

# Graph Theory with Applications

Syllabus, Math 622, Spring 2012

## Contact information:

- Instructor: Karen Collins
- Place: 137 Exley
- Time: Thursdays 6:30-9:00 p.m.
- Book: *Introduction to Graph Theory* by Richard J. Trudeau, ISBN 978-0486678702, Dover Publications.
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This course will be an introduction to Graph Theory and to abstract concepts in mathematics. We will study both what mathematics is, why it is important, and how to do it. In our modern technological world, many communications networks can be described by a graph, namely, a set of dots and a set of pairwise relationships between the dots. For example, the World Wide Web is a set of computer users, connected by computer servers via routers. Another example is the set of Facebook users connected by “friend” relations. Our focus will therefore be on understanding finite graphs and their properties, including connectedness, isomorphism, chromatic properties and embedding on surfaces.

Class discussion and class participation will be crucial to understanding of the material, as will detailed and careful write-ups of the homework exercises. Homework will be assigned weekly and there will be a final project/presentation. Grades will be based 65% on homework and class participation, and 35% on the final project.

- Week 1 What is Mathematics? Mathematical games.
- Week 2 Sets and Paradox. Graphs and Isomorphism.
- Week 3 Planar graphs and Kuratowski's Theorem.
- Week 4 Mathematical Induction.
- Week 5 Euler's Formula.
- Week 6 Platonic solids and Symmetry.
- Week 7 Graph coloring and Chromatic Number.
- Week 8 The Five Color Theorem and the Four Color Theorem.
- Week 9 Genus of a graph. Euler's second Formula.
- Week 10 Heawood Coloring Theorem.  $g$ -Platonic graphs.
- Week 11 Connectedness and Euler Walks
- Week 12 Hamiltonian walks and Multigraphs
- Week 13 Final project presentations