

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN  
DEPARTMENT OF MATHEMATICS  
COURSE DESCRIPTION — SPRING 2005  
MATH 412 — GRAPH THEORY

12noon MWF, 341 Altgeld Hall: D. Stolee (stolee @ illinois.edu)  
**Office:** 226 Illini Hall, Hours 2:00-3:30 MW or by appointment.

This is a serious introductory course about properties and applications of graphs. We study graph-theoretic concepts such as paths, Eulerian circuits, trees, distance, matchings, connectivity, network flows, colorings, planarity, and spanning cycles. A primary goal is to improve students' clarity of thought and language when writing proofs in discrete mathematics.

Famous applications include the **Minimum Connector Problem** (building roads at minimum cost), the **Marriage Problem** (matching men and women into compatible pairs), the **Assignment Problem** (filling  $n$  jobs in the best way), the **Network Flow Problem** (maximizing flow in a network of pipes), the **Committee Scheduling Problem** (using the fewest time slots), the **Four Color Problem** (coloring maps with four colors so that adjacent regions have different colors), and the **Traveling Salesman Problem** (visiting  $n$  cities with minimum cost).

**Requirements:** Weekly problem sets (15 points) require 5 out of 6 problems; students registered for 4 credits do all 6 problems. The twelve highest homework grades count. There are three tests, scheduled for the weeks of September 17th, October 15th, and November 12th. The exams will be two-hour evening exams, the exact time and day of the week will be scheduled during the second week of classes.

**Weighting:** Homework 180pts, Tests 100+100+100pts, Final Exam 150pts, Total 630pts. The homework provides practice finding proofs and writing proofs; writing up the solutions is among the most effective ways of keeping up with the material in the course.

**Resources:** Electronic mail is a medium for announcements and questions. Collaborative study sessions are offered from 7-9pm on Mondays in 145 Altgeld to aid students in understanding the material and solving problems.

Copies of homework assignments and some other material will be on the web at <http://www.math.uiuc.edu/~stolee/Teaching/12-412/>. To provide alternative viewpoints, several other textbooks will be on library reserve; these are listed at the web site.

**Prerequisites:** The official prerequisite is now Math 347 or CS 273 or equivalent experience. Students are best prepared if they have encountered logical reasoning, induction, and equivalence relations. Appendix A of the text discusses such mathematical background.

**Textbook:** Introduction to Graph Theory, West (Prentice Hall), Second Edition, Chapters 1-7.

**Special Circumstances:** If you have a circumstance that prevents you from performing to your utmost capacity in this class, such as a learning disorder or physical handicap, contact the division of Disability Resources and Educational Services (<http://www.disability.illinois.edu/>).

*The instructor reserves the right to modify this course.*