CS254 Spring 2017 Sec1 Sec Home Page/Syllabus

Theory of Computation

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Office Hours: MW 4:30-5:30pm
Class Meets:
Sec1 MW 3:00-4:15pm in MH422

Prerequisites

To take this class you must have taken: CS154 with a grade of C- or better.

Texts and Links

Required Texts:	Computational Complexity: A Modern Approach. Sanjeev Arora and Boaz Barak.
Online References and Other Links:	The Nature of Computation by Moore and Mertons. JFlap.

Description

This course covers the basics of computability and complexity theory. That is, it covers models of computation; decidability; complexity measures i.e., the effects of resources bounds on our models; hierarchies; P, NP and other complexity classes; reductions between problems in a complexity classes; intractable problems and what to do about them.

Course Learning Outcomes (CLOs)

By the end of this course, a student should be able to:

CLO1 -- Exhibit a simulation of one machine model with another. For instance, a Turing machine by a RAM.

CLO2 -- Give a minimal classification of the complexity of a computational problem as being in one of the class L, NL, P, P/poly, NP, coNP, some level of the polynomial hierarchy, PSPACE, E, EXPTIME, decidable, undecidable.

CLO3 -- Show the completeness of a complete problem for each of these classes.

CLO4 -- Know properties of the randomized classes RP, BPP.

CLO5 -- Know conditions under which various of these hierarchies might collapse.

CLO6 -- Be able to explain interactive proof characterizations of classes like PSPACE.

CLO7 -- Explain at least one circuit lower bound technique such as Razborov's techniques for monotone circuits or switching lemma techniques.

CLO8 -- Exhibit a relativized separation (oracle result) of complexity classes for standard classes such as P and NP.

Course Schedule

Below is a tentative time table for when we'll do things this quarter:

Week 1: Jan 30, Feb 1	Read Ch 0. Notations, languages, big-oh
Week 2: Feb 6, Feb 8	Read Ch 1. TMs, UTMs, Uncomputability
Week 3: Feb 13, Feb 15 (HW1 due)	Finish Ch 1
Week 4: Feb 20, Feb 22	Start Ch 2. NP and NP-completeness.
Week 5: Feb 27, Mar 1	More Ch 2
Week 6: Mar 6, (HW2 due) Mar 8	Read Ch 3. Diagonalization arguments.
Week 7: Mar 13, Mar 15	Read Ch 4. Space complexity.
Week 8: Mar 20, Mar 22 (Midterm)	Review
Week 9: Mar 27, Mar 29	Spring Recess
Week 10: Apr 3, Apr 5 (HW3 due)	Read Ch 5. The Polynomial Hierarchy.
Week 11: Apr 10, Apr 12	Finish Ch 5.
Week 12: Apr 17 , Apr 19	Read Ch 6. Boolean circuits.
Week 13: Apr 24, (HW4 due) Apr 26	Read Ch 7. Randomized Computation.
Week 14: May 1, May 3	Read Ch 8. Interactive Proofs
Week 15: May 8 , May 10	Read Ch 14. Circuit lower bounds
Week 16: May 15 (HW5 due) , May 17 (No class)	Review
	The final will be Wednesday, May 24 from 12:15-2:30pm

Grading

HWs and Quizzes	50%
Midterm	20%

Final	30%
Total	100%

Grades will be calculated in the following manner: The person or persons with the highest aggregate score will receive an A+. Since this is a graduate class, the curve will be slightly higher than for an undergrad course taught by me. A score of 55 will be the cut-off for a B-. The region between this high and low score will be divided into five equal-sized regions. From the top region to the low region, a score falling within a region receives the grade: A, A-, B+, B, B-. If the boundary between an A and an A- is 85, then the score 85 counts as an A-. Scores below 55 but above 50 receive the grade D. Those below 50 receive the grade F.

If you do better than an A- in this class and want me to write you a letter of recommendation, I will generally be willing provided you ask me within two years of taking my course. Be advised that I write better letters if I know you to some degree.

Course Requirements, Homework, Quiz Info, and In-class Exercises

This semester we will have five homeworks, weekly quizzes, and weekly in-class exercises.

Every Monday this semester, except the first day of class, the Midterm Review Day, and holidays, there will be a quiz on the previous week's material. The answer to the quiz will either be multiple choice, true-false, or a simple numeric answer that does not require a calculator. Each quiz is worth a maximum of 1pt with no partial credit being given. Out of the total of twelve quizzes this semester, I will keep your ten best scores.

On Wednesday's, we will spend 15-20 minutes of class on an in-class exercise. You will be asked to post your solution to these exercises to the class discussion board. Doing so is worth 1 "pre-point" towards your grade. A "pre-point" can be used to get one missed point back on a midterm or final, up to half of that test's total score. For example, if you scored 0 on the midterm and have 10 pre-points, you can use your pre-points, so that your midterm score is a 10. On the other hand, if you score 18/20 on the midterm, you can use at most 1 pre-point since half of what you missed (2pts) on the midterm is 1pt.

Links to the current list of homeworks and quizzes can be found on the left hand frame of the class homepage. After an assignment has been returned, a link to its solution (based on the best student solutions) will be placed off the assignment page. Material from assignments may appear on midterms and finals. Homeworks (and obviously, midterms and finals) this class should be your own individual work.

Homeworks for this class will be submitted and returned completely electronically. To submit an assignment click on the submit homework link for your section on the left hand side of the homepage and filling out the on-line form. **For homeworks, you are encouraged to work in groups of up to three people. Only one person out of this group needs to submit the homework assignment; however, the members of the group need to be clearly identified in all submitted files.** Hardcopies or e-mail versions of your assignments will be rejected and not receive credit. Homeworks will always be due by the start of class on the day their due. Late homeworks will not be accepted and missed quizzes cannot be made up; however, your lowest score amongst the five homeworks and your quiz total will be dropped.

Classroom Protocol

I will start lecturing close to the official start time for this class modulo getting tangled up in any audio/visual presentation tools I am using. Once I start lecturing, please refrain from talking to each other, answering your cell phone, etc. If something I am talking about is unclear to you, feel free to ask a question about it. Typically, on practice tests days, you will get to work in groups, and in so doing, turn your desks facing each other, etc. Please return your desks back to the way they were at the end of class. This class has an online class discussion board which can be used to post questions relating to the homework and tests. Please keep discussions on this board civil. This board will be moderated. Class and discussion board participation, although not a component of your grade, will be considered if you ask me to write you a letter of recommendation.

Exams

The midterm will be during class time on: Mar 22.

The final will be: Wednesday, May 24 from 12:15-2:30pm.

All exams are closed book, closed notes and in this classroom. You will be allowed only the test and your pen or pencil on your desk during these exams. The final will cover material from the whole semester although there will be an emphasis on material after the last midterm. No make ups will be given. The final exam may be scaled to replace a midterm grade if it was missed under provably legitimate circumstances. These exams will test whether or not you have mastered the material both presented in class or assigned as homework during the quarter. My exams usually consist of a series of essay style questions. I try to avoid making tricky problems. The week before each exam I will give out a list of problems representative of the level of difficulty of problems the student will be expected to answer on the exam. Any disputes concerning grades on exams should be directed to me, Professor Pollett.

Regrades

If you believe an error was made in the grading of your program or exam, you may request **in person** a regrade from me, Professor Pollett, during my office hours. **I do not accept e-mail requests for regrades.** A request for a regrade must be made no more than a week after the homework or a midterm is returned. If you cannot find me before the end of the semester and you would like to request a regrade of your final, you may see me **in person** at the start of the immediately following semester.

University Policies and Procedures

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/. Below are some brief comments on some of these policies as they pertain to this class.

Academic Integrity

For this class, you should obviously not cheat on tests. For homeworks, you should not share code problem solutions between groups! At a minimum a 0 on the assignment or test will be given. A student caught using resources like Rent-a-coder will receive an F for the course. Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development.

Accommodations

If you need a classroom accommodation for this class, and have registered with the Accessible Education Center, please come see me earlier rather than later in the semester to give me a heads up on how to be of assistance.