Math 564 Graph Theory Fall 2021

Instructors	Hans Parshall and Amites Sarkar
Text	None required, but Diestel's book is a great reference

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; graphs with high girth and high chromatic number

Algebraic methods

The adjacency matrix; strongly regular graphs

Notes

Graph theory is a young subject, 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

This will be a take home exam, and will take place at the start of finals week.
We (Hans and Amites) will work out the exact details soon.

Grading

We will base the grade on **homework** (there will be 3 homework assignments, worth 15% each), **presentations** (in groups of 3 or 4, during the week after Thanksgiving, worth 15%) and the final, worth 40%.

Office hours (currently run by Amites)

2–2:50 on Mondays, Tuesdays, Thursdays and Fridays, in 216 Bond Hall.
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