MATH 4513–Section 001 Senior Seminar

Welcome to MATH 4513-001 Senior Seminar! First of all, here is some contact information.

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Course Web Page: http://math.ou.edu/~nbrady/teaching/s10-4513
Office Hours: Mon 10:00-11:00, Tue 2:00-3:00, Wed 12:30-1:30, or by appointment.

Course Outline: Our main goal is to understand the following result of Banach and Tarski. In non technical language it says the following. *It is possible to decompose a solid ball in* 3*–dimensional Euclidean space into a finite number of pieces, and then to rearrange those pieces in space (using rigid motions, no stretching or distorting) to form two solid balls of exactly the same size as the original.*

Given your usual intuition about volumes (and cutting oranges into segments!) this might sound completely paradoxical. Indeed, it is often referred to as the Banach-Tarski paradox, but it is a theorem.

We will learn some geometry, set theory and group theory in preparing for a proof of the Banach-Tarski result. This is a senior seminar course, so your active participation is extremely important. The final destination of the course is not as important as our journey there, and what you learn on that journey. We will take a meandering route to our destination, touching on some applications of group theory to puzzle solving (eg. the 15–puzzle, the Rubik's cube), to enumeration problems (the Burnside (Cauchy-Frobenius) lemma), and to geometry (Frieze patterns, wallpaper patterns, symmetry groups of geometric objects). We will discuss finitely generated groups, and learn how to think of these as geometric objects (via Cayley graphs). There will be many opportunities for group projects along the way.

Lectures: You are expected to attend all lectures, and are responsible for all information given out during them. In particular, this includes any changes to the quiz/midterm dates or content.

Your participation is important in lectures. At a minimum, you will have to periodically get up to the board and write out solutions to homework exercises. Ideally, you will participate in classroom discussions. As in any course, you will optimize your gain from the lectures if you try to read the relevant sections of the textbook **before** attending class.

Grading Scheme: Grades will be assigned by weighting your totals from Homeworks, a Midterm, and a Final Examination (project) as follows:

Homeworks	20%
Midterm Total	20%
Final Project	60%

Homework: Homework will be due in class on Thursdays. You are responsible for ensuring that your homework gets turned in on time.

Midterm: There will be one midterm. The main point of this is to ensure that everyone works at understanding the core group theory and geometry content of the course.

Final Project: After we have covered the core topics in group theory and geometry, final projects will be distributed for you to work on in pairs. Each pair will be assigned a different project. The projects will be graded in stages.

1. *Stage 1.* Initial visit to my office. Provide me with an initial list of sources (books, articles, web pages) which you intend to use while working on the project, and a description of how you'll go about the project. Discussion and possible suggestions for other sources.

2. *Stage 2.* Follow up office visit. Give a short dry run of the presentation that you will make to the class. This should include an initial draft of your project write up. Record any comments//suggestions.

3. *Stage 3.* The in class presentation. Comments from class and form Dr. Brady.

4. *Stage 4.* Write up of the project (to be turned in by final examination day).

Policy on W/I Grades: Check out the academic calendar at
http://www.ou.edu/admissions/home/academic_calendar.html

Until Feb 1, there is no record of grade for dropped courses. From Feb 2 through Feb 26, you may withdraw and receive an automatic W grade, *no matter what scores you have so far achieved*. From March 1 onward, the grade for a dropped course is either W or F; you will need to see me about grades if you wish to withdraw. From April 5 on, University regulations specify that you may withdraw only with the permission of the College Dean.

Students who are failing the course should not expect to receive an "I" grade in place of a "W" grade. I will only consider assigning an "I" grade if the situation satisfies the following criteria.

1. the student is already maintaining a passing grade,

2. the student has completed most of the course work, and

3. the student can demonstrate that he/she is unable to complete the work at this time due to circumstances beyond his/her control.

Academic misconduct: Visit http://www.ou.edu/provost/integrity for the rules governing cases of academic misconduct. See also the *Academic Misconduct Code*, which is part of the *Student Code* and can be found at http://judicial.ou.edu/content/view/27/32/.

Accommodation of Disabilities: The University of Oklahoma is committed to providing reasonable accomodation for all students with disabilities. If you require special accomodation in this course you are requested to speak with me as early in the semester as possible. Students with disabilities must be registered with the Office of Disability Services prior to receiving accomodations in this course. The Office of Disability Services is located in Goddard Health Center, Suite 166, phone (405) 325-3852 or TDD only (405) 325-4173. Their website is at http://drc.ou.edu.

Religious Holidays: It is the policy of the University to excuse absences of students that result from religious observances and to provide without penalty for the rescheduling of examinations and additional required class work that may fall on religious holidays.

Students who plan to observe a religious holiday which may conflict with a class time, should notify me as soon as possible (preferably within the first week of the semester), so we can make appropriate arrangements.