Math 109Q
Fall 2016

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Office Hours: Usually Monday through Thursday 3pm – 5pm

Course Content: 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.

Course 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 you 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.

Inclusivity: If you have a documented disability and have anticipated barriers related to the format or requirements of this course, or presume having a disability (e.g. mental health, attention, learning, vision, hearing, physical or systemic), and are in need of accommodations for this semester, we encourage you to contact the Office of Access, Disability Services, and Resources (ADSR) as soon as possible to learn more about the registration process and steps for requesting accommodations.

If you are a student that is currently registered with ADSR and have not received a copy of your accommodation notification letter within the first week of class, please notify ADSR immediately by emailing Megan Bohinc at ADSROxford@emory.edu. Students who have accommodations in place

are encouraged to coordinate a face to face meeting with your professor, during the first week of the semester, to communicate your specific needs for the course as it relates to your approved accommodations. All discussions with ADSR and faculty members concerning the nature of your disability remain confidential. For additional information regarding ADSR and how to register, please visit the website: equityandinclusion.emory.edu/access.

Grading: Final course grades will be determined as follows:

Class Investigations	100 points
Problem Solutions (8×25 pts)	200 points
Tests (2×100 pts)	200 points
Research Journal	200 points
Article Project	200 points
Final Exam	100 points
TOTAL	1000 points

In general, letter grades will be determined as follows, based on points each student earns: A: at least 900 points; B: 800-899 points; C: 700-799 points; D: 600-699 points; F: fewer than 600 points. Grades of A-, B+, B-, C+, C-, D+ may be assigned for sums of points near these cut-off totals.

Teams: Students will be divided into small groups for the majority of the semester. Your team will work together on most assignments in the course, with the primary exception being tests. It is important that team members contribute to each assignment equally: this work is the responsibility of the entire team and should be completed by the entire team. You will have the opportunity to submit brief evaluations of your team; it will be appropriate here to mention problems within the group (bickering, non-participation, etc.) so long as it is done in a civil and respectable manner.

Class Investigations: Group investigations are a key component of this class; as such, you are expected to attend and actively participate in each class. In addition to being physically present, you 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; your grade will be penalized 10 points per additional absence. On the other hand, demonstrating exemplary initiative and ownership in your team's work has the potential to earn a small bonus.

Problem Solutions: Very broadly, the process of mathematical knowledge-making goes through three steps: a problem is posed, a solution is sought, a solution is published. Once someone finds a solution to a problem, it's likely that they will talk through it with others; however, in some sense the solution isn't complete until it's written down and shared with others. Many problems will be posed in this course. At several points throughout the semester, your team will be tasked with writing up a full solution to a problem. We will likely discuss the solution in class, but it will be up to you to craft a written document that clearly and completely conveys how to solve the problem.

Tests: There will be two tests, to be held on the following Thursdays: September 29 and November 10. These tests will cover basic concepts and statements of fact, not the demonstration of mathematical procedures as is often the case for math tests. Rather than preparing for these tests by carefully working practice problems, prepare by reviewing important definitions and constructing examples (and non-examples) of these concepts.

Research Journal: As mentioned above, mathematical knowledge is created through the process of posing problems, seeking solutions, and distributing solutions. Throughout the semester your team will be responsible for posing good research problems related to graph theory and seeking their solution. It's entirely likely that you will not arrive at a solution to these problems, but the pursuit of one is sufficient for our purposes. Your team will keep a binder containing lists of your developing questions and work towards answering these questions. This work will be submitted regularly for feedback.

Article Project: Later in the semester, each team will be assigned an important article in graph theory. The team is responsible for broadly understanding the content of this paper. Each team will produce a video (in the style of a math vlog as seen on YouTube) explaining the theorem, any prerequisite concepts, an interesting application of the theorem, and an outline of the proof.

Course Outline: We will use topics from the textbook to guide our inquiry. Our investigations will often not align precisely with the content covered in the reading for each class, but will expand and enrich this material. Broadly, we will explore concepts covered in and related to Chapters 1–5 before Test 1, and then Chapters 6–9 until Test 2. Any subsequent time will be devoted to further exploring topics of interest to the class. Note that this timing may change, dependent upon the needs of the class and the particular works used in the Article Project this semester.

The Honor Code of Oxford College applies to all work submitted for credit in this course. By submitting such work, you pledge that work was done in accordance with the rules stipulated on the work and in this syllabus.