CS 5300 : Advanced Algorithms and Data Structures

Instructor: Dr. Chen-Fu Chiang
Time: Fri. 12:30 PM - 3:10 PM
Location: Summit Center 144
Office Hours: Wednesday, Thursday and Friday 9:00 AM - 11:00 AM @ CSC 138 or by appointment

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Text
Introduction to Algorithms, 3rd edition, T. Cormen, C. Leiserson, R. Rivest and C. Stein,
The MIT Press 2009.

Prerequisites
CS 4300 or instructor consent.

Course Description
The course is designed for computer science students and is intended to introduce them to the standard techniques used in analyzing algorithms. If time allows, we will go further with techniques needed to analyze algorithms, greedy algorithms, dynamic programming, advanced data structures, vector and matrix manipulation, sorting networks, number-theoretic algorithms and NP-completeness. This course is designed for graduate students in computer science and is intended to introduce them to the standard techniques used in analyzing algorithms. Examples from a variety of computer science sub-disciplines will be presented. The relationships between these sub-disciplines will be shown through the study of NP- completeness.

Objectives

- Analyze algorithms with respect to both their time complexity and space complexity
- Compare algorithms using established analysis techniques
- Determine an appropriate strategy for utilizing an algorithm, given both time and monetary constraints
- Understand the notions of class P and class NP problems

Topics :

- Foundations
  - The Roles of Algorithms in Computing
  - Insertion Sort
  - Growth of Function
  - Recurrences

- Sorting and Order Statistics
  - Heapsort
  - Quicksort
  - Sorting in Linear Time
- Data Structures
  - Hash Tables
- Graph Algorithms
  - Elementary Graph Algorithms
  - Minimum Spanning Trees
  - Single-Source Shortest Paths
  - All-Pairs Shortest Paths
- Selected Topics
  - Sorting Networks
  - Fast Fourier Transformation
  - NP-Completeness

Procedure/Grading
The lecture format will be the basic mechanism used in the course. Computer demonstrations in the classroom will be used whenever appropriate.

Assessment of student performance will use a criterion-referenced model which will include written assignments (30%, might have programming assignments), regular examinations (midterm 30%), and a comprehensive final exam (40%). For the written assignments, please type up your homework. I strongly encourage you to learn how to use latex. A late assignment will receive penalty of 25% off points earned for each day. Make-up exams are not given, unless under *extreme* circumstances. A typical grading scale will be as follows:

Percent	Grade
90 -100	A
80 - 89	B
70 - 79	C
60 - 69	D
Below 60	F

Academic Integrity/Policy
Plagiarism and Cheating of any kind on an examination, quiz, or assignment will result at least in an F for that assignment (and may, depending on the severity of the case, lead to an F for the entire course). See the UCM Academic Dishonesty Policy at http://www.ucmo.edu/student/documents/honest.pdf. I will assume for this course that you will adhere to the academic creed of this University and will maintain the highest standards of academic integrity. In other words, do not cheat by giving answers to others or taking them from anyone else. Make-ups are only given under extreme circumstances. I will also adhere to the highest standards of academic integrity, so please do not ask me to change (or expect me to change) your grade illegitimately or to bend or break rules for one person that will not apply to everyone.