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**Course Content:** This discovery seminar 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:** *Introduction to Graph Theory* by Richard J. Trudeau; in addition, supplementary excerpts and handouts will be posted on Canvas.

**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.

**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 in these evaluations to mention outstanding behavior from other team members—positive or negative—as well as a reflection on your own contributions.
**Grading:** Final course grades will be determined as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>Class Investigations</td>
<td>100</td>
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<tr>
<td>Problem Sets</td>
<td>200</td>
</tr>
<tr>
<td>Tests (2 × 100 pts)</td>
<td>200</td>
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<tr>
<td>Research Journal</td>
<td>200</td>
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<tr>
<td>Article Project</td>
<td>200</td>
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<tr>
<td>Final Exam</td>
<td>100</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>1000</strong></td>
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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.

**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 Sets:** Very broadly, the process of mathematical knowledge-making goes through three steps: a problem is posed, an answer is sought, a solution is produced. 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: October 3 and November 14. These tests will emphasize basic concepts and statements of fact, rather than precise mathematical procedures as is often the case for math tests. While preparing for these tests by carefully working practice problems is useful, it is often more helpful to prepare by reviewing important definitions and constructing examples (and non-examples) of the objects and properties we have encountered in class.

**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 collection 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 have the opportunity to select an article proving some result 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, key prerequisite concepts, a demonstration or application of the theorem, and a sketch outline of the proof.
**Final Exam:** The final exam will be given according to the exam schedule. Students, including students with related accommodations from the Office of Accessibility Services (OAS), must follow the posted exam schedule. Students must secure the approval of the associate dean of academic affairs to take a final exam earlier or later than scheduled. Permission will also be granted for students scheduled to take three exams on a single calendar day (not three exams within a general twenty-four-hour period). Students must document their situation with the associate dean for academic affairs no later than April 1 in spring semester and December 1 in fall semester. Students in this situation may be granted permission to take one of their exams at an alternate date and time within the official exam period. Students may not select which exam is rescheduled.

**Important Dates:** Take note of the following important events and deadlines:

- September 17 (Tue): Introduction to Digication
- September 27 (Fri): First research journal submission due
- October 3 (Thu): Test 1
- October 17 (Thu): Article project kick-off
- November 1 (Fri): Second research journal submission due
- November 8 (Fri): Article project storyboard due
- November 14 (Thu): Test 2
- December 3 (Tue): Article project showcase
- December 10 (Tue): Final research journal submission due
- December 16 (Mon): Final exam (9am)

**Honor Code:** Oxford College is a community of scholars. As scholars, we are interested in pursuing truth and becoming more adept at our individual contribution to this pursuit. As a community, we have certain expectations of—and responsibilities to—each other in our scholarly endeavors. The Honor Code is the document detailing expected behaviors as members of this community, as well as the means by which these expectations are upheld; a copy of this document is available at [http://oxford.emory.edu/catalog/regulations/honor-code.html](http://oxford.emory.edu/catalog/regulations/honor-code.html).

Generally, if permission is not given in writing to use a certain resource—including collaboration with other people—then any use of that resource in the completion of an assignment constitutes a violation of the Honor Code. While completing in-class assignments, all personal papers and cell phones must be put away for the duration of the assessment. Students who have taken an exam or test must not discuss the content or nature of the assessment until all students have completed the assignment. Any graded out-of-class assignments should be completed using only the resources explicitly permitted in that assignment’s written instructions. The guidelines listed here are not intended to be exhaustive; if you are uncertain about any aspect of how an assignment is to be completed, ask first!

**Written Style:** Thoughts are expressed through sentences, even in mathematics. Mathematical arguments will often use symbols to efficiently convey complex ideas, but these notions are still communicated through sentences. Note “1+1 = 2” is a complete sentence: it has the subject “1+1”, verb “=”, and predicate “2”. It is important to clearly communicate solutions using appropriate mathematical symbols and complete sentences; pertinent work needs to be neat and orderly to be intelligible. Taking time to be neat while working problems often eliminates careless mistakes and allows the writer (and ultimately, the audience) to focus on the main concept at hand.
Absences: It is the student’s responsibility to notify the instructor as soon as possible in the event of an absence from an assessment. If an excused absence from a test is known in advance—such as those due to official school functions or religious holidays—arrangements can be made to take the test ahead of time. Missing a test due to an emergency will be handled on a case-by-case basis; such absences must be documented (e.g. a doctor’s note in case of illness) in order to be excused.

Religious Holidays: Instructors are encouraged, not required, to accommodate students’ academic needs related to religious holidays. Please make every effort to negotiate your religious holiday needs within the first two weeks of the semester; waiting longer may compromise your instructor’s ability to extend satisfactory arrangements. If you need guidance negotiating your needs related to a religious holiday, the College Chaplain, Rev. Lyn Pace, ppace@emory.edu, Candler Hall 202, is willing and available to help. Please be aware that Rev. Pace is not tasked with excusing students from classes or writing excuses for students to take to their professors. Emory’s official list of religious holidays may be found at http://www.religiouslife.emory.edu/faith_traditions/holidays.html.

Accessibility: 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 Accessibility Services (OAS) to learn more about the registration process and steps for requesting accommodations at oas.oxford@emory.edu. If you are a student that is currently registered with OAS and have not requested or received a copy of your accommodation notification letter, please notify OAS immediately. Students who have accommodations in place are encouraged to coordinate with their professor during the first week of the semester, to communicate specific needs for the course as it relates to approved accommodations. Accommodations may not be implemented until the instructor is provided an accommodation letter and discusses the accommodation plan for this course face to face with the OAS student. Accommodations may not be implemented retroactively. All discussions with OAS and faculty concerning the nature of your disability remain confidential. For additional information regarding OAS, please visit the website: http://accessibility.emory.edu.

Inclusivity: Oxford College of Emory University’s ideals of inclusivity compel us to foster an environment where people of diverse backgrounds, identities, abilities, and ideologies are affirmed, respected, and seen as a source of strength—where we strive to learn together, and ultimately thrive communally. When these ideals are not upheld, we encourage discussion to better understand and spur action towards improvement. In my teaching, I always aim to challenge your thinking, but never to challenge your identity. If there is anything I can do to help you feel more comfortable and engaged (pronoun usage, calling on you more often, calling on you less frequently, etc.), please let me know.

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 assignment and in this syllabus.