BOĞAZİÇİ UNIVERSITY

DEPARTMENT OF INDUSTRIAL ENGINEERING

Spring 2008

IE 494 - GRAPH ALGORITHMS AND APPLICATIONS

Day/Time/Classroom :	TTTh / 121 / TBA
Instructor :	Tınaz Ekim-Aşıcı (tinaz.ekim@boun.edu.tr)
Office/Phone :	Old Engineering Building, M 4055 / Ext. 6676
Office Hours:	TBA
Prerequisite :	None
Grading :	Homeworks 30 % Midterm 30 % Final Exam 40 %

Objective : The primary objective of this course is to provide necessary tools of graph theory in order to handle various engineering problems. Students are expected to acquire the ability of modeling real life problems as graph theory problems and expressing their ideas using graph theory terminology. Besides their power for modeling real life problems, graphs are also very important for their underlying mathematical theory. Consequently, the second objective is to provide students with a rigorous mathematical thinking skill using graphs.

Textbook : R. Gould, Graph Theory, 1988. Online at: http://www.mathcs.emory.edu/∼rg/m531.html and http://www.mathcs.emory.edu/∼rg/m532.html

References :

1. J. A. Bondy and U. S. R. Murty, Graph Theory with Applications, 1976. Online at: http://www.ecp6.jussieu.fr/pageperso/bondy/books/gtwa/gtwa.html
2. D. West, Introduction to Graph Theory, 2001.
3. C. Berge, Graphs and Hypergraphs, 1976.
4. TR. Jensen and B. Toft, Graph Coloring Problems, 1995.

COURSE OUTLINE

1. BASIC NOTIONS IN GRAPHS

Definitions, graph representations, modeling using graphs, graph search (BFS, DFS), shortest paths (Dijkstra algorithm, Bellman algorithm), minimum weight spanning tree (Kruskal's algorithm, Prim's algorithm)

2. EULERIAN AND HAMILTONIAN GRAPHS

Eulerian graphs, Fleury's algorithm, Chinese Postman Problem, Hamiltonian cycles, Traveling Salesman Problem

3. NETWORK FLOWS

Definitions, Maximum Flow Problem, Ford-Fulkerson Algorithm, Min Cut - Max Flow Theorem, Maximum Flow of Minimum Cost, Feasible Flows, Menger's theorem

4. MATCHING THEORY

Maximum matching, augmenting path, Edmond's algorithm, maximum matching and minimum vertex cover in bipartite graphs, König's Min-Max theorem, Min Cost bipartite matching, Assignment Problem, Hungarian Method

5. COLORING PROBLEMS

Edge coloring and its applications to timetabling and sport scheduling, Vizing's Theorem, König's bipartite graph edge coloring theorem, vertex coloring and its applications to frequency assignment and aircraft scheduling, Mycielski graphs, Brook's Theorem, 4-color theorem.