch (or sketches) submitted as part of Homework 5. It is acceptable to improve the drawing before re-submitting it as part of your final report. If necessary, shrink the drawing with a photocopier so that it is no larger than half a page. This sketch should have a figure number and a caption.
   - A photograph of your completed fan. If necessary, shrink the photograph so that it is no larger than half a page.
   - Diagrams of the electrical circuits used in your fan.
   - An appendix consisting of the listing of the Arduino code that runs the fan..
   - The primary design objective for choosing the shape of your structure.
   - The biggest challenge faced by your team.
   - The one thing you would change (if you had more time, money or both) to make your fan design better.
   - Advice would you give to a student who is about to start this project.

   Completion of the fan requires item (a) and (b) and may include items (c) and (d) for additional credit.
   a. Assemble the components so that the structure is free-standing. Using tape to attach the frame to a base (made of cardboard, say) is acceptable.

b. Use the Arduino to provide power to the fan, and to control the motion of the servo so that the direction of the air from the fan oscillates through at least 90 degrees.

Bonus points:

c. The speed of the fan is adjusted with a potentiometer on the breadboard.

d. The fan is turned on and off by pressing a button switch on the breadboard.

3. Water pressure readings are recorded as a function of depth by a diver, resulting in the following table of data.

Water Depth (m)	Pressure (Pa)
1.0	9780
2.5	23730
6.0	56010
8.0	82400

a. Determine the best fit line for pressure as a function of water depth manually using Excel. What are the slope and intercept?

b. At each depth shown in the table, compute the theoretical pressures as $P= \varrho \cdot g \cdot h$ where $\varrho=1000$ kg/m^3 and $g=9.81$ m/s^2.

c. Determine the coefficient of determination for the line in part (a) manually using Excel. A: 0.9937

d. Plot the data (markers only) and the fit (lines only) on the same graph.

e. Repeat parts (a) and (c) above using a trendline in Excel.

4. Study the slides for the pump machining activities. Complete the Milling Machine Safety Quiz on the last page. Turn in the completed quiz by the start of class on Monday, 15 November.

5. Complete the Solidworks on-line tutorial called "Lesson 1 — Parts". Print at least two screen shots of the parts made during the tutorial. One of the screenshots should be an intermediate stage in the tutorial.

Milling Machine Safety Quiz Name:

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View slides in the pump fabrication presentation and complete the "safety quiz" below. When you are sure you understand all of the information in the presentation, sign the bottom of the quiz. Do not include this quiz with your homework. Submit it in a separate stack at the next class period. Do not fold this quiz.

1. (T F) You should clean and inspect the machine before starting work and let your instructor know if you think something may be wrong with the equipment.
2. (T F) The crank handle on the right side of the machine (down low) moves the x-y table in the y-direction.
3. (T F) The lock-bolt for the x-direction slide should be turned upward to keep it from breaking.
4. (T F) DRO stands for Don't Run Outside (unless there is a fire).
5. (T F) You should hit the emergency stop if you suspect there may be a problem.
6. (T F) The speed control should be set to full blast all the time, especially when using the large Forstner bit.
7. (T F) I will never turn the machine on unless the shield is closed and is clear of the spindle and the x-y table.
8. (T F) When tightening the workpiece into the vise, I should get it as tight as possible, using all of my weight.
9. (T F) I am only allowed to use the equipment when I completely understand all of the safety rules and agree to carefully abide by them.
10. (T F) I will never attempt to touch anything on an operating milling machine except the crank handles, the off button, or the emergency stop button.

I promise to adhere by the guidelines presented in the Pump Fabrication presentation and act responsibly when using equipment that could be hazardous to others and me.

Signature: _____ Date: _____