CAAM 570: Introduction to Graph Theory

Course Description
This course will explore the structure, properties, and beauty of graphs, together with a variety of applications. Fundamental concepts of graphs and digraphs, trees, matchings, connectivity, graph colorings, planar graphs, and networks will be studied. The tractability of various graph problems will be explored from an algorithmic and computational perspective.

Time and Room
Class meets Tuesday and Thursday, 9:25 - 10:40 in Mech Lab 251.

Instructor
Boris Brimkov
Office: Duncan Hall 3018
Office Hours: 10:40-11:30 Tuesday, 1:00-2:00pm Wednesday
email: boris.brimkov AT rice.edu

Textbook

Course Website
Visit www.caam.rice.edu/~bb19/caam570.html for assignments and other pertinent information.

Grading Policy
7 homeworks – 35%
1 project – 20%
1 midterm – 15%
1 final – 20%
class participation – 10%

Course Outline
Fundamentals of graph theory (2-3 weeks)
Intro to complexity theory (1-2 weeks)
Trees, distance, connectivity (2-3 weeks)
Network flows and matchings (2-3 weeks)
Planar graphs (1-2 weeks)
Graph coloring (2-3 weeks)
Advanced and modern topics (if time allows)

Groups
Students will divide into groups of 3-5 to work together on homework and a final project.
**Homework Policy**

Homework can be discussed within the groups, but each student must turn in a separate homework individually. Outside references, including textbooks, websites, and articles, may be used with proper citation. The blog [http://mindseye.fr/GT/](http://mindseye.fr/GT/), contains hints and cited errors in the book. Sometimes, hints might also be posted on the course website. Homework must be turned in by the beginning of class on the day it is due. No late assignments accepted for any reason. If a student requests a problem to be re-graded, I reserve the right to re-grade their entire homework/exam by my own criteria, which are possibly different from the graders’ criteria.

**Group Project**

Each group will give a 15 minute presentation of a concept in graph theory that is acquired through a primary source, i.e., a published (preferably recent) research article. You may use Google Scholar or MathSciNet to locate an article. In the presentation, provide definitions and examples to understand the material, give motivation/applications for the subject, and present a theorem and its proof from the paper. Also, prepare three homework-type questions related to the topic of the paper.

Students who have prior experience in graph theory and conducting research can petition to work on an extended project which results in a research paper. Only students who are deemed by the instructor to have sufficient experience will be allowed to undertake such a project. Students must submit a written proposal of a research problem they intend to work on to be approved by the instructor, or select a problem from a list that the instructor provides. The research must be conducted by a group of 2 (preferably) or 3 students, working together with the instructor. Groups must meet with the instructor weekly to discuss progress on the project. All technical work and a substantial part of the writing must be completed by the end of the semester. The obtained results will be graded on their novelty, correctness, and completeness; if the students wish, the grade for the project will count as their final exam grade as well as their final project grade. The amount of work expected for this project is far more than the amount of work it takes to prepare for a final exam; the main benefit for students who undertake such a project is to acquire depth in a topic of graph theory, research experience, and potentially a publication. Students who wish to work on such an extended research project should begin as soon as possible.

**Americans with Disabilities Act Statement**

Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with the instructor during the first two weeks of class. All discussions will remain as confidential as possible. Students with disabilities will need to also contact Disability Support Services in the Allen Center.