

# Math 1230 Syllabus

Prof. Richard Schwartz

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**Instructor:** Prof. Richard Schwartz  
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**Course Time/Place:** Tu-Th 2:30-3:50 Salomon Hall 203

**Course Description:** This course covers some of the basic topics in graph theory. I hope to cover a lot of “the classics” in graph theory. Here is, roughly speaking, the list of topics that I will cover:

- **trees** (spanning trees, Prufer codes, Matrix-Tree theorem)
- **planar graphs** (polygonal Jordan curve theorem, Euler characteristic, non-planarity proofs, Kuratowski’s Theorem)
- **graph coloring** (chromatic number, chromatic polynomial, 5-Color Theorem, Brooks’s Theorem)
- **graph matching** (Hall’s matching theorem, Gale-Shapely matching algorithm)
- **network connectivity** (max-flow/min-cut, Menger’s theorem)
- **electric networks** (resistance, conductance, Polya’s random walk)
- **Ramsey theory** (The basic theorem, applications) recurrence theorem)
- **Random graphs** (Rado’s Theorem, probabilistic existence proofs)

- **Additional topics** (Cayley Graphs, Sperner's Lemma, matroids)

I plan to spend a week or two on each of the topics above, in the order that they are listed. I've listed some additional topics in case we have some time left over at the end of the semester. Most of the topics are covered in the course textbook, be *Introduction to Graph Theory, 2nd Edition*, by Douglas B. West, but I'll jump around somewhat in the text.

**Objectives:** Here are 4 main objectives for the class.

- Learn the course material.
- Solve challenging math problems.
- Practice writing mathematical proofs.
- Develop combinatorial and algorithmic reasoning skills.

**Learning Goals:** The goal of this class is to teach students some of the fundamental topics of graph theory, and to sharpen their theorem-proving skills within the context of the subject. Given the concrete and open-ended nature of graph theory, another goal for the class would be to inspire some of the students to get involved in research projects.

**Student assessment:** As is typical with upper level math courses, students will be given weekly homework, several midterms, and a final exam. My usual breakdown is:

- HW: 20 percent
- midterm : 40 percent
- final: 40 percent

**HW Assignments:** There will be weekly HW assignments. The assignments will consist of 5 to 10 problems each week. Sometimes the problems will be from the book and sometimes I will make them up. I will post the assignments on my website (<http://www.math.brown.edu/~res/M1230>) each Tuesday and then collect them the next Tuesday in class. There is no late HW allowed.

**Readings:** The book for the course is *Graph Theory* by Douglas B. West.

**Accommodations:** Brown University is committed to full inclusion of all students. Please inform me, as soon as possible, if you have any conditions which might require special consideration. For more information, please contact the Student and Employee Accessibility Services (SEAS) at SEAS@brown.edu or 401.863.9688.

**Credit Hours:** The class meets 2.5 hours per week, for 13 weeks. This totals to about 33 hours of in-class material. There will be weekly readings from the book and (as mentioned above) weekly HW assignments. Given the wide range of students taking an upper level math class, it is impossible to give a precise estimate on the amount of time these readings and assignments will take, but it seems not unreasonable to say that *on average* these tasks, together with studying for exams, will take between 11 and 12 hours per week, totalling about 147 in all. So, the total time the average student can expect to spend on this class is 180 hours.