CSE 830: Design and Theory of Algorithms

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Textbook: Introduction to Algorithms, Third Edition by Cormen, Leiserson, Rivest, and Stein, McGraw Hill, 2009 ISBN 0262033844
Meeting time & Room: Tu/Th 10:20-11:40am, 1234 Engineering Building
Pre-reqs: Knowledge of at least one major programming language, basic data structures, and recursion.
Web page: http://www.cse.msu.edu/~cse830/

Description: Analysis of algorithms. Algorithm design techniques. Efficient algorithms for classical problems. Intractable problems and techniques to cope with them.

Grading: 25% Homework ; 10% Project ; 20% Exam I ; 20% Exam II ; 25% Final Exam

Homework

There will be *five homework assignments* over the course of the semester, each contributing 5% of your final grade. Some assignments will contain a small programming component. On each homework assignment, only a subset of the problems may be graded.

You must work in *groups of three to four*; only one solution should be turned in for the entire group. The best way to understand the subtleties of algorithmic problems is to argue about the answers. Each of you should look at all of the problems independently, and not just divide them up. If you let your partners do all of the work, you will get burned on the exams and thus for your final grade. Always try to find the simplest answer to each problem; I reserve the right to take off points if your answer is unnecessarily complex, regardless of technical correctness.

You must *staple your homework* pages together -- I don't want you to lose points because one page of your homework got separated. The homework does not have to be typed, but please keep it neat. Anything I cannot read, I will not grade.

Homework assignments will be *due at the beginning of class*. You will lose 20% of your grade per class session late and no homework will be accepted more than a week late. I do understand that unexpected events befall even the most dedicated student, so I will provide a free one-week extension on a single assignment without a penalty. You do not have to ask for this - just write "free extension" on your homework when you turn it in. Do not waste this extension or feel obligated to use it; I will be very unhappy to give you another one even with a good excuse.

Project

In addition to the homework assignments, there is a single project (worth 10% of your final grade) where you must write a program individually; you may *not* share source code even within your group. The project will also be setup as a contest, so those of you who write the best (i.e., fastest and correct) programs will receive small prizes.

Exams

There will be a total of three exams: two midterms and a final. One week before each exam, I will provide a sample exam so that you will know what to expect. All questions on the actual exam will be based on either homework questions or those from the sample exams. Each exam will contain 140 points worth of questions, and you will only be expected to answer 100 points of them, so if you have trouble in limited areas, it won't prevent you from getting an A in the class. I do, however, plan to ask difficult questions so your algorithmic ability will be honed.

Grading

Your numeric grade shall be determined by your scores on the homeworks and exams, as described above. By default, grades from 90-100% will be in the A range, from 80-90 will be B's, 70-80 is C's, 60-70 is D's, and below 60 is an F. I reserve the right to adjust these numbers (probably in your favor) later in the term. Several other factors can also affect your final grade:

Extra Credit: Throughout the course, you will have opportunities to receive extra credit points: homework assignments and exams will have difficult questions labeled as extra credit, and in general I will reward particularly clever answers with extra credit points. Extra credit is never required, and I will construct any grade curve ignoring extra-credit points. Once grades are assigned, I will consider the extra credit to boost grades up one rank (that is, one-half letter grade). If your grade is borderline, it's always good to have some extra credit to sway my decision.

Participation: Those who participate in class provide me with another source of information as to how well they are learning the material, and how much effort they are putting into the course. I can use this information to help counterbalance a difficulty with exams or homeworks. Let's have an active class! Class participation will never harm your grade; always ask any questions you may have about the material.

Academic Dishonesty: Because a primary goal of this course is to teach professionalism, any academic dishonesty will be viewed as evidence that this goal has not been achieved, and will be grounds for receiving a failing grade in the course.

Re-grades: Requests for re-grading can go in either direction; I am often generous when I first grade something, so please be sure that I did make a mistake before you submit your request. I am, however, always willing to explain how to do any problems that you have trouble with. All requests for re-grades must come within one week of the return of the graded item. Thereafter, no requests will be considered, so be sure to pick up your returned assignments and exams on time. I reserve the right to ask for a regrade in writing so that I may evaluate it properly.

General Note

The goal of this class is for you to learn about algorithms. If you find that anything is coming in your way of that goal, please talk with me about it. I plan to keep the class flexible to the learning styles that seem to work best for the students, so feedback is always appreciated.

CSE 830 - Tentative Lecture Schedule

Week 1		
9/1	Course Introduction	Syllabus out; HW1 Out
Week 2		
9/6	Analysis Tools	Book: Chapter 3
9/8	Recurrence Relations	Book: Chapter 4
Week 3		
9/13	Elementary Data Structures	Book: Chapters 10-12
9/15	Applications of Sorting	HW1 due; HW2 out; Book: Ch. 6
Week 4		
9/20	Quicksort	Book: Chapter 7
9/22	Data Structures Workshop	
Week 5		
9/27	Data Structures Workshop - Part II	
9/29	Intro to Optimization Problems	HW2 due; Sample Exam I out; Book: Chapters 15-16
Week 6		
10/4	Catch up/Review	
10/6	**Exam I**	HW3 out
Week 7		
10/11	Using Dynamic Programming	
10/13	Knapsack Problems	
Week 8		
10/18	Optimization Problems Workshop	
10/20	Intro to Graph Algorithms	HW3 due; HW4 out; Book: Chapter 22
Week 9		
10/25	Topology and Connectivity	
10/27	Spanning Trees and Shortest Paths	Project out; Book: Chapters 23 & 24
Week 10		
11/1	Graph Algorithm Workshop	
11/3	Approximation Algorithms & Design Techniques	HW4 due; Sample Exam II out; Chapter 35
Week 11		
11/8	Catch up/Review	
11/10	**Exam II**	

Week 12

11/15	Special Topics	
11/17	P, NP, and NP-completeness	Book: Chapter 34

Week 13

11/22	NP-completeness proofs	Project due; HW 5 out
11/24	**No Class**	*Thanksgiving*

Week 14

11/29	Example Reductions	
12/1	Cook's Theorem	

Week 15

12/6	Intractability Workshop	
12/8	Catch up / Review	HW 5 due; Sample Final out

Week 16

12/16 **Final Exam (7:45am-9:45am)**