Math 497E/564   Graph Theory   Winter 2012

Instructor   Amites Sarkar

Text   Modern Graph Theory
                        Béla Bollobás

Syllabus

Introduction

Basic definitions; trees; spanning trees; bipartite graphs; Euler circuits; planar graphs

Connectivity and matchings

Hall's theorem; Menger's theorem

Extremal graph theory

Long paths and cycles; Dirac's theorem; Turán's theorem; problem of Zarankiewicz; Erdős-Stone theorem

Graph coloring

Simple bounds; chromatic polynomial; theorems of Brooks and Vizing; five color theorem; Heawood's theorem

Ramsey theory

Ramsey's theorem; upper bounds for Ramsey numbers

Probabilistic methods

Lower bounds for Ramsey numbers; the model $G(n,p)$; graphs of high girth and high chromatic number

Eigenvalue methods

The adjacency matrix and Laplacian; strongly regular graphs

Notes

Graph theory is a young subject: almost everything in this course is less than 80 years old and many of the most exciting developments are really very recent. Furthermore, the basic concepts are very intuitive and all the proofs you are required to know are both short and elegant. However, understanding proofs is only half the course – the other half is solving problems. In graph theory, these are two separate skills, as you will discover.

Relation to overall program goals

Among other things, this course will (i) enhance your problem-solving skills; (ii) help you recognize that a problem can have different useful representations (graphical, numerical, or symbolic); (iii) increase your appreciation of the role of mathematics in the sciences and the real world.

Final

Wednesday 14 March 10:30–12:30 pm. This will be a closed book exam.

Grading

I will base the grade on **homework** (there will be 4 homework assignments), **presentations** (you will each have to do a 30 minute presentation at the end of the quarter) and the final (which will be worth about 50%). I'm in the process of drawing up a list of presentation topics, which I'll distribute within the next 2 weeks.

Office hours

My office hours are 3–3:50 on Mondays, Tuesdays, Thursdays and Fridays, in 216 Bond Hall. My phone number is 650 7569 and my e-mail is amites.sarkar@wwu.edu