CS353 - Theory of Computation (Spring 2011)

Logistics:
TTh 2:00-3:30, ENS 31NM
Unique Number: 53495
Course web page: http://www.cs.utexas.edu/~diz/353

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Office Hours: TTh 3:30-4:00, or by appointment.

Who should take this? Students interested in the science of computation, students who liked CS 341 or CS 341H, and students who like mathematics should like this class. This course is excellent preparation for graduate school.

Text: Michael Sipser, *Introduction to the Theory of Computation*

Course Overview: This undergraduate course develops a theoretical framework to understand computation. It is essentially a continuation of CS 341, but is more in depth and focuses on more modern topics. Perhaps the most important concept in the class is that there are limits to computation. Some languages are uncomputable; others are "complete" for certain hard classes, such as NP. Sometimes these limitations prove useful, as in the case of cryptography. We will also explore tradeoffs and relationships between different computational resources, such as time and space.

Prerequisite: CS 341 or 341H with a grade of at least C. Often the prerequisite is waived for strong students, such as those who got an A in CS 336H or 357, who are willing to do some extra reading. Please discuss this with me first.

Grading:
75%: 3 Exams
15%: Homework
10%: Participation

Exams: The three exams will be held in class on the following dates: Exam 1 on Thursday, February 17; Exam 2 on Thursday, March 24; and Exam 3 on Thursday, May 5. No make-up exams will be given, so plan accordingly. You may bring a single, 8.5x11 inch, handwritten sheet of paper (you may use both sides). No calculators are allowed (they won't be necessary).

Laptops/Phones: The use of laptops and mobile devices is prohibited. All phones must be silenced.

Class Schedule:

Date	Topic
Jan 18	Introduction. Turing Machines and Variants.
Jan 20	Decidable Languages.
Jan 25	Countability, Diagonalization, and Undecidability.
Jan 27	Reductions.
Feb 1	Mapping Reducibility: Properties and Consequences.
Feb 3	Introduction to Time Complexity.
Feb 8	The Class P.
Feb 10	The Class NP.
Feb 15	Review.
Feb 17	Exam 1.
Feb 22	Polynomial-Time Reductions and NP-Completeness.
Feb 24	Cook-Levin Theorem.
Mar 1	Basic NP-Complete Problems.
Mar 3	More NP-Complete Problems.
Mar 8	Coping with NP-Completeness. Introduction to Space Complexity.
Mar 10	Nondeterministic Space.
Mar 22	Review.
Mar 24	Exam 2.
Mar 29	Savitch's Theorem and PSPACE-Completeness.
Mar 31	PSPACE-Complete Problems.
Apr 5	NL = coNL.
Apr 7	Hierarchy Theorems.
Apr 12	Circuit Complexity.
Apr 14	Parallel Computation.
Apr 19	Approximation.
Apr 21	Randomized Computation.
Apr 26	Cryptography and One-Way Functions.
Apr 28	Public-Key Cryptography.
May 3	Review.
May 5	Exam 3.

Homework: There will be about ten short problem sets throughout the semester.

Collaboration policy: While you should first think about the problems on your own, you are encouraged to discuss the problems with your classmates. Moreover, you must write up your own solutions. In particular, nobody should email partial or full solutions to anybody. Finally, you must acknowledge any collaboration by writing your collaborators' names on the front page of the assignment.

Citation policy: Try to solve the problems without reading any published literature or websites, besides the class text and links off of the class web page. If, however, you do use a solution or part of a solution that you found in the literature or on the web, you must cite it. Furthermore, you must write up the solution in your own words.

Submission policy: Homeworks are due at the beginning of class.

Late policy: Late homeworks will not be accepted.

Grading policy: Because this class has no TA, I do not expect to grade all homework problems. Rather, I will grade at least one problem from every problem set.

Participation and Attendance: I do not take attendance nor require it. However, poor attendance will be reflected in your participation grade.

Students with Disabilites: Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Services for Students with Disabilities area of the Office of the Dean of Students at 471-6259 (voice) or 471-4641 (TTY for users who are deaf or hard of hearing) as soon as possible to request an official letter outlining authorized accommodations.