

CSE 100 Algorithm Design and Analysis

Syllabus

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Goal and Topics

The course introduces the basics of computational complexity analysis and various algorithm design paradigms. The goal is to provide students with solid foundations to deal with a wide variety of computational problems, and to provide a thorough knowledge of the most common algorithms and data structures. Topics include analysis and implementation of algorithms, concepts of algorithm complexity, and various algorithmic design patterns. The course will also cover major algorithms and data structures for searching and sorting, graphs, and some optimization techniques. In addition to learning about all these different topics, by the end of the class, you should be able to model a computational problem, understand the trade-offs in the design of a solution, and be able to implement a software solution to the problem. In the overall picture of the CSE program, this is one of the few classes that will teach you foundational skills to develop solutions for computation problems and the skills to implement the solutions in software.

By the end of the course, students will be able to:

- (1) apply knowledge of computing and mathematics to algorithm design;
- (2) analyze a problem and identify the algorithm appropriate for its solution;
- (3) design, implement, and evaluate an algorithm to meet desired needs;
- (4) have the ability to compare and analyze different algorithms and their usage.

Textbook and class materials

We will use a combination of textbook, class notes and papers available online. The main textbook used in class is:

Title: **Introduction to Algorithms**

Authors: **T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein**

3rd edition

MIT Press

ISBN: 0-262-03384-4

You could find it in the University Library and/or buy it online. Please make sure it is the 3rd Edition. It is your responsibility to read the related chapters in the textbook.

All class lecture notes/slides will be available in PDF format from the class webpage on CatCourse. I often use a tablet to write examples on the slides. The annotated slides will also be available. However, it would be difficult to understand them without attending classes. Therefore, it is in your best interest that you attend classes and take necessary notes.

For certain topics, I may ask you to read some additional materials, which will be provided on the course webpage on CatCourses.

Student Learning Outcomes

By the end of the course, through lectures, readings, homework assignments, and exams, students will demonstrate:

- An ability to apply knowledge of computing and mathematics appropriate to the discipline;
- An ability to analyze a problem and identify the computing requirements appropriate for its solution;
- An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs, and use current techniques, skill, and tools necessary for computing practice;
- An ability to apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices.
- An ability to apply design and development principles in the construction of software systems of varying complexity.

Contact Information

Sungjin Im's (instructor)

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The TAs may also provide extended office hours when there are students with difficulties at the sole discretion of the TA's (no obligation).

Tutoring Resources

We may have some tutoring resources for the students that need extra support and help, from the PALS Center and the STEM Center; this will be updated on the course syllabus on CatCourses.

Grading Policy

I reserve the right to change this, but grades will be assigned roughly as follows:

- Labs: 20%
- Midterm 1: 18%
- Midterm 2: 18%
- Midterm 3: 18%
- Final: 26% (final is cumulative)

There will be some extra credits, which in aggregate can earn you up to an additional 4%; up to 2% at my discretion and up to another 2% at the TAs' discretion. The extra credits will be awarded for your participation in classes, discussion sessions, or letting us know some 'critical' typos/errors in the course materials.

As you can see from the grade distribution, the most critical aspect of the class are the exams, so you should plan to spend a significant amount of time studying for them.

Exams

There will be three midterm exams and a final exam for this course:

Midterm 1: 4:30 pm to 5:45 pm, Tuesday, Feb 18, 2020 COB2 110

Midterm 2: 4:30 pm to 5:45 pm, Tuesday, Mar 17, 2020 COB2 110

Midterm 3: 4:30 pm to 5:45 pm, Tuesday, Apr 7, 2020 COB2 110

Final: 8:00 am to 11:00 am, Tuesday, May 12, 2020 COB2 110 (3 hours)

The midterm and final exams will be changed only under extremely **exceptional** circumstances; e.g. natural disasters. For all practical purposes, you should assume they are set in stone. This means that you should plan to take both the midterms and the final at the dates and times given above. *Failure to do so means an automatic zero in the exam(s).* If you have an exceptional circumstance for that date and time, I would **ONLY** consider you taking an alternative exam **before** the dates and times given above for each exam. Makeup exams will never be provided **after** the above dates. If you want to take exams before the fixed dates/times, you must notify me at least 2 weeks before and it must be approved by me. I reserve the right to determine what an exceptional circumstance is and my decision is final.

Labs

Each weekly lab (3 hours) consists of two parts. The first part is a discussion session, which is run by the TAs. The goal of the discussion is for you to become more proficient in solving algorithms problems, so this part is like a problem-solving review. This is important to get you ready for the midterms and final exams.

The second part consists of lab programming assignments. This semester, we will be implementing various algorithms in C++. Correspondingly, you need to be quite comfortable programming in C++. If you're not already well-versed in C++ programming, you will need to teach yourself, and do so in a hurry. This will put you at a disadvantage relative to your classmates.

All lab assignments should be done **individually** (see academic honesty policy below) either in the lab, or remotely accessing your lab account. Copying even part of the code from the sources like StackOverflow, chegg.com ([Links to an external site.](#)), geeks-for-geeks is **prohibited**. We will enforce the academic honesty policy very **strictly**. Please note that for the lab assignments we run your code through a system to detect similarity with other projects submitted by your classmates and a database of previous five (5) year's submissions and also code available in public repositories mentioned above. The algorithm analyses the structure and flow of the code, so simply changing the variable names and introducing minor changes to input/output will not be effective to defeat it. You would have to modify the code so much, that you are better off writing the code on your own. So **caveat emptor**.

Please check the instructions in the class web page for more information and/or consult with the TAs. There will be 12 or 13 lab assignments this semester. You can submit the code as many times as you want before the deadline. The last version of the code submitted will be evaluated for grading. Typically, the labs will be released (almost) every Tuesday, and they will be graded the following Thursday. The labs are graded with an auto-grader based on a standardized output and the grades will be released every week. Each programming assignment is tested against 10 test cases, and your grade is based on the correct output of those test cases (see Late Policy below for additional information). The labs will provide some test cases for you to test your code, but we will use additional test cases to test your code for grading, so students cannot "fake" the output (doing a simple mapping). If your grade is low, you have the option to resubmit your code for re-grading the following week. Again during that extra week, you may resubmit your code as many times as you want, only the last version will be re-graded with the corresponding penalty (see Late Policy below for additional information).

Class Policies

Policy on Personal Electronic Devices: Our classroom is a heaven from the distractions of everyday life, giving us a place to focus attentively, in collaboration, on learning. Listening to each other is imperative and enables focused concentration. "Multitasking" inhibits learning and disrupts communication; unexpected beeps and surprising ring tones distract us all. I only allow you to use your devices to take notes; e.g. taking notes on tablet. My policy on this matter can be summed up in one phrase: "class in the foreground." If you ever appear to be "backgrounding" the class you may be expelled from the room. **Examples of "backgrounding" the class in a punishable way include: answering or making a cell phone call; texting or IMing; checking or writing e-mail; surfing the web; wearing headphones; logging into LinkedIn, Facebook, Google+, Twitter, your blog, or other social networking sites; reading an ebook or any printed matter not related to class content (e.g. a magazine); and handheld gaming. Please set your cell phones to "silent" mode before class begins. I reserve the right to ban electronic devices entirely if I feel they are distracting you or your classmates from the proper study.**

Late Policy: unless otherwise indicated, lab assignments are due by the specific due date determined in the class web page. If you submit an assignment late, we will take off 10% of the total value. We will not consider granting Incompletes as grades. Assignments are to be submitted electronically using the UCM class management system (CatCourses). We will use the clock on the UCM class management system to determine the time of submission. Lab assignments will be graded right after the due date, so you should have immediate feedback on how well you did. If your lab assignment received a very low score, this means that your code is not working properly. For those students that want to improve the code, they will get a full week to do it and resubmit. If you resubmit within the resubmission week, you will still get penalized 10%, but you have the chance to improve your grade. For example, if in your original (on time) lab submission you got 90-100% score, it makes no sense to resubmit, since the maximum score for a perfect resubmission will be 90% with the 10% penalty. However, if you got 0-20% in your original submission, it is in your best interest

to improve your score and resubmit. Even if you resubmit and get only 50% in the new assignment, you will get a final score of 45% (50% - 10% penalty over your 50% score, which is 45%).

Submission File Format: ONLY a single C++ file. *Failure to do this implies no submission, and you will be assigned a zero (0) for the assignment.*

Reasonableness: the "Reasonable Person Principle" applies throughout this course. This principle simply states that a reasonable request made in a reasonable way shall be reasonably handled by reasonable persons. The TA and I are reasonable people: we expect that everybody else involved in this class will be as well.

Disability Services Information

Academic Support Services are designed to provide equal access to the instructional learning environment for all qualified students with disabilities deemed eligible to receive academic adjustments according to the implementing regulations of Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990. UC Merced Disability Services (DS) is the sole designated and authorized student support unit that determines a student's eligibility for accommodation services because of disability.

Academic Support Services are planned in consultation with the student, faculty and other departmental staff as needed. Because accommodation services are planned on a case-by-case basis, students deemed eligible to receive Disability Services must schedule an appointment and meet in person with Disability Services staff to discuss and properly plan for academic accommodation service delivery. For that reason, Email is not used as a communication mechanism to discuss academic accommodation service provision as it does not adequately facilitate a collaborative and interactive process between the student and appropriate DS staff.

To be eligible for academic adjustment services, students must provide appropriate documentation according to UC documentation of disability guidelines. Each service must be approved by Disability Services and is generally tailored to the individual need of each student.

I have successfully accommodated students with disabilities in the past, and they have been able to successfully learn the content of the class and pass with a satisfactory grade. I urge any student with disabilities to contact the UC Merced Disability Services to make proper arrangements. Any student who feels he or she may need an accommodation based on the impact of a disability should contact me privately to discuss his or her specific needs. Also, contact Disability Services at (209) 228-7884 as soon as possible to become registered and thereby ensure that such accommodations are implemented in a timely fashion. More information can be found at

<http://disability.ucmerced.edu/default.asp>

Academic Integrity Policy

The campus Academic Honesty Policy states:

"Academic integrity is the foundation of an academic community. Academic integrity applies to research as well as undergraduate and graduate coursework. Academic misconduct includes, but is not limited to cheating, fabrication, plagiarism, altering graded examinations for additional credit, having another person take an examination

for you, or facilitating academic dishonesty or as further specified in this policy or other campus regulations.

Cheating is the unauthorized use of information in any academic exercise, or another attempt to obtain credit for work or a more positive academic evaluation of work through deception or dishonesty. Cheating includes, but is not limited to: copying from others during an examination; sharing answers for a take-home examination without permission; using notes without permission during an examination; using notes stored on an electronic device without permission during an examination; using an electronic device to obtain information during an exam without permission; taking an examination for another student; asking or allowing another person to take an examination for you; tampering with an examination after it has been corrected, then returning it for more credit than deserved; submitting substantial portions of the same academic work for credit in more than one course without consulting the second instructor; preparing answers or writing notes in a blue book before an examination; falsifying laboratory, or other research, data or using another person's data without proper attribution; allowing others to do the research and writing of an assigned paper (for example, using a commercial term paper service or downloading a paper from the internet); and working with another person on a project that is specified as an individual project.

Plagiarism refers to the use of another's ideas or words without proper attribution or credit. This includes, but is not limited to: copying from the writings or works of others into one's academic assignment without attribution, or submitting such work as if it were one's own; using the views, opinions, or insights of another without acknowledgment; or paraphrasing the ideas of another without proper attribution. Credit must be given: for every direct quotation; when work is paraphrased or summarized, in whole or in part (even if only brief passages), in your own words; and for information which is not common knowledge. The requirement to give credit applies to published sources, information obtained from electronic searches, and unpublished sources.

Collusion is when any student knowingly or intentionally helps another student to perform any of the above acts of cheating or plagiarism. Students who collude are subject to discipline for academic dishonesty. No distinction is made between those who cheat or plagiarize and those who willingly facilitate cheating or plagiarism." More information about the policy and the Office of Student Conduct can be found here: <http://studentconduct.ucmerced.edu/>

Some students may still have some confusion (albeit the policy is quite clear), in particular concerning collaboration. The following rules are in place to make this issue clearer, from the perspective of my class.

Cheating vs. Collaboration: Collaboration is a very good thing. On the other hand, cheating is considered a very serious offense. Please don't do it! Concern about cheating creates an unpleasant environment for everyone. If you cheat, you risk losing your position as a student in the college. The school's policy on cheating is to report any cases to the university judicial office. What follows afterward is not fun. So how do you draw the line between collaboration and cheating? Here's a reasonable set of ground rules. Failure to understand and follow these rules will constitute cheating and will be dealt with as per university guidelines.

The Simpson's Rule: This rule says that you are free to meet with a fellow student(s) and discuss assignments with them. Writing on a board or shared piece of paper is

acceptable during the meeting; however, you should not take any written (electronic or otherwise) record away from the meeting. This applies when the assignment is supposed to be an individual effort or whenever two teams discuss common problems they are each encountering (inter-group collaboration). After the meeting, engage in a half-hour of mind-numbing activity (like watching an episode of the Simpsons), before starting to work on the assignment. This will assure that you can reconstruct what you learned from the meeting, by yourself, using your brain.

The Freedom of Information Rule: To assure that all collaboration is on the level, you must always write the name(s) of your collaborators on your assignment in the beginning of your submission file as a comment.

Computer Science Department Policy on Academic Honesty

As stated in the campus-wide Academic Honesty Policy (AHP), "academic integrity is the foundation of an academic community". Accordingly, the CSE faculty takes this matter very seriously and has embraced a zero tolerance on this matter. The process described in the following establishes the minimum consequences for violations of the AHP in CSE courses, but repercussions may be more severe for egregious violations. The Computer Science Department Policy on Academic Honesty ("CSE Policy" from now onwards), does not substitute the AHP but rather specifies how it will be implemented when students enrolled in classes offered by the Computer Science and Engineering (CSE) department are found in violation of the AHP. In particular, the CSE Policy defines how the CSE faculty implements the "Instructor-Led Process" described in AHP 802.00.A. This policy and the associated processes have been developed in collaboration with the Office of Student Conduct and the School of Engineering and is jointly implemented by the CSE Faculty, the School of Engineering, and the Office of Student Conduct. The CSE Policy has been in effect since the Fall 2019 term.

Preamble

Computer science education relies on a variety of methods to assess students' preparation and learning. The term "assignment" shall be interpreted as any method or process resulting in a grade or contributing to the final grade for a class. Accordingly, the term "assignment" used in the following includes, but is not limited to: homeworks, quizzes, in-class exams, take-home exams, programming assignments, software projects, and presentations.

Shared Responsibility

Maintaining an environment where academic integrity is valued and enforced requires commitments by both instructors and students. Instructors will specify what type of collaboration is allowed or disallowed for a given assignment, and students should strictly follow the provided guidelines. When in doubt, students should contact the instructor and ask for clarifications.

First Infraction

If it is determined that a student has cheated, plagiarized, or otherwise violated the AHP, the student will receive a 0 (or equivalent grade) for the assignment. As per the AHP, violations will be reported to the Dean of the School of Engineering and the Office of Student Conduct for review of possible violations of the Code of Student Conduct.

Additional Infractions

The School of Engineering keeps a record of all infractions reported by its faculty. If upon receiving a notification it is determined that the student has one or more prior violations of the AHP, the School will inform the instructor who reported the new violation. The additional violation will immediately lead to a failing grade (F) for the course. The student will be informed in writing and will not be allowed to withdraw from the class. According to CSE Policy, students should note that even the first infraction in a class may lead to a failing grade if after reporting it is determined that the student had been previously sanctioned for one or more infractions in other classes. Students will have the right to appeal the instructor's decision as per AHP 802.00.A.

Resources

If in doubt, students are encouraged to seek guidance from the faculty, advisors, and the Office of Student Conduct. Additional resources can be found on:

<http://studentconduct.ucmerced.edu/>

<https://ombuds.ucmerced.edu/>

https://eecs.ucmerced.edu/sites/eecs.ucmerced.edu/files/page/documents/computer_science_department_policy_on_academic_honesty_fall_2019.pdf

Class Schedule

See the Syllabus of CSE 100 on CatCourses:

<https://catcourses.ucmerced.edu/courses/16333/assignments/syllabus>