CSCI 1570: Design and Analysis of Algorithms

Lectures and Lab

T Hour: MW 3-4:20
Required Lab: Friday 3-4:20

Textbook (required)

Algorithms by Dasgupta, Papadimitriou, and Vazirani
(A Kindle edition can be rented from Amazon for under $14.)

Prerequisites

- Computer Science 160 or Computer Science 180 or Computer Science 190
- Computer Science 22 or Computer Science 1010 or Computer Science 1450 or Math 1530 or another course in which students are required to write mathematical proofs and are evaluated on their proofs.

Prior experience with probability theory and linear algebra are very helpful. However, deep knowledge of these topics is not necessary, and there are supplementary materials available, so students without prior background in these areas will just have to work slightly harder on some occasions.

Instructor

Philip Klein

Student work

Each student is expected to attend lecture and lab, and participate in group problem-solving efforts during those. In addition, there will be homework assignments for most weeks. Finally, there will be a take-home midterm exam and a take-home final exam. Solutions must be written up using LaTex.

Time requirements

Each week, three hours of lecture, plus 1.5 hours of lab, plus an estimated 10.5 hours of solving homework/exam problems and writing up solutions.

Goals

The goals are to learn the principles of and develop skills in designing and analyzing algorithms. In this class, we focus on algorithms that can be mathematically proven to be correct for all inputs, and can be mathematically analyzed to accurately estimate the time required as a function of input size. Our goal is that this class also begins training you to be able to think algorithmically about computational problems.

Diversity and inclusion

Our intent is that this course provide a welcoming environment for all students who satisfy the prerequisites. Our TAs have undergone training in diversity and inclusion; all members of the CS community, including faculty and staff, are expected to treat one another in a professional manner. If you feel you have not been treated in a professional manner by any of the course staff, you are invited to talk with Prof. Philip Klein (the instructor), Prof. Ugur Cetintemel (the department chair), or Ms. Laura Dobler (the department's coordinator for diversity and inclusion initiatives). We take seriously all complaints about unprofessional behavior.

Course meetings

The course will meet in Friedman 108 on Monday, Wednesday, and Friday from 3:00 to 4:20. Technically, the Friday meeting is a lab. However, the format will be roughly the same each day:

- Lecture material
- A *problem-solving session* (the "lab" part)

Work and grading

There are three categories of work:

- *Homework:* Homework will be assigned weekly. Ordinarily a homework assignment will be released Friday evening or Saturday morning, and due the following Friday by 6:00 pm. Each of your homework solutions will be assigned a grade based both on the content and the style (i.e.. clarity of presentation). As discussed in the section on collaboration, homeworks will be done in teams of two.
- *Exams:* There will be a take-home midterm and a take-home final exam. Each will be similar in format to a homework. You must work on the exam without help from anybody other than CSCI 1570 teaching staff. Grading on exams will be similar to grading on homeworks.
- *Problem-solving sessions:* These will be held most Mondays, Wednesdays, and Fridays. These constitute the "lab" part of the course. Students will form groups and will work collaboratively to solve a problem assigned in that lecture. At the end of the problem-solving session, each team will hand in a report on their solution (or attempt to find one). The reports are graded as pass/fail. Each report will be awarded full credit, even if it does not describe a complete solution, if it demonstrates a reasonable application of algorithmic techniques to the problem (especially those techniques that are relevant to the current topic).

You must achieve a passing grade (at least 60%) in each of the three categories in order to pass the course. Beyond that, the course grade will be determined

as follows:

Homework	43%
Midterm Exam	13%
Final Exam	30%
Reports	14 %

Collaboration

Homework: Collaboration on homework is mandatory. Early on, students will be randomly assigned partners for each homework assignment. (Part way through the semester students will be allowed to choose their own partners.) Each two-person team will work together to solve the problems and write up solutions together.

In addition, *collaborative TA hours* are an opportunity for students to collaborate with any students in the course. However, a student is not permitted to retain a physical or digital record from the collaborative period; the two-person team must write up solutions based on their memory of the collaboration with students outside the team.

Problem-solving sessions in lecture and lab are generally collaborative. Ordinarily students will work in groups.

Exams: Collaboration is not allowed on exams.

Violations of the course's collaboration policy, including writing up homework solutions drawing on a written or digital record of collaboration with people outside the homework team, will be considered violations of the university's academic code.

Deadlines

Students are expected to hand in their homework solutions on time. No consideration will be afforded based on a student's participation in outside activities such as job search, attending conferences, participating in sports or other activities.

However, each student will be provided with five late days. A student chooses how to allocate these late days to homework assignments, subject to the constraint that a student can assign at most three late days to any single assignment. A student's homework solution is considered late if it is turned in later than the deadline plus late days allocated. Late homework solutions are not graded and receive no credit.

The midterm exam will be assigned October 25. The final exam will be assigned Friday, December 6. (These are tentative dates and subject to change.)

Health and sickness

Please do your best to stay well and keep others well. If you are sick, please do not come to class; you will be exempted from that day's problem-solving session. Let the professor know via email, and we will work out arrangements. Extensions on homework are routinely granted in case of sickness. Don't make your sickness worse by pushing yourself.

Topics

The following is a tentative timetable and is subject to change.

- Week 1 (September 4-6): Big O Analysis
- Week 2 (September 9-13): Algorithms with Numbers
- Week 3 (September 16-20): Divide-and-Conquer
- Week 4 (September 23-27): Decomposition of Graphs
- Week 5 (September 30-October 4): Paths in Graphs
- Week 6 (October 7-11): Greedy Algorithms
- Week 7-8 (October 16-25): Dynamic Programming
- Week 9-10 (October 28-November 8): Linear Programming
- Week 11-13 (November 11-25): NP-Complete Problems
- Week 14-15 (December 2-December 11): Coping with NP-Completeness