

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN  
DEPARTMENT OF MATHEMATICS  
COURSE DESCRIPTION — SPRING 2013  
MATH 412 — GRAPH THEORY

12noon MWF, 243 Altgeld Hall: D. Stolee (stolee@illinois.edu)

**Office:** 226 Illini Hall, Hours 1:00-3:00 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. Occasionally, a 1-point pop quiz will be taken at the start of class asking for definitions or theorem statements. There are three midterm exams, scheduled for the weeks of February 18, March 25, and April 22. The exams will be two-hour evening exams, the exact time and day of the week will be scheduled during the first week of classes. There will also be a three-hour final exam, 8:00-11:00 AM, Friday, May 10.

**Weighting:** Homework 180pts, Tests 100+100+100pts, Final Exam 150pts, Total 630pts+quiz points. 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 to aid students in understanding the material and solving problems. Sessions will be scheduled in the first week of classes.

Copies of homework assignments and some other material will be on the web at <http://www.math.uiuc.edu/~stolee/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.*