College of Computer Science
Northeastern University
COM 3391: Advanced Algorithms

Fall 1999
Handout 2
29 September 1998

Tentative Course Schedule

Sep 29 **Overview of NP-Completeness**
P, NP, polynomial-time reductions
Reading: Chapter 36 of [CLR90]

Oct 6 **Introduction to approximation algorithms**
Approximation schemes for multiprocessor scheduling and knapsack
Reading: [Mot92]

Oct 13 **Traveling Salesperson Problem**
Reading: [Aro96] and Chapter 37 of [CLR90]

Oct 20 **Covering problems: Vertex cover and set cover**
Greedy techniques and randomization
Reading: [Mot92]

Oct 27 **Linear programming (LP)**
Introduction to LP
LP-based algorithms for set cover and vertex cover
Reading: [Goe94] and Chapter 3 of [Hoc95]

Nov 3 **Primal-dual method**
Reading: Chapter 4 of [Hoc95]
Take-home midterm handed out

Nov 10 **Primal-dual method**
Network design problems
Reading: Chapter 4 of [Hoc95]
Take-home midterm due

Nov 17 **Facility location**
Local search and LP-based algorithms
Reading: [CGST99, KPR98]

Nov 24 **Facility location**
Primal-dual method
Reading: [JV99]

Dec 1 **Online algorithms**
Caching, load balancing and virtual circuit routing
Reading: Chapter 13 of [Hoc95] and [ST85]

Dec 8 **Student presentations**

Dec 15 **Student presentations**

References

[Aro96] S. Arora. Polynomial time approximation schemes for euclidean TSP and other geometric problems. In *Proceedings of the 37st Annual IEEE Symposium on Foundations of Computer Science*, pages 2–11, October 1996. An extended version of the paper will appear in the *Journal of the ACM.*

[CGST99] M. Charikar, S. Guha, D. Shmoys, and É. Tardos. A constant-factor approximation algorithm for the k-median problem. In *Proceedings of the 31st Annual ACM Symposium on Theory of Computing*, pages 1–10, May 1999.

[CLR90] T. H. Cormen, C. E. Leiserson, and R. L. Rivest. *Introduction to Algorithms.* MIT Press, Cambridge, MA, 1990.

[Goe94] M. Goemans. Introduction to Linear Programming. Lecture notes, available from http://www-math.mit.edu/~goemans/, October 1994.

[Hoc95] D. S. Hochbaum, editor. *Approximation Algorithms for NP-hard Problems.* PWS Publishing Company, Boston, MA, 1995.

[JV99] K. Jain and V. Vazirani. Primal-dual approximation algorithms for metric facility location and k-median problems. In *Proceedings of the 40th Annual IEEE Symposium on Foundations of Computer Science*, October 1999. To appear.

[KPR98] M. Korupolu, C. G. Plaxton, and R. Rajaraman. Analysis of a local improvement heuristic for facility location problems. In *Proceedings of the 9th Annual ACM-SIAM Symposium on Discrete Algorithms*, pages 1–10, January 1998. Journal version to appear in the SODA 98 special issue of *Journal of Algorithms.*

[Mot92] R. Motwani. Lecture notes on approximation algorithms: Volume I. Technical Report STAN-CS-92-1435, Department of Computer Science, Stanford University, 1992. Postscript document is available at
http://Theory.Stanford.EDU/~rajeev/postscripts/approximations.ps.gz (134 pages).

[ST85] D. D. Sleator and R. E. Tarjan. Amortized efficiency of list update and paging rules. *Communications of the ACM*, 28(2):202–208, 1985.

[Vaz99] V. Vazirani. Approximation algorithms. Preliminary draft of monograph available at http://www.cc.gatech.edu/fac/Vijay.Vazirani/book.ps (118 pages), March 1999.