California State University Dominguez Hills

Computer Science Department

Course Syllabus

CSC 401/501 Design and Analysis of Algorithms, 3 units, Fall 2016

Course Information Monday and Wednesday, 5:30pm-6:45pm, SBS E116

Faculty Information Dr. Bin Tang
Assistant Professor of Computer Science

office hours Office is NSM E-117
Office hours: Mondays 3pm-4pm, Wednesdays 7pm-8pm, and Thursdays 4pm-5pm, or by appointment

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Course Information This course introduces several major and fundamental algorithm design techniques. Topics include basics of algorithm analyses, graph algorithms, greedy algorithms, dynamic programming, NP-hard problems, and approximation algorithms. Throughout this course, students are expected to go through the entire cycle of scientific research by

- identifying an algorithmic problem from a (sometimes) messy and vague problem out in the world,
- developing a model and formulating the problem mathematically,
- designing an algorithm to solve the problem,
- checking its correctness and analyzing its running time, and finally
- implementing the algorithm and analyzing its result using simulations, or well-known software.

Prerequisites Good programming experience with at least one high level programming language.

Course content and instructional method This course consists of lectures, five homework assignments, one term project (including a midterm and a final presentations, and a term paper), one midterm and one final exam. Homework is done individually, while the term project is done in groups of at most three students.

Required Textbook **Algorithm Design**, by Jon Kleinberg and Eva Tardos, ISBN: 0-321-29535-8.

Optional Textbook **Algorithms**, fourth Edition, by Rober Sedgewick and Kevin Wayne. Website: algs4.cs.princeton.edu, where it provides many working codes of algorithms in Java.

Term Project The best way to learn and appreciate algorithms is through real-world scenarios. In this class, we go through the entire cycle of scientific research by working on a term project. The topics of the term project are mainly about virtual machine and network function (middlebox) placement in data center networks. To start, please read following papers (you can google the titles and find them easily):

- The Cost of a Cloud: Research Problems in Data Center Networks
- A Cost Comparison of Data Center Network Architecture
- A Survey of Network Function Placement
- Application-aware Virtual Machine Migration in Data Centers

Problem of the Day (for fun) Periodically, we will discuss some interesting problems that are mainly interview questions (with algorithmic flavor) from high tech companies.

Lecture Schedule

WEEK	*DATE*	*READING*	*TOPICS*
1	8/22, 24	Chapter 1.1, 1.2	Stable Matching and Some Representative Problems
2	8/29, 8/31	Chapter 2.1, 2.2, 2.4	Basics of Algorithm Analysis
3	9/7	Chapter 3.1, 3.2	Graphs
4	9/12, 14	Chapter 3.3, 3.4	Graphs
5	9/19, 21	Chapter 4.1, 4.2	Greedy Algorithms
6	9/26, 28	Chapter 4.4, 4.5	Greedy Algorithms
7	10/3, 5	Chapter 6.1, 6.2	Dynamic Programming

8	10/10, 12	Chapter 6.3, 6.4	Dynamic Programming, **Midterm Exam**
9	10/17, 19	Chapter 8.1-8.3	NP and Computational Intractability
10	10/24, 26	Chapter 8.4-8.5	NP and Computational Intractability, **Midterm Presentation**
11	10/31, 11/2	Chapter 10.1-10.2	Extending the Limits of Tractability
12	11/7, 9	Chapter 10.3-10.4	Extending the Limits of Tractability
13	11/14, 16	Chapter 11.1	Approximation Algorithm
14	11/21, 23	Chapter 11.2	Approximation Algorithm
15	11/28, 30		Review, **Final Presentation**
16	12/5		**Final Presentation**

Examinations **Midterm Examination is on 10/12 Wednesday, in class. It covers the Chapters 1, 2, 3, 4, 6.**

Final Examination is on 12/12 Monday, 4:00pm-6:00pm. It covers Chapters 8, 10, 11.

Exams are close book/notes.

No class on 9/5 Monday, Labor Day Holiday

Grading

20% Homework Assignments
30% Midterm Exam
30% Final Exam
20% Term Project

Course letter grades For all assignments, their numerical grading equivalent, and course grade, the grading criteria is described as follows:

A – Outstanding Work: In addition to the criteria for a "B", superior knowledge regarding details, assumptions, implications, superior thinking with information relevant to application, critique, and relationship to other information. An outstanding mastery of the subject with excellence evident in preparation for and attendance in class sessions, curious and retentive mind, unusual ability to analyze and synthesize material, with a positive attitude making productive contributions to the learning community in the classroom.

B – Above Average Work: In addition to the criteria for a "C", more than adequate knowledge regarding technical terms, distinctions, and possesses an ability to use information. Above average student in terms of attendance, preparation, time management, mostly consistent in test taking, and attitude.

C – Average Work: Basic knowledge needed to function and carry on learning regarding major principles, central terms, major figures, also possesses an awareness of field or discipline. Average or typical student in terms of attendance, preparation, time management, inconsistent test taking, and attitude.

D – Below Average Work: Serious gaps in knowledge, confusion of concepts and categories, inability to recall basic information. Below average or atypical student in terms of attendance, preparation, time management, inconsistent test taking, and attitude--minimally passing in performance.

F – Not Acceptable Work: Absence of knowledge, incapable of carrying on a conversation about the subject, misunderstands most concepts, confuses all categories. Inadequate/insufficient performance. Repeat course.

Incompletes will not be given for this course without extenuating circumstances and convincing reasons demonstrated by the student to the instructor's satisfaction.

Grade Scale Grade is curved, based on students' standings in class.

Course Policies

Attendance, Preparation and Participation Arriving promptly to class, coming fully prepared, participating actively in the discussions and activities are important components of this part of your grade for the course. Tardiness and absences must be discussed with the instructor.

Classroom Disruption Learning is best achieved in an atmosphere where the passion for learning is encouraged and everyone has the opportunity to participate in classroom activities. There are six categories of student incivility that undermine this atmosphere. They are disengaged, disinterested, disrespectful, disruptive, defiant and disturbed behaviors. Actions that fall into these categories impede teaching and learning processes for all and will not be permitted. Scholarly disagreement with the instructor does not itself constitute incivility. Classroom actions that fall into one of these categories may result in dismissal from

the course.

Deadlines — All assignments for the course are to be completed and submitted on time in order to receive consideration for full credit of the assignment. No late submission, no email submission will be accepted.

Make-up Work — Late work is not permitted for any assignment in this course. No make-ups are available for any homework, assignment, or examination in this course.

Withdrawal Policy — See undergraduate and graduate catalog for policies on withdrawals, grade permanence and all policies relating to academic records.

Special Course Policies — The instructor may designate certain assignments as teamwork assignments. If every member of the team does a similar amount of work, every member of the team will receive the same grade. However, if the instructor perceives that there is an inequitable workload, then individual team members may receive more points, or fewer points, than other members. The decision to adjust the point distribution within a team is reserved for the instructor's discretion.

Academic Integrity Policy

Honesty, Integrity and Professional Ethics — The mission of CSUDH includes cultivating in each student not only the academic skills that are required for a university degree, but also the characteristics of academic integrity that are integral to a CSUDH education. It is therefore part of the mission of the university to nurture in each student a sense of moral responsibility consistent with the biblical teachings of honesty and accountability. Furthermore, a breach of academic integrity is viewed not merely as a private matter between the student and an instructor but rather as an act, which is fundamentally inconsistent with the purpose and mission of the entire university.

Consequences for violations of academic integrity in this class will automatically receive an "F" in the course and may be in jeopardy of expulsion from the university.

Academic dishonesty includes:

Cheating – Intentionally using or attempting to use unauthorized materials, information, or study aids in any academic exercise.

- Students completing any examination should assume that external assistance (e.g., books, notes, calculators, and conversations with others) is prohibited unless specifically authorized by the instructor.
- Students may not allow others to conduct research or prepare work for them without advance authorization from the instructor.
- Substantial portions of the same academic work may not be submitted for credit in more than one course without authorization.

Fabrication – Intentional falsification or invention of any information or citation in an academic exercise.

Facilitating academic dishonesty – Intentionally or knowingly helping or attempting to help another commit an act of academic dishonesty.

Plagiarism – Intentionally or knowingly representing the words, ideas, or work of another as one's own in any academic exercise."

Further details may be found in the Undergraduate Academic Integrity Policy. Wherever the current university policy is different from the policies in this syllabus, the university policy takes precedence.

Disability services — Students in this course who have a disability that might prevent them from fully demonstrating their abilities should meet with an advisor in the Office of Special Services as soon as possible to initiate disability verification and discuss accommodations that may be necessary to ensure full participation in the successful completion of course requirements

Bibliography

Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
Algorithm Design Manual, Steven Skiena.