CAL POLY

September 2008

MATH 335 Graph Theory

1. Catalog Description

MATH 335 Graph Theory (4)

Introduction to graph theory and its applications: isomorphism, paths and searching, connectedness, trees, tournaments, planarity, graph colorings, matching theory, network flow, adjacency and incidence matrices. Further topics to be selected from the theory of finite state machines, Ramsey theory, extremal theory, and graphical enumeration. 4 lectures. Prerequisite: Junior standing or consent of instructor.

2. Required Background or Experience

Junior standing.

3. Learning Objectives

The student should gain an understanding of the fundamental concepts of graph theory.

4. Text and References

Possible texts:

Buckley, Fred and Marty Lewinter, A Friendly Introduction to Graph Theory, Prentice-Hall, 2002.
Chartrand, G. and Linda Lesniak, Graphs and Digraphs, 4th ed., Chapman & Hall/CRC, 2004.
West, Douglas B., Introduction to Graph Theory, 2nd ed., Prentice-Hall, 2000.
Wilson, Robin J., Introduction to Graph Theory, 4th ed., Addison-Wesley, 1996.

References:

Balakrishnan, V. K., Schaum's Outline of Graph Theory, McGraw-Hill Trade, 1997.
Cameron, Peter J., Combinatorics, Cambridge University Press, 1994.
Grimaldi, Ralph P., Discrete and Combinatorial Mathematics, 5th ed., Addison-Wesley, 2003.
Harary, Frank, Graph Theory, Addison-Wesley, 1995.

5. Minimum Student Materials

Paper, pencils, and notebook.

6. Minimum University Facilities

Classroom with ample chalkboard space for class use.

7. Content and Method

Topic	Lectures
a. **Introduction** Graphs and digraphs as models	1
b. **Isomorphism**	1
c. **Paths** Eulerian and Hamiltonian paths with applications to the postman and traveling salesman problems, determination of shortest and longest paths, scheduling, use of matrices to find the number of paths of a given length	6
d. **Connectivity** Edge and vertex connectivity, cutpoints, bridges, and blocks	2
e. **Trees** Kruskal's minimal spanning tree algorithm, rooted search trees, tree enumeration, the knapsack problem	4
f. **Tournaments**	2
g. **Planarity** Planar graphs, Euler's formula, testing for planarity, duality	4
h. **Graph Coloring** Edge and vertex colorings, chromatic polynomials, the Four-Color Theorem, graph embeddings and the Heawood Map-Coloring Theorem	6
i. **Network Flow and Connections with the Matching Theorem** Optimal flow algorithm and the theorems of Menger, Konig, and Hall	6
j. **Further Topics Selected by Instructor**	5
Total	37

Method
Lecture, discussion, student participation.

8. Methods of Assessment

Homework assignments, class demonstrations, quizzes, and examinations.