

5.95 (Spring 2009)

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:

- 'The Eric experiment' from Sheila Tobias (1990), *They're Not Dumb, They're Different: Stalking the Second Tier*, Research Corporation, Tucson, Arizona.
- R. David Middlebrook, 'Methods of design-oriented analysis: Low-entropy expressions', *New Approaches to Undergraduate Education IV*, Santa Barbara, 26–31 July 1992.
- 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.

- [for an intro calculus course] Construct a function $f(x)$ with all of these characteristics: $f(0) = 0$; $f(x) \approx |x|$ as $|x| \rightarrow \infty$; and $f(x) \approx x^2$ as $|x| \rightarrow 0$. Sketch $f(x)$ by hand (e.g. without using a graphing calculator).
- [for an introductory calculus course] Sketch $f(x) = \ln \cosh x$ by hand (e.g. without using a graphing calculator).
- [for an introductory calculus course] Graph $f(x) = \ln \cosh x$ using a graphing calculator.
- [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?
- [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.