

Math 29 Spring 2009 Syllabus

Computability Theory

Instructor: Rebecca Weber

Office: 317 Kemeny Hall, 646-1720 (better to e-mail)

Office Hours: Thursdays 1–3 and by appointment

Webpage: www.math.dartmouth.edu/~m29w09

Course Meets: 11 hour, 11:15-12:20 MWF, Haldeman 028

X-hour: Tuesday, 12:00-12:50 (I do not expect to use this)

Textbook: *Computability Theory*, Rebecca Weber (Copy Center)

General Information

Computability theory is considered a branch of mathematical logic, and could be considered an abstractification of theoretical computer science. It is a young field, stemming from work in the 1930s by Gödel, Turing, Church, Post, Kleene, and others, and is concerned with the nature of algorithms and those sets which can and cannot be computed by algorithms.

The goal of this class is to give you a sense of not just the content but the viewpoint of computability theory. We will see the basic concepts but not dwell too much on technicalities, and with luck we'll have time at the end of term to meet some current active research areas.

Class format will be lecture with some discussion. There will be no exams; the small amount of information I'd like to see you memorize will be covered in quizzes. Instead, homework will be a significant portion of your grade and include problems on the level of open-book exams. Finally, a term paper will allow each of you to explore a topic of particular interest in somewhat more depth. More details follow.

Quizzes

Once a week we will have a short (15 minute) quiz in class. Quizzes will make up 25% of your grade; I will use them to test basic concepts and vocabulary.

Homework

The bulk of your course grade (50%) will be based on homework. Homework problems will range from “computational” (determining the elements of a particular set, working out details of an example) to conceptual, including some short proofs.

Homework will be assigned roughly daily and due weekly. Please put your name and the due date on each page of your write-up and number the pages. Identify each problem by section and number, and please state the problem before giving your solution (you may abridge or condense when appropriate). Write legibly or type (I am happy to help if you wish to do write-ups in LaTeX, what this syllabus is written in; if you are considering graduate school this is an especially useful bit of knowledge) and leave plenty of room for comments.

Grading (per problem or part) will be on a scale of 0 to 5, as follows:

- 5: The problem and the solution are explained thoroughly, clearly, and completely. It is easy to read and understand, is correct, and contains nothing extraneous. It shows a deep understanding of the problem, includes all necessary details, and addresses any subtleties. Scores of 5 will be assigned very selectively.
- 4: The solution is correct and written up clearly and completely, with at most minor omissions, tangents, or errors.
- 3: Either the solution is correct but unclearly written, or it is clear but only partially correct, with some significant error.
- 2: The solution is only partially correct, with some significant error, and the explanation is also unclear, incomplete, or includes nonsense, irrelevancies, or egregiously misused terminology or notation. A 2 may also be given for a good explanation of a completely incorrect solution, or a strong attempt at a solution which did not get anywhere.
- 1: It is apparent some reasonable attempt was made to solve the problem.
- 0: No attempt was made or what is written is so incoherent that it fails to communicate the fact that an attempt was made.

You may interpret the numbers roughly as letter grades, where 4 is an A, 3 a B, etc.

Term Paper

The remainder of your grade (25%) will come from a term paper. The goal of this is to have you explore in more depth some aspect of computability theory that matches your particular interests. Mathematical exposition will be a part of every term paper, but the point of the paper may vary. For example:

- all math: pure computability theory
- all math: computability-theoretic results about another area of math
- math/CS: mathematical theory behind a programming language
- math/CS: result of putting CS-inspired restrictions on computability
- math/history: a computability result and its historical context
- math/philosophy: a computability result and its philosophical ramifications

More specific topic suggestions will be made available later in the class, and you are encouraged to do some reading and come up with your own.

The term paper will have three drafts. Draft one can be quite rough, with lines like [find additional example of ...]. However, it should be clear that you know what gaps are left to be filled in and have the outline of a complete term paper in mind. Draft two should be near-final; say, something you would turn in as a final draft were you pressed for time. It may lack polish but should have no content gaps and should, in particular, include a complete bibliography. Drafts one and two will be commented on and returned to you the class period after they are due, and are worth 5% each. Draft three is actually the final draft, worth the remaining 15%. Example first and third drafts of a purely mathematical and a math/history paper will be provided.

There is no firm upper or lower page limit, but papers should be in the vicinity of 8 pages. Due dates for the three drafts are below.

Important Dates

March 30	Monday	First day of class
May 15	Friday	First draft of term paper due
May 25	Monday	Memorial Day: no class
May 29	Friday	Second draft of term paper due
June 1	Monday	Last day of class
June 8	Monday	Final draft of term paper due by 8:00 AM

Disabilities

I encourage any students with disabilities, including “invisible” disabilities such as chronic diseases and learning disabilities, to discuss appropriate accommodations with me, which might help you with this class, either after class or during office hours. Dartmouth College has an active program to help students with disabilities, and I am happy to do whatever I can to help out, as appropriate.

The Student Disabilities Coordinator, Nancy Pompian, can be reached at 6-2014 if you have any questions. Any student with a documented disability requiring academic adjustments or accommodations is requested to speak with me by the end of the second week of the term. All discussions will remain confidential, although the Academic Skills Center may be consulted to verify the documentation of the disability and advise on an appropriate response to the need. It is important, however, that you talk to me soon, so that I can make whatever arrangements might be needed in a timely fashion.

The Honor Principle

How the Honor Code applies to quizzes should be clear: keep your eyes on your own paper, and don't use crib sheets.

You may discuss your homework assignments with each other, and in fact are encouraged to do so. However, if you work out a homework problem with someone else, you must each write up your own solution to hand in, and state on your assignment with whom you've collaborated. If you use outside sources for a homework assignment they should also be cited. It is a breach of the Honor Code to read another student's solutions in order to write your own.

For the term paper, you must cite all sources and the writing must be your own. It can be difficult in mathematics to find a different way to set out a proof than you have found in a published source; try to put it into your own words as much as possible, and use citations, noting “the proof of this theorem is organized as in (source).”

If you have any questions as to whether some action would be acceptable under the Academic Honor Code, please speak to me and I will be glad to help clarify things. It is always easier to ask beforehand than to have trouble later!