MAT 280: Experimental Mathematics
Spring 2017

Course syllabus[1]

Course instructors: Dan Romik and Anne Schilling

Course meeting times: Mondays 10:00-12:50[2]

Course web page: `www.math.ucdavis.edu/~romik/experimental-mathematics/`

Course description

Experimental mathematics is the approach to doing research in pure mathematics by systematic experimentation to discover and sometimes prove new phenomena, usually (these days) using a computer. The idea is both old and new: Gauss, Euler, Riemann were all experimental mathematicians, and so are many modern mathematicians. In particular, nowadays the practice of experimental mathematics has become much easier and more widespread thanks to sophisticated mathematics software applications such as `SageMath` and `Mathematica`, which have become an indispensable tool for research in many areas.

The goal of this course is to teach you both the philosophy and the practice of experimental mathematics. We argue that a mathematician with working knowledge of these ideas and techniques is a better mathematician, regardless of their chosen area of research. This will be demonstrated with many examples from actual research done by the instructors and guest speakers. These include examples from combinatorics, probability and Markov chains. You will learn to program in `SageMath` and experiment with mathematical objects. Along the way, you will also learn about some beautiful ideas and interesting open problems in modern mathematics.

Prerequisites: A general interest in many areas of mathematics and in computer programming. Previous experience with symbolic math software is recommended but not required.

Grading policy: Grades will be based on a final project. Students will each pick a topic for an experimental mathematics project to work on, submit a

[1] Syllabus version of February 13, 2017— subject to minor changes before quarter starts.
[2] Meetings will be arranged as two 1:20-hour sessions with a 10-minute break.

written report (4-10 pages) on their results along with accompanying code and data, and give a short presentation about the work.

Tentative schedule

Week 1	Session 1	Introductory lecture 1 (Romik)
Week 1	Session 2	SageMath installation session and tutorial (Schilling)
Week 2	Session 1	Introductory lecture 2 (Romik)
Week 2	Session 2	Guest lecture
Week 3	Session 1	Introductory lecture 3 (Schilling)
Week 3	Session 2	Coding session
Week 4	Session 1	Romik/Schilling
Week 4	Session 2	Coding session
Week 5	Session 1	Guest lecture
Week 5	Session 2	Coding session
Week 6	Session 1	Guest lecture
Week 6	Session 2	Coding session
Week 7	Session 1	Guest lecture
Week 7	Session 2	Coding session
Week 8	Session 1	Guest lecture
Week 8	Session 2	Coding session
Week 9	Session 1	Guest lecture
Week 9	Session 2	Coding session
Week 10	Session 1	Student presentations
Week 10	Session 2	Student presentations