

CSUMS: Undergraduate Computational Research in Arithmetic Geometry

The proposed project is for a group of 6 undergraduate students each year to do research with a strong computational emphasis in number theory and arithmetic geometry, where each project will be relevant to research on the Birch and Swinnerton-Dyer conjecture (BSD conjecture) or modular functions. Participants will become well versed in the practical use of computation in advanced mathematical research, gain knowledge about mathematical software, make long-term connections with a vibrant research and development community, and contribute tools that will be used by expert researchers and students. Number theory is a venerable research area that draws strongly from many areas of mathematics. The BSD conjecture is one of the deepest problems in number theory. Modular curves and the functions which uniformize them lie at a crossroads of number theory, geometry, complex analysis, and differential equations. Student research will thus make connections with a wide range of mathematics. The program is structured so that students will learn teaching and writing skills, which will prepare them to apply computational mathematics techniques in graduate school and industry.

Intellectual Merit:

Students will do research on a central problem in number theory and implement algorithms and give presentations at seminars and conferences. Their work will enhance our understanding of and ability to work with important mathematical objects.

Broader Impact:

This proposal has the potential to transform research and education in several ways. One broader impact of this project would be to provide tools for research and education in number theory and related areas that are better than anything available today. Another impact is that instead of students and researchers having to pay to buy mathematics software for number theory courses and research, they will have the option to use Sage for free. The PI will also develop course materials for use by the students that will be of broader interest.