CSCI 6454: Advanced Analysis of Algorithms Fall 2006

Time M W 4:00 – 5:15 ECST 1B21

Instructor Hal Gabow ECOT 6-2 X2-6862 `hal@cs.colorado.edu`

Prerequisite CSCI 5454 (Design and Analysis of Algorithms) or equivalent

Requirements Problems (of your choice) & presentations of solutions; multipart reports on journal articles

Texts Course notes written by instructor, &
Introduction to Algorithms, 2nd Ed.
by T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein McGraw-Hill, NY, 2001
Approximation Algorithms
by V. Vazirani, Cambridge University Press, NY, 2001.

Recommended:
Network Flows: Theory, Algorithms and Applications
by R.K. Ahuja, T.L. Magnanti & J.B. Orlin, Prentice Hall, Englewood Cliffs, NJ, 1993
Randomized Algorithms
by R. Motwani & P. Raghavan, Cambridge University Press, NY, 1995.

We continue the study begun in CSCI 5454 of techniques for efficient algorithm design, and specific areas of discrete computation. The major topics of the course are graph algorithms and graph theory, randomized algorithms, and approximation algorithms. If possible some readings of papers from *SODA 2007 (ACM-SIAM Symposium on Discrete Algorithms)* will be covered.

The level of difficulty of the course is similar to CSCI 5454. No background in probability or linear programming is assumed, although previous exposure will help.

Topics
Topic A: Network Flow We study the maximum flow problem, its practical applications, efficient max flow algorithms, applications to graph connectivity and Min-max Theorems of graph theory, minimum cost flow.

Topic B: Approximation Algorithms. This has been a hot area over the last dozen years and many techniques have been developed. We survey some technqiues, and then concentrate on the use of linear programming. We progress from simple to more involved algorithms, in areas with real-life applications such as communication network design and facility location.

Topic C: Randomized Algorithms We review simple probability. We study high probability algorithms, Chernoff bounds (e.g., why quicksort works well with high probability), random sampling, algebraic techniques (polynomials), randomized rounding, and finally derandomization (how to get rid of randomness!)