

Map Coloring, Graph Theory and the Four Color Theorem

Time and Place: MTh 1.30–2.50pm, Sci217

Level: Intermediate, 4 credits

Instructor: Matt Ollis, matt@marlboro.edu

Website: http://cs.marlboro.edu/courses/spring2012/graph_theory/home

Blurb: Every map, no matter how the countries are laid out, can be colored using just four colors in such a way each pair of adjacent countries are different colors (there are some minor, natural restrictions). This is the celebrated Four Color Theorem. Conjectured to be true in the 1850s and subject to many failed attempts at proof, it was controversially settled in 1976. The controversy comes from the fact that the proof relies on a computer calculation; no human has (or could) check all of the details. This result lies within the field of Graph Theory, one of the most vibrant subfields of math of the last 100 years (and still so today). This course will take us through the methods used in the proof of the Four Color Theorem by way of many discursions into Graph Theory. Topics to be covered include chromatic polynomials, hamiltonicity, planarity, graph decompositions and classifying polyhedra. We'll also investigate related problems: What if each country has a lunar colony that must be colored with the same color as that country? How many colors would we need if we lived on a torus?

Grading: The most important part of the class is your engagement with the material and, in particular, the process of proving mathematical results and solving mathematical puzzles. You will be expected to both regularly share your proofs with the class and work on problems together. In addition, there will be regular homework assignments, at least one extended individual project (with write-up and presentation) and a take-home final exam. The precise proportions that each aspect will contribute to your grade will be decided as a class early in the semester.

What now: Make sure you have access to the text, *Graphs, Colourings and the Four-Colour Theorem* by R. A. Wilson, and read Chapter 1, the (short) introduction. Attempt to solve Problems 1.1 and 1.2 and be ready to discuss your attempts in class on Monday.

Academic Integrity: You are expected to be aware of the college's policy on academic integrity and to abide by it. It can be found on the college website, and is linked from the course website. Please come and talk to me if anything is unclear.