

COURSE NAME, NUMBER Advanced DM/FP Seminar, CS 394
SEMESTER, YEAR Spring 2008
INSTRUCTOR T. VanDrunen
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OFFICE HOURS MTuWF 3:10-4:10 pm; Th 8:30-11:30 am.
COURSE WEBSITE <http://cs1ab.wheaton.edu/~tvandrun/cs394>

RESOURCES There is no textbook for this course. However, if you own a copy of my *Discrete Mathematics and Functional Programming*, you should have it handy; it is also available electronically (both the 2006 and 2007 versions) from the course website. I also will be giving handouts throughout the semester.

COURSE DESCRIPTION
 A study of topics in computing and mathematics from a functional-programming and set-theoretical approach. Pipe and filter algorithms, memoization, and circuit simulation. Graphs, trees, and their implementations and applications. Lattices and boolean algebras. Groups and semigroups, cryptography. Complexity classes, automata, non-determinism, and NP-completeness.

INFORMAL COURSE DESCRIPTION

This course is supposed to be fun, for both the students and the instructor. It's not part of anyone's program of study, it doesn't fulfill any requirements, and we're not constrained by any catalog description. I will try very hard to keep the workload to something reasonable for a two-hour pure elective; feel free to let me know if I'm not doing that.

That said, the topics we will be looking at are "advanced." *Advanced* doesn't necessarily mean "hard," but usually it turns out that way. This course will require your attention, and the hope is that it will expand your brain in some new ways.

This course is mainly about topics that didn't make the cut in 243—either because they are too advanced or specialized, or because they're too difficult for the wider audience of 243, or simply because there isn't enough time. There are three categories:

1. Programming techniques in the functional paradigm. Most of these things come straight out of a book called *Structure and Interpretation of Computer Programs* by Harold Abelson and Gerald Sussman. That book is all in Scheme, and mainly I've just translated certain things into ML.
2. Mathematical ideas that CS majors should see, but usually don't. These all build on set theory, which is the major mathematical topic of 243.
3. Computing ideas that math majors usually don't see, but would enjoy if they did. We'll come at these from a set-theoretical and functional-programming approach, too.

Nearly all of you already will have seen some topics in this course, but those will be different topics for different students. Be prepared to be called on more when we are covering a topic in which you have experience.

GOALS AND OBJECTIVES

1. Students will enjoy and appreciate the use of functional programming to solve computational and mathematical problems.
2. Students will be able to articulate the properties of various mathematical structures (in particular graphs, trees, lattices, and groups), prove theorems about them, and implement data structure related to them.

ASSESSMENT PROCEDURES

1. Weekly homework will exercise students' abilities to prove mathematical propositions and to write short programs in the functional paradigm.
2. The midterm and final exam will evaluate students' mastery of the comprehensive material.

Grading:

	<i>weight</i>
Homework	1/3
Midterm exam	1/3
Final exam	1/3

SPECIAL EXPECTATIONS

Academic Integrity

Collaboration is permitted on all homework. Students should judge for themselves that they are getting the full benefit out of the homework. Any outside source (either published or found on the internet) must be cited; any plagiarism will result in zero credit on the entire assignment plus an additional 10% penalty against your homework grade for the course.

Special needs

Whenever possible, classroom activities and testing procedures will be adjusted to respond to requests for accommodation by students with disabilities who have documented their situation with the registrar and who have arranged to have the documentation forwarded to the course instructor. Computer Science students who need special adjustments made to computer hardware or software in order to facilitate their participation must also document their needs with the registrar in advance before any accommodation will be attempted.

Attendance

As this course meets once a week, missing one class meeting means missing an entire week. Therefore there is all the more important that class should be skipped only in extreme circumstances. If you must miss a class, it is courteous to tell the instructor.

Class meetings

A typical class meeting will consist of three parts: An opening presentation of the material; a time to work individually or in groups on a problem related to the material; discussion of the problem and further exploration of the topic.

Homework

At the end of each class meeting, I will give a homework assignment based on the material. The assignment will generally involve writing a few proofs and/or a few small programs. *All problem sets assigned on Tuesday are due on Friday of the same week.* This is so that I can grade and get them back to you by the next class meeting.

Preparing for class

I intend that every Thursday or Friday I will post on the course website a handout for the next class period. It is your responsibility to print it out, at least to skim all of it, if any section is marked "Read this before class" to read that section carefully and to think about it before class, and to bring the handout with you to class.

Schedule. See the course website. This is subject to change. I will entertain requests to modify the selection of topics and/or the length of time spent on them.

Midterm exam. The midterm will be take-home, and you will be given one week to complete it. It will overlap with at least one homework assignment. During class on Jan 22, I will ask the class to pick when the midterm will be given. The midterm will be "open book" in the sense that you may use class handouts, your own notes, your homework, and the 243 course manual. You may not use any other resource, and you must work on it alone. Any violation of this will result in a zero on the midterm.

Final exam. The final will be held during our official final exam block, which is Wednesday, May 7, 10:30 am. *Note that this is the same block as classes that meet at 1:15 on Thursdays.* If you have a conflict, make sure you make arrangements with me or your other instructor to reschedule. I do not allow students to reschedule examinations because of travel, so make your plans accordingly. The final will be "not explicitly" cumulative.