Mathematics 109Q, Graph Theory and Math Models
Spring, 2015

Mathematics 109 is an introduction to the area of mathematics known as graph theory. The course will introduce graphs and their basic properties, and introduce students to the process of mathematical inquiry. There is no expectation of familiarity with graph theory or even a strong high school mathematics background.

Goals:

The overall goal is to introduce students to mathematical inquiry by exploring graph theory, a mathematically rich area that requires relatively few mathematical prerequisites. At the end of the course, the student should demonstrate the ability to:

1. Identify several types of planar graphs and determine when a given graph embedding is planar.
2. Use basic properties of graphs to solve problems.
3. Discuss and explain several well-known problems and theorems in graph theory.
4. Identify several mathematicians and their contributions to graph theory.
5. Deduce patterns from a collection of related objects.
6. Produce and understand rudimentary mathematical proof.
7. Work as a group to solve appropriate yet challenging problems related to graph theory.
8. Clearly explain an assigned topic in graph theory so that their peers may also understand it.
9. Pose interesting questions that arise from small modifications of known results.

Text Material:

Graphs and Their Uses by Oystein Ore, revised by Robin J. Wilson.
In addition, supplementary excerpts and handouts will be posted on Blackboard.

Ways of Inquiry:

This course is designated a Ways of Inquiry course: this means the student will be expected to pursue mathematical knowledge rather than simply consume it. The subject matter of this class is likely new to each student and the aim is that we will discover some of the high points of the field together. In order to press on in our exploration, we will need to learn how to mathematically justify many of the statements we investigate as well as how to continue our inquiry by asking appropriate and interesting questions.

Grading:

Tests (3 @ 100 points each)	300 points
Problem Sets (4 @ 75 points each)	300 points
Class Participation	100 points
Group Project	200 points
Final Exam	100 points
Total	1000 points

Point totals will determine a student's final grade as follows: A: 900 points and up; B: 800-899 points; C: 700-799 points; D: 600-699 points; F: below 600 points. Plus and minus grades will be assigned based on point distributions within each whole letter grade.

Class:

Group investigations are a key component of this class; as such, students are expected to attend and actively participate in each class. In addition to being physically present, students are expected to be mentally present as well: gross under-preparedness for class will be treated the same as an absence. Mathematicians are not immune to illness, important events, and crummy days, so up to three absences will be permitted at no penalty. A student's participation grade will be penalized 10 points per additional absence. On the other hand, demonstrating exemplary initiative and ownership in their group's work has the potential to earn the student a small bonus to their participation grade.

Problem Sets:

Groups will turn in four problem sets throughout the course of the semester. These problems will require each group to work together outside of class to explore, understand, and explain mathematical phenomena that complements or extends material covered in class. This aspect of the assignment is meant to be a true group effort: simply dividing up the problems and solving them individually is not the intent! The solutions to these problems are to be cleanly written up and submitted as a group.

In addition to this group submission, each individual member is expected to submit a brief analysis of their experience in solving the problem set as a group: this analysis should address their comfort and understanding of the material encountered, their attitude towards the inquiry process, and their involvement in the group process. It is appropriate here to mention problems within the group (bickering, non-participation, etc.) so long as it is done in a civil and respectable manner.

Group Project:

A capstone project for the class will be for each group to investigate a topic related to graph theory and share the results of their investigation. The two main products of this investigation will be a paper (with the instructor as the intended audience) and a presentation (with your peers as the intended audience). Both of these products should explain the fundamental ideas of the topic being investigated, clearly explain and prove (or provide a sketch of the proof) for an important result related to the topic, and pose a novel relevant question suitable for additional mathematical research. Additional information on possible topics and exact expectations will be provided online.

Tests:

Students are expected to take tests at the scheduled times. Conflicts, problems and emergencies will be handled on an individual basis. For reasons deemed legitimate by the professor, arrangements may be made for a student to take a test prior to the testing time. Arrangements must be made several days in advance.

Any student requiring special accommodations must present their letter of accommodation provided by the college; the student must make arrangements for these accommodations several days in advance of the scheduled test date.

A cumulative final exam, including material from the group presentations, will be given at the time assigned by the college.

Course Outline:

We will use topics from our text to guide our inquiry. Our investigations will often not align precisely with the material covered in the text, but will expand and enrich this material. Two tests will occur before midterm, and one will occur shortly after this point. The last week of class will be reserved for groups to present the results of their project. Problem sets will generally be due about a week before each test, including the final exam.

The following is merely a guideline for course content and is subject to change.

Week of:
January 12- Chapter 1
January 19- Chapters 1 & 2; Start Groups
January 26- Chapters 2 & 3; ***Problem Set 1 Due***
February 2- Chapter 3 & Review; ***Test 1***
February 9- Chapters 4 & 5
February 16- Chapters 5 & 6; ***Problem Set 2 Due***
February 23- Chapter 6 & Review; ***Test 2***
March 2- Group Project Work Begins
March 9- Spring Break
March 16- Chapter 7
March 23- Chapters 8 & 9; ***Problem Set 3 Due***
March 30- Chapter 9; ***Test 3***
April 6- Further Investigations; Group Projects
April 13- Further Investigations; Group Projects
April 20- Group Project Presentations; ***Problem Set 4 Due***
April 27- Review; ***Final Exam 5/4 at 9am***

THE HONOR CODE OF OXFORD COLLEGE APPLIES TO ALL ASSIGNMENTS IN THIS COURSE. BY YOUR SUBMISSION OF SUCH WORK, YOU PLEDGE THAT WORK WAS DONE IN ACCORDANCE WITH THE RULES STIPULATED ON THE ASSIGNMENT OR IN THIS SYLLABUS AND THAT YOU ARE UNAWARE OF ANY SUCH VIOLATIONS OF THE HONOR CODE.