

CS 584: Theory of Computation/Complexity Theory

Purdue University, Spring 2014

1 Basic info

Instructor: Elena Grigorescu, elena-g@purdue.edu.

Time/location: Tu/Th 9-10:15 am, LWSN B134.

Website: <http://www.cs.purdue.edu/homes/egrigore/584ST14/>

Text: *Introduction to the Theory of Computation* by Michael Sipser, 3rd edition, Cengage Learning.

Office hours: by appointment.

2 Description

This is an introductory graduate level course on the theory of computation. We will focus on the fundamental mathematical model of a Turing Machine, discuss its powers and limitations, discuss computational resources that a TM might use (time, space, randomness) and the complexity classes associated with them (P, NP, PSPACE, BPP, RP, etc). In the latter part of the course we'll cover more advanced topics, possibly including Interactive Proofs (IP, PCP).

Prerequisites: Mathematical maturity: familiarity with proofs, discrete math and algorithms.

3 Tentative schedule

Computability (2-3 weeks)

Complexity (remaining time): P; NP; Cook-Levin's Theorem; Space complexity; L, NL, NL=coNL, PSPACE (and games); Hierarchy theorems; Probabilistic computation: BPP, RP, coRP; Kolmogorov complexity, Advanced topics (Interactive Proofs (IP), Probabilistically Checkable Proofs (PCP), Zero Knowledge Proofs (ZKP))

4 Homework instructions

The homeworks are due *before class* on the due date, in hard copy. Extensions to homeworks will be granted only in exceptional circumstances and only if announced 24 hours in advance.

Write each problem on *a separate sheet* of paper. Try to be as concise as possible in presenting your solution.

If you do not know the solution to a problem you'll receive 15% of the grade if you write "I do not know how to solve this problem" on the solution sheet and nothing else. Otherwise, your solution will be graded according to its content.

There will be an extra optional problem on the homeworks. Optional problems will not be used in computing your final score. They might however be taken into account in assigning grades for borderline cases. The 15% option does not apply to optional problems.

Collaboration policy You may discuss the problem sets with other students in the class, however you *must* write up the solutions yourself. If you collaborate, specify who you worked with. No other solution sources are allowed. No collaboration is allowed on the optional problems.

Cheating/plagiarism on homeworks or exams will result in a score of 0 and will be subject to Purdue's academic integrity policies (<http://www.purdue.edu/odos/aboutodos/academicintegrity.php>)

Project The project will consist of a short presentation of a paper from a theoretical CS conference on a topic in complexity theory (eg. FOCS/STOC/SODA/RANDOM/CCC/ICALP) and writing scribe notes for this paper. You may work in teams of at most 2 on the project.

5 Grading

25% for the homework

25% for the midterm

20% for the project

30% for the final