CS/CMS 139, Design & Analysis of Algorithms **Winter 2019**
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Course Organization **Monday January 7th, 2019**

The goal of this course is to develop core principles for the analysis and design of algorithms. We will learn mathematical techniques for analyzing performance in terms of resources, such as time, space, and randomness. We will apply these techniques to the major paradigms for algorithm design, including randomized algorithms, linear and semidefinite programming, approximation algorithms, spectral methods, and online learning.
Evaluation in the course is based on homework assignments, a midterm and a final, as well as weekly exercises. The homeworks are meant to be solved in collaboration, whereas the midterm, final, and exercises are to be solved on your own.

Indicative syllabus: See the course webpage for up-to-date information.
Week 1: Randomized algorithms. Weeks 2-5: Approximation algorithms based on linear programming and semidefinite programming. Dimension reduction. Week 6: Combinatorial optimization. Week 7: Online algorithms. Weeks 8-9: Spectral methods. Analysis of random walks. Week 10: Solving linear systems of equations.

Prerequisites: Ma 2, Ma 3, Ma/CS 6a, CS 21, CS 38/138, and CMS/ACM/EE 116 or ACM/CMS 113 or equivalent.

Resources: We won't be following any particular textbook. Lecture notes will be posted on piazza after each lecture. Standard books you may find useful include Probability and Computing by Mitzenmacher and Upfal, Randomized Algorithms by Motwani and Raghavan, and Approximation Algorithms by Vazirani.

Office hours and recitation: You are strongly encouraged to come to my office hours or to those held by the TA. My office hours are Tuesdays 5-6pm in my office, 207 ANB. You can come to office hours to discuss assignments, but not only for that. You can come to discuss anything related to the course: the material covered in class, the material not covered in class, your interest in the class, etc. You are also welcome to come in for advice on how to do well in the class.
Recitation sections will be held (roughly) once every two weeks. The goal of recitation is to spend additional time reviewing key material from the class, or that is needed to understand class. Recitations are particularly useful for students having difficulties for the class, but they are meant for all students.

Communication: Course communication will be made in class and through the course webpage on Piazza. Make sure you have access to Piazza. If not, email the TA or the instructor.

Course TAs: The TAs are Spencer Gordon and Wenqing (William) Xu. Their office hours are Wednesday 5-6pm in 205 ANB.

Assignments and evaluation: Each student is required to complete the following:

- Pre-class exercises: 10% of grade. At the end of the lecture notes from class on any given day there will (often, but not always) be one or two small exercises, to be handed in on paper at the start of the next class. The goal of the exercises is to make sure every student is following the class, and that no one falls behind; they are not meant to be difficult and should take under 20 minutes to complete. Grading of the exercises will be done generously, and skipping up to 20% of them will not affect your grade.

- Five take-home assignments: 50% of grade. These will generally be due on Fridays by 5pm, with the first assignment due Friday 01/18. The assignment will be available on Piazza at least one week before the due date. Assignment consists of 4-6 exercises each. Solutions are to be handed in via Gradescope (handwritten and scanned solutions are equally good as latexed solutions). Instructions for registering on Gradescope will be posted to Piazza in the first week. Grading will take into account clarity and rigor of exposition: make sure your solutions are presented appropriately and include complete proofs whenever required.
- A midterm and a final, each worth 20% of the grade. The midterm and final are similar to the homeworks in length and difficulty, except that they cover material from the entire class to date. You have one week to solve each of them, and they are strictly no-collaboration.

Collaboration policy: See the collaboration table for details.

- The exercises, the midterm, and the final, should be completed on your own: strictly no collaboration.
- The homeworks can be solved in collaboration with other students in the class (and I encourage it). But you should read and think about each problem alone for at least a few minutes before collaborating. *You must produce the final write-up for submission alone, without relying on notes of any kind from your discussions; your solution must depend solely on your own understanding.*

In all cases where collaboration is allowed, you should indicate on your solution the name of your collaborator(s).

Sources: It is ok to look up definitions online or wherever you find convenient. It is not ok to use solutions found online, in whole or in part. If by accident you find a solution to an assigned problem, or a problem that is close to an assigned problem, you should immediately put it aside. **Do not violate the honor code**. In case of uncertainty **ask.**