CS 353 Theory of Computation
FALL 2015

Time: TTh 11:00 - 12:30. **Place:** GDC 2.410 **Unique Number:** 50835

Professor: Anna Gál
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Office hours: TTh 3-4 pm or by appointment.
(Except November 3 and November 5)

Teaching Assistant: Siddhesh Chaubal e-mail: `siddhesh@cs`
TA Office hours: Monday 3-4, Wednesday 11-12, desk 1, in GDC 1.302.

Prerequisites: The following coursework with a grade of at least C-: Computer Science 429 (or 310) or 429H (or 310H); and Computer Science 331 (or 357), 331H (or 357H), 341, or 341H.

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 computtaional problems. 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 three written tests during the course on October 1, November 5 and December 3 in class.

Grading: Homework: 40%, Test 1: 20% Test 2: 20% Test 3: 20%.

Course Schedule:

Aug 27	introduction, models of computation	
Sep 1	Turing machines, decidable languages	
Sep 3	running time, Turing machines basics	HW1 out
Sep 8	Hilbert's 10th problem, Church-Turing thesis	
Sep 10	diagonalization, undecidability	HW1 due
Sep 15	reducibility, mapping reductions	HW2 out
Sep 17	time complexity	
Sep 22	complexity classes, the class P	HW2 due
Sep 24	examples of problems in P	
Sep 29	review	
Oct 1	test 1	
Oct 6	nondeterminism, the class NP	
Oct 8	polynomial time reductions, NP-completeness	HW3 out
Oct 13	basic NP-complete problems	
Oct 15	Boolean circuits	HW3 due
Oct 20	examples of problems with small circuits	HW4 out
Oct 22	Cook-Levin theorem	
Oct 27	P vs. NP	HW4 due
Oct 29	beyond NP	
Nov 3	review	
Nov 5	test 2	
Nov 10	space complexity	
Nov 12	Savitch's theorem	HW5 out
Nov 17	L and NL	
Nov 19	parallel computation, the class NC	HW5 due
Nov 24	time vs. space	
Dec 1	review	
Dec 3	test 3	