MATH 553 – Graduate Graph Theory

Course Description from Bulletin: Graph Theory is the study of mathematical structures underlying the ubiquitous network models occurring in computer science, machine learning and optimization, electrical and computer engineering, physics, chemistry, and social networks. This graduate-level introduction to graph theory lays a rigorous foundation in graph theory through existential and algorithmic problems, structural and extremal results, and applications to science and engineering. Topics include trees, matchings, connectivity, planarity, and coloring. Credit will not be granted for both MATH 553 and MATH 454. (3-0-3)

Enrollment: Graduate students and advanced undergraduates from Applied Mathematics, Computer Science, Data Science, or other majors. Graduate Core Course for Applied Mathematics.

Textbook(s): West, *Introduction to Graph Theory,* 2nd ed., Prentice Hall, supplemented with Diestel, *Graph Theory, 5th ed.*, Springer-Verlag.

Prerequisites: MATH 410 or MATH 430 or MATH 453 or instructor's consent.

Objectives:

1. Students will achieve command of the fundamental definitions and concepts of graph theory.
2. Students will understand and apply the core theorems and algorithms, generating examples as needed, and asking the next natural question.
3. Students will achieve proficiency in writing proofs, including those using basic graph theory proof techniques such as bijections, minimal counterexamples, and loaded induction.
4. Students will work on clearly expressing mathematical arguments, in discussions and in their writing.
5. Students will become familiar with the major viewpoints and goals of graph theory: classification, extremality, optimization and sharpness, algorithms, and duality.
6. Students will be able to apply their knowledge to related topics.

Lecture schedule: Three 50 minute (or two 75 minute) lectures per week

Course Outline:	Hours
1. Fundamentals	6
2. Trees	6
3. Matchings	6
4. Connectivity and Network Flow	6
5. Coloring	6
6. Planarity	6
7. Project	2

Assessment:		
	Homework/Project	10-50%
	Quizzes/Exams	20-50%
	Final Exam	30-50%

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Date: 03/21/24