Homework 3

Due in class on Tuesday, 17 March 2009.

Here are questions to work on and readings for Lecture 5 (March 17). The only item to bring in is your writeup for Problem 3, so that you can trade it with a colleague.

1. **Readings on course design**
   The website (mit.edu/5.95) has readings related to course design – the topic of the upcoming lecture:
   


c. Selection from Grant Wiggins and Jay McTighe (2005), *Understanding by Design*, ASCD.

   Skim them, then choose your favorite to read more carefully; feel free to choose more than one if you are inspired. Write a question about the reading for yourself (no need to turn it in).

2. **Practice with Bloom’s taxonomy**
   Where on Bloom’s taxonomy would you categorize the following problems? There is no one right answer, but making the categorizations will give you practice using Bloom’s taxonomy.
   
a. *[for an intro calculus course]* Construct a function \( f(x) \) with all of these characteristics: \( f(0) = 0; f(x) \approx |x| \text{ as } |x| \to \infty; \) and \( f(x) \approx x^2 \text{ as } |x| \to 0. \) Sketch \( f(x) \) by hand (e.g. without using a graphing calculator).

b. *[for an introductory calculus course]* Sketch \( f(x) = \ln \cosh x \) by hand (e.g. without using a graphing calculator).

c. *[for an introductory calculus course]* Graph \( f(x) = \ln \cosh x \) using a graphing calculator.

d. *[for a comprehensive exam at the end of a physics undergraduate degree]* In the special-relativity course, you learnt that the speed of light is always \( c \) in any reference frame, no matter what. In the electrodynamics course, you learnt that the speed of light in matter is \( v = c/n \), where \( n \) is the index of refraction. Can these two statements be reconciled?

e. *[for a freshman-physics course in the hydrostatics unit]* A solid iron sphere is floating in a bath of mercury. You pour water over the sphere and cover it with water. Does the sphere rise, sink, or stay at the same height?
3. Redesigning problems
   
a. For a course that you are likely to teach or would like to teach, choose a problem from the usual repertoire for that course, and write out the problem. It could be an exam or a homework problem or a problem that you might ask during class.

   Then write out a modified version or related problem that is lower in Bloom’s taxonomy, and a modified version or related problem that is higher in Bloom’s taxonomy.

b. Make up a new problem for this course, at whatever level of Bloom’s taxonomy you like.

c. Choose one of the proposed problems in Problem 2 and make lower- and higher-level versions of it.

Write up your new problems and bring them to class with you on Tuesday in order to trade with a colleague.

You can see examples of my problems at mit.edu/6.055 (including at the OCW and Spring 2008 links) and mit.edu/18.098.