

Instructor	Amites Sarkar
Text	Modern Graph Theory Béla Bollobás

Syllabus

Introduction

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

Flows, connectivity and matching

Hall's theorem; Menger's theorem; the max-flow min-cut theorem

Extremal graph theory

Dirac's theorem; Turán's theorem; the problem of Zarankiewicz

Graph coloring

Simple bounds; the chromatic polynomial; the five color theorem

Ramsey theory

Ramsey's theorem (finite and infinite); Erdős-Szekeres bound; Schur's theorem

Probabilistic methods

Lower bounds for Ramsey numbers; the model $G(n, p)$; the giant component

Algebraic 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

Friday 13 December 10:30 am–12:30 pm. This will be a closed book exam.

Grading

I will base the grade on **homework** (there will be 3 homework assignments, worth 10% each), **presentations** (you will each have to do a 30 minute presentation at the end of the quarter, worth 20%) and the final, worth 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 1–1:50 on Mondays, Tuesdays, Wednesdays and Fridays, in 216 Bond Hall. My phone number is 650 7569 and my e-mail is amites.sarkar@wwu.edu