CS 353 Theory of Computation
FALL 2012

Time: TTh 11:00 - 12:30. **Place:** BUR 134 **Unique Number:** 53033

Professor: Anna Gál
e-mail: `panni@cs`, office: ACES 3.434, phone: 471-9539,
Office hours: TTh 2pm - 3pm or by appointment.
(Except September 6, October 16, 18 and 23.)

Teaching Assistant: Eshan Chattopadhyay e-mail: `eshanc@cs`
TA Office hours: MW 12 noon - 1 pm, Painter Hall 5.33, Desk 1

Prerequisites: CS 341 or 341H with a grade of at least C. The prerequisite is possibly 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.

Course description: This course provides a general, undergraduate level introduction to the theory of computation.

Theory of computation includes topics related to understanding what can and cannot be computed, how quickly, with how much memory, and on what type of computational models. Topics covered in the course include Turing machines and computability, undecidability and reducibility among languages. We will also cover topics of computational complexity: understanding the time and space complexity of natural computational tasks. We will cover the most important complexity classes, like P and NP, NP completeness, and the famous P vs. NP problem. There will be several other famous open problems mentioned during the course.

This course is excellent preparation for students interested in continuing to graduate school.

Textbook: We will use the book "Introduction to the theory of computation" by Michael Sipser.

Homework: There will be regular homework. The assignments will be paper/pencil exercises.

Exams: There will be a midterm exam on **Tuesday, October 16**, 11-12:30 in class. The final exam will be on **Wednesday December 12, 7pm-10pm** according to the registrar's schedule. No make-up exams will be given.

Grading: Homework: 50%, Midterm: 20% Final exam: 30%.

Course Schedule:

Aug 30	introduction, models of computation	
Sep 4	Turing machines, decidable languages	
Sep 6	running time, Turing machines basics	HW1 out
Sep 11	Hilbert's 10th problem, Church-Turing thesis	
Sep 13	diagonalization, undecidability	HW1 due
Sep 18	reducibility, mapping reductions	HW2 out
Sep 20	more undecidable languages	
Sep 25	time complexity	HW2 due
Sep 27	complexity classes, the class P	HW3 out
Oct 2	nondeterminism, the class NP	
Oct 4	polynomial time reductions, NP-completeness	HW3 due
Oct 9	basic NP-complete problems	
Oct 11	review	
Oct 16	MIDTERM EXAM	
Oct 18	more on NP-completeness and reductions	
Oct 23	hierarchy theorems	
Oct 25	Cook-Levin theorem	
Oct 30	space complexity	HW4 out
Nov 1	L and NL	
Nov 6	Savitch's theorem	HW4 due
Nov 8	PSPACE	
Nov 13	beyond NP	HW5 out
Nov 15	NL equals coNL	
Nov 20	circuit complexity	HW5 due
Nov 27	parallel computation, the class NC	
Nov 29	randomized computation	
Dec 4	advanced topics	
Dec 6	review	
Dec 12	Final Exam (7pm - 10pm)	