CS 413: Analysis of Algorithms, Fall 2018
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Office Hours: M: 3:30 pm - 4:30 pm, W: 3:30 pm - 4:30 pm, or by appointment only.

Class Schedule

Either CS 413-04 - Analysis of Algorithms - MW 11:00 am - 12:15 pm
Or CS 413-03 - Analysis of Algorithms - MW 2:00 pm - 3:15 pm

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 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 (e.g., *divide-and-conquer, dynamic programming, etc*) and the mathematical background necessary for analyzing the properties of these techniques and the algorithms based on them (e.g., *recurrence relations, graph theory*).

This course introduces students to the analysis and design of computer algorithms. Upon completion of this course, students will be expected to:

- Design, analyze, and implement efficient algorithms; work with asymptotic notations and efficiency analysis;
- Be familiar with major algorithms, specifically some well-known algorithms.
- Be familiar with important algorithmic techniques like dynamic programming, greedy algorithms, etc.
- Develop efficient algorithms for different problems. Analyze the complexity of different algorithms.

The students **ARE EXPECTED** to understand the material typically covered in CS 301 (and its prerequisites such as MATH 211). In particular, students should know how some basic algorithms like quicksort and mergesort work. 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.

Textbooks

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.

Web material

Please make sure that you are added to this course on Blackboard.

Please be sure to check the *Bulletin Board* — which can be reached from the CS 413 myCSUEB homepage by following the link to Discussion Board — regularly. *Course announcements* will be announced in the class or posted on the bulletin board (some course announcements may actually be posted on the bulletin board *only*).

Email

Since email has proliferated, and now constitutes the bulk of extra-classroom conversation between student and 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:` (for example, the subject line of your email may read `CS 413: 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, classnotes/class material, or the Bulletin Board. Please avoid asking questions in email which 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.

Evaluation

The grades will be based on
- Class participation (5%): The classroom is interactive. You will be given some problems to think about and discuss with your classmates. Participation in class discussions and trying to solve the given problems are of great worth. The credit will be given for thoughtful attempts and clear explanations, even if the correct answer is not reached.
- Homework, Programming assignments, and a presentation (25%): about five to seven assignments (could be more depending on class need and progress). For some hw assignments, not all the questions of the assignments may be graded: In those assignments, the instructor will *select a subset, usually 2 or 3, of the questions at random to be graded*; your grade in the assignment will be the *sum the graded questions* plus some fixed number of points that you will receive for each other answer submitted but not graded. Some assignments may be in groups of 2-3 students.
- Max (two Midterm exams) (30%),

- Final exam (40%)

All students are expected to be present on all exams; if for some unforeseen reason you may not be able to make it to one of the exams, I will need a verifiable document (e.g., a doctor's or hospital note, or some other form of documentation) supporting your absence: No makeup exams will be given without proper documentation.

All the exams will be closed book.

Grading scale

$90 - 100$ *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
- 2 days 75%, only if the solution for the assignment has not been posted yet
- 3 days 100%

Grade Disputes

A digital repository will be created for every assignment. A student may submit a digital copy (electronic file, picture of the written solutions, etc.) of his/her solutions to a hw assignment to the repository *before* the assignment deadline. Grade disputes for the hw assignments will *only* be considered if a digital copy of the respective solutions has been submitted. You may request a grade dispute for an 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.

Disability Accommodations

If you have a documented disability and need accommodation, please talk to Accessibility Services. Please contact me if my assistance is required.

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

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- Introduction
- Foundations
 * Algorithm, Problem solving, and Complexity
 * Analysis  and Asymptotic notations
- Review of some concepts like recursion, recurrence relations, etc (if needed).
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- Algorithmic techniques like
  * Divide and Conquer,
  * Dynamic Programming,
  * Greedy Algorithms,
  * etc.
- Network Flows (if time allows)
- Polynomial Time Reductions and NP-completeness (only if time allows).
- Additional materials supplement to textbook (only if time allows).
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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 textbook. I may also provide some extra slides or concepts to you to help cover any background material.

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 repeat offenders may be debarred from the University.