CS 413-02: Analysis of Algorithms, Spring 2025, Online

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Virtual Office Hours: Tuesdays: 12:30 - 2:30 PM (by appointment)
Office Location: Virtual

Class Schedule

This is a Fully Online upper-division course. This class is asynchronous with synchronous (live) midterm/final exams. Students can work through the weekly materials at a time convenient for them, however, it is timed, which means assignments will have specified due dates, to keep you from falling behind. This 3-unit course mixes and mashes online lectures, readings, assignments, and exams. Successful online students pace themselves and set aside dedicated time for their coursework.

Course Description

The goal of this course is to show you some useful algorithms and explain how they work and why they are considered good, in order to (1) help you recognize situations in which you would be better off looking in the literature, thinking more, or asking someone knowledgeable for a good algorithm to solve your problem instead of just coding the first idea that comes to your mind, and (2) give you enough background so that you are able to understand and navigate the literature on algorithms. In order to achieve this, you will have to understand the meaning of algorithms for problem solving and work through several algorithmic techniques and the mathematical background necessary for analyzing the properties of these techniques and the algorithms based on them (e.g., recurrence relations, graph theory). As we go through some algorithmic techniques, you will study some well-known searching and sorting, binary tree traversal algorithms, and probably some more if time allows.

Objectives and Learning Outcomes

Students who successfully complete this course will be able to:

- Apply asymptotic notation to describe the behavior of algorithms in different cases.
- Select an appropriate algorithmic strategy for solving a suite of well-known problems.
- Develop new and correct algorithms to solve complex tasks.
- Calculate the time and space efficiencies of novel algorithms.
- Analyze the complexity of computational problems in different domains.

Prerequisites

The students **ARE EXPECTED** to understand the material typically covered in CS 301 (and its prerequisites such as MATH 211). All of this prerequisite material is covered in CS 301 which is listed as a prerequisite for the current course.
Additionally, students are required to be familiar with programming techniques. In particular, they need to be able to program and test their algorithms using *either* C++ or Java programming languages.

Recommended Textbook

Main Textbook: J. Kleinberg and E. Tardos. *Algorithm Design*, Addison Wesley, 2006.
Other recommended reference: Cormen, Leiserson, Rivest, and Stein. *Introduction to Algorithms*, 3rd edition, MIT Press.

Online Office Hours

Each week, I will be available for live chat (through email or by Zoom if more than email message passing is needed or video chat is more desired) based on a scheduled appointment basis. We will use Zoom meetings (web conferencing tool) for live video chats once needed. The link to the meeting will be provided to you and you can use it to connect to the meeting room. If you have questions of a personal nature, like grades or challenges, please email me directly using your CSUEB email account. More instructions regarding emails will be provided to you in the Email section.

Web material and announcements

Please make sure that you are added to this course on Canvas. Please be sure to check the Canvas course page for CS 413.
Note: Watching video lectures is a must. They are the primary source of understanding the course concepts. While I will post some course slides, they may not cover everything we cover and discuss in the video lectures, so consider them secondary resources. It's your responsibility to study video lectures carefully and take notes as needed.
Some assignments or quizzes are targeted for **virtual student engagement and participation** in course activities, and may **only** be announced through the lecture videos and course material. I explicitly specify in the video lectures if you are required to submit the solution to such assignments to Canvas.
There will be some sections/subsections of the textbook to be studied/reviewed. You are required to check course announcements for reading/assignments. There might be some small online quizzes designed on course concepts.

Exams

- There will be two cumulative midterm exams and one final exam. All students are expected to be present on all exams.
- **No make-up exam for anyone for any reason**.
- No exam may be taken before or after the scheduled time for any reason.

- You should be present for the final exam, no matter what your grade is without considering the final exam's grade. You will obtain a zero for the course if you are absent for the final exam.
- Exam questions may include multiple-choice, multiple-answer, true-false, short-answer, and complete algorithms (writing code or pseudocode). All exam questions will remain with the instructor and their solutions will not be posted on the Canvas. Upon your request, I can go through their solutions with you in my office hours, though.
- All the exams will be closed book.
- *Exams should not be taken on cell phones.*
- For our synchronous meetings (exams), your on-time attendance is mandatory.
- Have a PHOTO ID ready once you take the exam. We might need to verify your identity.
- **Tentative schedule for midterm exams** would be as follows:

  First Midterm: on Monday, 03/03/2025.

  Second Midterm: on Monday, 04/07/2025.

  Your class is asynchronous (with sync exams), but if it was in person, the class would happen on MWs at 11:00 AM. So, you may expect the time for your exams from 11:00 AM to 12:45 AM. Sometimes, depending on how well my students do in the course and the course plan, I "may" extend it to a longer duration "on the same date", but I will provide details later once we get closer to each exam if that's the case.
- Final Exam: According to the university schedule the final exam is scheduled on **Monday, May 12, 2025, 10:15 AM - 12:15 PM**. However, to give you some flexibility and more time to work on the questions, the time window to submit your solutions might be extended to 5:00 PM, on the specified date.

  Please double-check the schedule here for the Final exam Schedule.
- Depending on how well students do in course assignments and other course activities, and according to the course needs and progress, the instructor may decide to change the way she assesses your knowledge in the exams, by changing the live exam to a take-home exam, or a project assignment, etc. It will be based on the instructor's decision, and any such changes will be announced to you.

Email

Since email has proliferated, and now constitutes the bulk of extra-classroom conversation between students and the instructor, it must be subject to normal rules of formality. Therefore, all email communication will follow the guidelines enumerated here.

Email communication regarding this class **MUST** include in the *subject line* the prefix `CS 413-02:` (for example, the subject line of your email may read `CS 413-02: question about hw1`).

Email should be clear, self-contained, and to the point. Email should not ask questions whose answers are contained in the course syllabus, class notes/class material, or the Canvas. Please avoid asking questions in the email that are of an excessively conceptual nature, and questions that expect an unreasonable amount from the instructor. A good rule of thumb: if your question cannot be answered in a short paragraph, or if it is a question that you should solve on your own through the course of your reading, then it is not appropriate for email. Email that does not follow the

guidelines above might *not* be returned by the instructor. I will respond within 24 hours during the week, and 48 hours on the weekend. Please email me directly using your CSUEB email account.

Evaluation

The grades will be based on

- Assignments, Projects, Quizzes (40%):

  Not all the assignments and not all the questions in each assignment might be graded. The instructor randomly selects some of the assignments/questions in an assignment to be graded. Your grade for the Assignments part is is mostly affected by the assignments/questions that are graded. The ones that are not graded will have some fixed points as long as you have provided fair answers to ALL of the questions. Some assignments may be in groups of 2-3 students.
- Two Midterm exams, Each (20%)
- Final exam (20%)

Grading scale

There is no extra credit in this class. There are no outside projects. Grades will not be adjusted in any way - so an 89.9% is still a B.
No incomplete grades will be given.
The grading scale is as follows:
$90-100$ *will ensure A,* $<90-80$ *will ensure B,* $<80-70$ *will ensure C and so on.*

Loss of points due to late submission of assignments:

- 1 day 50%, only if the solution for the assignment has not been posted yet or we have not talked about the solution in class lectures
- 2 days 100%

Grade Disputes

A digital repository will be created for every assignment. A students submits a digital copy (electronic file, picture of the written solutions, etc.) of their solutions to an assignment to the repository *before* the assignment deadline. Grade disputes for the assignments will *only* be considered if a digital copy of the respective solutions has been submitted. You may request a grade dispute for a graded assignment **1 week** of receiving your grade. Grade disputes for assignments will *NOT* be given after the final exam.

All grade disputes, for hw assignments or exams, must be submitted *in written*, including a *detailed description* on why you believe we should reconsider the grading of your hw or exam. If your description does not satisfactorily describe why you believe that we may have made a mistake in grading, it will *not* be considered.

No exceptions will be granted.

Course Topics

Below is a **tentative** schedule of topics:

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- Introduction
- Foundations (about 2.5 weeks)
 * Algorithm, Problem solving, and Complexity
 * Analysis  and Asymptotic notations
- Recursion, Recurrence relations (about 1 weeks)
- Introducing some important algorithmic techniques like Divide and Conquer algorithms
 and possibly more (about a month)
- Sorting and Searching  (about 2 weeks)
- Graph algorithms (about 1.5 weeks)
  * Famous tree traversal algorithms
  * Dijkstra's algorithm, Prim's algorithm, Kruskal's algorithm
- Priority Queues, Heap sort Algorithm, Binary Search Trees (review, only if time allows)
 (about 1.5 week)
- Hashing, String matching algorithms if time allows (review, about 1 week)
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If time allows we can talk about Network Flows, Polynomial Time Reductions and NP-completeness, and additional materials supplement to textbook.

The course outline and the order of topics I teach may be modified, depending on class needs and progress.

Not all sets of slides are covered directly in the class lectures. During the class, I may talk about some concepts not directly covered in slides or textbooks. I may also provide some extra slides or concepts to you to help cover any background material.

The information on this syllabus is subject to change(s). For example, I may see the need to spend more time mastering a particular concept, which may cause the need for changing the syllabus. If any, it will be carefully explained in class, and it is your responsibility to become aware of them.

Courtesies

- Deactivate all cellular phones during synchronous meetings.
- Students are not allowed to share the video lectures, assignments, exams, and any of the provided solutions to anyone not currently enrolled in our class.

Disability Accommodations

If you need accommodation, please use this link Accessibility Services to contact the related experts. Please contact me if my assistance is required.

Emergency information

California State University, East Bay is committed to being a safe and caring community. Your appropriate response in the event of an emergency can help save lives. Information on what

to do in an emergency situation (earthquake, electrical outage, fire, extreme heat, severe storm, hazardous materials, terrorist attack) may be found here, Please be familiar with these procedures. Information on this page is updated as required. Please review the information on a regular basis.

Note on Discrimination, Harassment, and Retaliation (DHR) Title IX and CSU policy prohibit discrimination, harassment and retaliation, including Sex Discrimination, Sexual Harassment or Sexual Violence

California State University East Bay is committed to a community free from sexual assault and violence. Title IX and CSU policy prohibit discrimination, harassment and retaliation, including Sex Discrimination, Sexual Harassment or Sexual Violence. CSUEB encourages anyone experiencing such behavior to report their concerns immediately. CSUEB has both confidential and non-confidential resources and reporting options available to you. As a faculty member, I am required to report all incidents and thus cannot promise confidentiality. I must provide our Title IX coordinator and or the DHR Administrator with relevant details such as the names of those involved in an incident. For confidential services, contact the Confidential Advocate at 510-885-3700 or go to the Student Health and Counseling Center. For 24-hour crisis services call the Bay Area Women Against Rape (BAWAR) hotline at 510-845- 7273. For more information about policies and resources or reporting options, please visit the following websites:here.

Brief summary of the University policies on cheating

Any incidence of cheating in this class will be severely dealt with. This applies to all assignments and tests. The *minimum* penalty for cheating will be that the student will not obtain any credit for that particular assignment. (This means that if in a test or assignment a student is found to have cheated, he/she will obtain zero in that test/assignment.) For the homework and programming assignments students are *encouraged to discuss* the problems with others, but one is expected to turn in the results of one's own effort (not the results of a friend's efforts). If it is a group assignment, the same applies for the members of each group — that is, the whole group is supposed to be involved in solving all different parts of the assignment. The names of the offenders will be maintained in the departmental files. The University may consider further penalties than listed here. The repeat offenders may be debarred from the University.

By enrolling in this class the student agrees to uphold the standards of academic integrity described at this website.

You can refer to the Canvas course areas and read "University Policies" and "Student Support Services" for further information.

Recommended System Requirements, Technical Requirements, & Technology

- Students will need a stable and reliable internet connection and a laptop or desktop computer for taking exams.
- Students may need a webcam, microphone, and speakers.

Student Services

To access student services offered at Cal State East Bay, click on the MyCompass icon to get you to your one-stop online student support hub for information on academic advising, tutoring,

financial aid, the library, the health center, technology support, career counseling, campus life, equity programs, and more.

The University is committed to maintaining a safe and healthy living and learning environment for students, faculty, and staff. Each member of the campus community should choose behaviors that contribute toward this end. More information about the community expectations for student conduct can be found at this link.

If you wish to appeal your course grade at the end of the semester or have other academic concerns related to a course, please visit the Grade Appeals and Academic Grievances (GAAG) section of the catalog, which explains the process.

Other Campus Resources

To access student services offered at Cal State East Bay, visit MyCompass, your one-stop-shop for information on advising, tutoring, financial aid, and more.

Bay Advisor is the online advising portal that undergraduate students use to find their advisor and make advising appointments. Graduate students should contact their major department directly for advising.

SCAA stands for Student Center for Academic Achievement. Visit the SCAA website for more information on tutoring and other academic support services.

The Office of Financial Aid provides information and support for students who are seeking financial aid and/or who have received financial aid awards.

Student Health and Counseling provides individual and small-group appointments as well as other wellness related services.

University Libraries provides 24/7 support for all your academic research needs.

Pioneers for H.O.P.E. assists students who are experiencing food insecurity, homelessness, or other crisis situations. DISC stands for Diversity and Inclusion Student Center. Visit the DISC website at (https://www.csueastbay.edu/diversity-inclusion/index.html) for more information on their mission, services, and events.

This link to Student Equity and Success Programs connects you with campus programs that focus on equity and success. These programs provide services and activities that support low-income, first-generation, historically underrepresented and underserved students.

This link to Student Life and Leadership connects you to student government, student organizations, and additional campus resources to support you in your journey at Cal State East Bay.

Muwekma Ohlone Tribal Land Acknowledgment For Cal State University East Bay located in Hayward, CA

Cal State University East Bay recognizes that it is located on the ethnohistoric territory of the Jalquin (hal-keen) / Yrgin (eer-gen), the ancestral and unceded land of the Chochenyo Ohlone-speaking People, the successors of the sovereign Verona Band of Alameda County. This land was and continues to be of great importance to the Muwekma Ohlone Tribe and other familial descendants of the Verona Band.