

MATH 412: Introduction to Graph Theory

Fall 2006 — Course Outline — University of Illinois

Sections X13/14: MWF 12-12:50pm, 443 Altgeld Hall

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Web page: <http://www.math.uiuc.edu/~hartke/teaching/math412>

Study sessions: Mondays 7:00-9:00pm, 141 Altgeld Hall

Office Hours: MWF 1:00-1:50pm or by appointment, 227A Illini Hall

Tests: Wednesdays, Sept 27, Oct 25, and Nov 29, in the evening; 2 hours long

Final Exam: 7:00-10:00pm Tuesday, Dec 12

TEXT: **Introduction to Graph Theory**, D. West (Prentice Hall), 2nd ed., Chp. 1–7.

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 *Assignment Problem* (filling n jobs in the best way), 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 from a choice of 6 problems; graduate students registered for 4 credits do all 6 problems. The twelve highest homework grades count. There are three tests plus a final examination, all of which are written and closed-book.

Weighting: homework 180 points, tests 100+100+100 points, final exam 150 points, total 630 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. Students may discuss the problems with each other as long as all help is properly cited in the solution. However, all students are expected to *individually* write their own solutions.

All students are expected to be aware of and abide by the University's policies on student conduct and academic integrity and honesty.

RESOURCES: Email and web pages can be used for announcements and questions. Collaborative study sessions are offered to aid students in understanding the material and solving problems. There are also several other graph theory textbooks on reserve in the library.

Students should discuss with the instructor any class conflicts or other problems as soon as possible. Late homework and makeups for missed tests and the final exam will only be allowed in extreme situations.

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