
Course Information

Instructor	Room	Phone	Email	Office Hours
Prof. Sofya Raskhodnikova	IST 343F	x3-0608	sofya@cse.psu.edu	Mon 3–5pm

Webpage: <http://www.cse.psu.edu/~sofya/theory-of-computation/>

Prerequisites: You need to be comfortable with mathematical proofs. Most of the assignments in this course require proving some statement and some creativity in finding the proof will be necessary. CSE260 and CSE565 (or equivalents) are helpful, but not required.

Lectures: MW 11:15–12:30pm (IST, Room 333).

Textbook: Michael Sipser. *Introduction to the Theory of Computation, 2nd edition*, Course Technology, 2005.

Syllabus: An introduction to the theory of computation. Topics include automata, formal languages, computability, complexity and reducibility among computational problems.

Note: This is an updated version of CSE568. The instructor will support petitions to count this course as CSE568, but cannot guarantee that the petitions will be approved.

Course outline: I **Automata and Language Theory (2-3 weeks)**. Finite automata, regular expressions, push-down automata, context free grammars, pumping lemmas.

II **Computability Theory (3-4 weeks)**. Turing machines, Church-Turing thesis, decidability, halting problem, reducibility, recursion theorem.

III **Complexity Theory (remaining time)**. Time and space measures, hierarchy theorems, complexity classes P, NP, L, NL, PSPACE, BPP and IP, complete problems, P versus NP conjecture, quantifiers and games, provably hard problems, probabilistic computation, interactive proof systems.

Homework: There will be an assignment due every Wednesday **strictly before** the lecture. The assignments will be posted one week in advance.

Late homework will generally not be accepted. If there are extenuating circumstances, you should make arrangements at least 48 hours in advance with the instructor. Only serious excuses will be considered in cases where prior arrangements were not made.

You should be as clear and concise as possible in your write-up of solutions. Understandability of your answer is as desirable as correctness, because communication of technical material is an important skill. A simple, direct analysis is worth more points than a convoluted one, both because it is simpler and less prone to error and because it is easier to read and understand. Points might be subtracted for illegible handwriting and for solutions that are too long. Incorrect solutions will get from 0 to 30% of the grade, depending on how far they are from a working solution. Correct solutions with possibly minor flaws will get 70 to 100%, depending on the flaws and clarity of the write up.

“I go for 15%” option: Understanding whether a solution is correct is an important skill. If you realize that you cannot solve a problem, you have an option of writing “I go for 15%” instead of your answer. In this case, you will get 15% for this problem (or part of the problem). If you do write an answer, however, that answer will be graded and your score will be 0 if your solution is completely wrong.

Optional problems: Some homework assignments will include optional problems, marked by *. Later, if you ask me for a recommendation or express an interest in working on a research project with me, I will definitely check how well you did on the optional problems. *“I go for 15% option”* is not available for optional problems.

Collaboration and Honesty Policy: Collaboration on homework problems is permitted. If you choose to collaborate on some problems, you are allowed to discuss each problem with at most 3 other students currently enrolled in the class. Before working with others on a problem, you should think about it yourself for at least 45 minutes. Finding answers to problems on the Web or from other outside sources (these include anyone not enrolled in the class) is strictly forbidden.

You must write up each problem solution by yourself without assistance, even if you collaborate with others to solve the problem. You must also identify your collaborators. If you did not work with anyone, you should write “Collaborators: none.” It is a violation of this policy to submit a problem solution that you cannot orally explain to an instructor or TA.

No collaboration whatsoever is permitted on exams.

Violations of this policy will be dealt with according to University regulations (see Senate Policy 49-20 on Academic Integrity).

Exams and Grading: The grade will be calculated as follows:

Homework	weekly	40%
Midterm 1	???	15%
Midterm 2	???	15%
Final exam	finals week	20%
Class participation		10%