MAS450 Spring 2003 Problem Set #1
Due: Lecture 4 at the end of class

MIT Students only: take the online safety tests required by MIT. More information can be found on the lab safety web page:
http://www.spl.harvard.edu/courses/mas450/lab-safety/safety-guide.html
You should finish this quiz, print your score sheet, and turn it in with either problem set #1 or #2.

1. (8pts) What characteristics of holograms make them potentially interesting in the following applications? Elaborate as needed.
    a. Microscopy/metrology
    b. Non-destructive testing
    c. Holographic optical elements
    d. Data storage

2. (5pts) What precautions should you take when working around the types of lasers we use in class? What laser class are they? What are the do's and don'ts? What are the potential threats or risks?

3. (5pts) You're exposing a hologram in the holography lab, and you hear the crashing sound of breaking glass coming from the darkroom? What should you do?

4. Try out the holography demo programs "sourcedemo" and "fringedemo":
   http://www.spl.harvard.edu/courses/mas450/holodemos/
   Now, answer the following questions:
    a. (2pts) Set up either program to display the e-field of two spherical sources. Animate the phases of both sources. Switch to intensity mode and observe. Now, repeat the process but animate the phase of only one source. What happens to the intensity fringes at the plate? What fundamental characteristic of holography can you observe from this experiment? Explain.
    b. (3pts) Set up either program to display intensity with both sources visible, and with the fringe pattern somewhat coarse (several fringes visible). Turn on phase animation of both sources. Position your mouse in the center of a dark area of the fringe. Without moving the mouse, press "e" to change to the electric field display. Where are you in the e-field? What happens over time? Go back to the intensity view (press "i"). Move the pointer to a bright fringe. Switch back the e-field. Write a brief summary of your observations.
    c. (2pts) Simulate the basic behavior of the Michelson interferometer that you'll create in lab using both demos. Print out the results.

5. (5 pts) Michelson interferometer: You have set up a Michelson interferometer as shown in Lab #1. Using a 10X objective, you project the fringe image onto a white surface half a meter away from the objective. You observe a pattern of vertical fringes where the distance between the centers of two adjacent dark fringes is 3cm. What is the spacing and orientation of the two point sources focused from the HeNe laser by the objective? State all assumptions/approximations you make.