

Algebraic Graph Theory, I

MTH 661, Fall 2009, Section 1

The object of mathematics is the honor of the human spirit. -Carl Jacobi

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Office Hours: Tuesday 10:00-11:00, Thursday 1:00-2:00 (or by appt.)

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Class time: 2:00-3:15 TR in 346 Neuberger Hall

Text: Chris Godsil and Gordon Royle, *Algebraic Graph Theory*, Springer. We will be working through the book in order, with an occasional diversion.

Background: This is the first of a three-term sequence in Algebraic Graph Theory. It is recommended that the student have taken courses in graph theory, group theory, and linear algebra before enrolling in this sequence. A degree of mathematical maturity appropriate for a 600-level course is assumed.

Goals: Graphs are basic mathematical structures that are used not only in a wide variety of applications, but also in many branches of mathematics itself. In this course, we focus on some of the surprising and elegant points of contact between graph theory and algebra. Topics will include: Cayley graphs of groups, automorphism groups of graphs, adjacency matrices, line graphs, vertex-, edge-, and arc-transitivity, vertex- and edge-connectivity, Laplacian matrices, and related spectral results.

Homework/Grading: Your grade will be based 80% on homework and 20% on a final exam. As material is covered in class, accompanying homework will be assigned. (Often this will mean that you are to choose 6 problems from the chapter). Budget your time wisely; reading the text and completing the homework is the core of this course, and are likely to require substantial time and effort on your part. Graph theory results can be tricky to see and even more subtle to prove rigorously. You are strongly encouraged to work together and discuss solutions with other students outside of class. In the end, however, each student must write up her or his own work. The ultimate due date for homework is the end of the term. I encourage you, however, to submit solutions throughout the term so I can provide preliminary feedback on your work.

The aim of science is to seek the simplest explanation of complex facts... The guiding motto in the life of every natural philosopher should be, "Seek simplicity and distrust it."

Alfred North Whitehead, in The Concept of Nature (1926)