CS695 Special Topics on Theoretical Computer Science: Approximation Algorithms

Administration and Getting Started

Instructor: Fei Li

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Office hours:
Engineering Building, Room 5326, Thursdays 4:15pm - 6:15pm or by appointments

Course web-site: `http://cs.gmu.edu/~lifei/teaching/cs695_fall10`

About this Course

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The area of approximation algorithms is aimed at giving provable guarantees on the performance of algorithms for hard problems. In this course, we will learn approximation algorithms and their analysis. We will also discuss about online algorithms and competitive analysis.

Prerequisites
1. CS 583 (Design and Analysis of Algorithms)

Weekly Schedule
- ▶ When: Tuesdays 7:20pm - 10:00pm
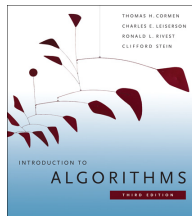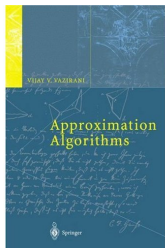- ▶ Where: Innovation Hall 134

Recommended Books

Approximation Algorithms

Approximation Algorithms by Vijay V. Vazirani (GaTech), Springer, 2003

Introduction to Algorithms

Introduction to Algorithms by Thomas H. Cormen (Dartmouth), Charles E. Leiserson and Ronald L. Rivest (MIT), Clifford Stein (Columbia), 3rd Edition, 2009

How to Reach Me and the TA

1. Instructor: Fei Li
2. Email: lifei@cs.gmu.edu
3. Office: Room 5326, Engineering Building
4. Office hours: Thursday 4:15pm - 6:15pm or make an appointment

1. No TA

Topics To Be Covered

1. Approximation Algorithms for NP-hard Problems

    1.1 Combinatorial Approaches (Set Cover, Steiner Tree and TSP and Euclidean TSP, Shortest Super-string, Knapsack, Bin Packing, Minimum Makespan Scheduling)

    1.2 LP-based Approaches (LP-duality, Set Cover, Scheduling on Unrelated Parallel Machines, Facility Location, Semi-Definite Programming for MAX-CUT)

2. Online Algorithms
   Amortized Analysis (Secretary Problem), Paging Problem, k-Server Problem, Buffer Management, Online Load Balancing

3. Learning Algorithms

4. Green Computing
   (depends on our schedule)

Topics Not Covered

1. Any algorithm background that you can find in the book "Introduction to Algorithms".
2. Linear programming.
3. NP-completeness inductions and proofs.
4. Those not mentioned in the above slide or our course website.

Making the Grade

Grading Policy

1. Assignments (20%)
2. Two presentations (40%)
3. A project. You can work on designing and analyzing an approximation algorithm for a NP-hard problem, or designing and analyzing an online algorithm for an online problem, or implementing some known approximation algorithms for some specific applications and provide experimental analysis. (40%)

Any Questions?