Claremont Colleges REU, 2005–07

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In 2005 the Claremont Colleges, with Pitzer College acting as lead institution, began a summer Research Experiences for Undergraduates program in mathematics. The Claremont Colleges include five undergraduate liberal arts colleges: Claremont McKenna, Harvey Mudd, Pitzer, Pomona, and Scripps (a women's college). The five campuses are contiguous and the physical size of the consortium is comparable to a typical university campus. Roughly 85% of the funding for the REU comes from the National Science Foundation with the balance divided among the five Claremont schools.

The primary goal of the REU is to expose students to the real-world nature of mathematical research and the practicalities of an academic career in mathematics. In doing so we hope to encourage students to go into careers in the mathematical sciences. A secondary goal of the program is to provide a uniting focus for the already existing summer mathematical activities in Claremont, which heretofore had been occurring at each college separately and without the benefit of shared activities.

Previous to 2005 the Claremont colleges have not operated a shared REU, or equivalent, program. However, the Claremont colleges place a high value on undergraduate instruction and have a long history of fostering undergraduate research. Students majoring in mathematics are required to write a senior theses (or "senior exercise") at three of the five colleges and must choose between writing a thesis or participating in a research clinic at a fourth college. A majority of the faculty have supervised student research and many have co-authored mathematical papers with undergraduates. Research which does not lead to publications will often still result in a poster presented at a conference.

Ten students participate in our REU each summer for a period of eight weeks (June and July). Students work in teams of two or three with one faculty advisor. (Teams of four students with two faculty advisors may also occur.) The advisors propose the research topics in advance of the summer and each topic that will run that summer is advertised on our website. When students apply they are asked to indicate which research group they would like to participate in.

Research topics for 2005 and 2006 were: Lissajous knots and billiard knots, dynamics of three-population interactions, robustifying clustering methods for microarray data, analysis on metric trees, generalized continued fraction representations

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of certain algebraic numbers, and Fourier analysis on groups. Topics for 2007 will include knot theory, lattice theory, geometric combinatorics, and mathematical biology.

Students are primarily recruited through the website and by mailing out flyers to around 400 mathematics departments. Flyers and letters are also sent to a small collection of colleagues who we think may have access to interesting students, especially ones from typically underrepresented groups. Faculty who will be leading research projects also promote the program by speaking at various venues, mostly neighboring institutions in Southern California. In our first year, we received about 95 applications and accepted 6 men and 4 women. In our second year applications increased to nearly 200 and we accepted 5 men and 5 women. Most are between their Junior and Senior year with some one year younger. In accepting students, we are primarily guided by a desire to have

- A diverse group of students, yet one that can work well together;
- Students with the background necessary to successfully engage in the research topic;
- Students who are considering a career in the mathematical sciences for whom this could be a pivotal experience.

During the summer, students not only work on their specific research project, but also attend a variety of workshops as well as a weekly colloquia. The workshops are designed to teach basic skills needed by every research mathematician:

- How to use library resources including MathSciNet, arXiv, etc.
- How to use TeX, LaTeX, etc.
- How to give a mathematics talk.
- How to prepare a mathematics poster.

We also hold a workshop on how to apply to graduate school. In addition to the workshops our weekly colloquium series draws on talented expositors throughout Southern California who can introduce the students to a wide variety of current research topics.

Each student receives a stipend of $2800, a free single dorm room, a weekly food allowance of $100, a travel allowance (to and from Claremont) of $250, and an allowance of $350 for attending a conference following the summer. We encourage all of our students to attend the Joint Meetings in January and to present their findings at the Undergraduate Poster Session. Each faculty advisor receives a stipend of $3500.

To evaluate the program we survey the students both before and after the program, asking them a variety of questions to assess their attitudes and skills related to mathematics and mathematical research. The surveys were designed by our evaluation consultant who is a developmental psychologist at a local university. The consultant also leads a group focus session twice during the summer. We also survey the faculty advisors regarding the attitudes and skills of the students. It is too early to report on the data, except to say that, in general, the students attitudes do not change much (they already had a high regard and interest in mathematics before coming) and their skills improved (although many of them already had rather advanced skills before coming). At least two students (one from each summer) have decided, as a result of learning what it is like to do research in mathematics, that it is not for them. One has decided to apply to law school the other to medical

school. The others all seem to have been drawn closer to a career in mathematics by the experience.

In addition to all the mathematical activities that take place during the REU, we also plan weekly social events that allow a high level of contact between REU students and faculty and with other students and faculty who are spending the summer in Claremont doing research. Some of these activities have been in collaboration with a Computer Science REU taking place at the same time at Harvey Mudd College. The students also have adjacent rooms in the residence halls, usually eat lunch and dinner together, and the faculty eat lunch with the students at least once a week.

Our website, `www.pitzer.edu/mathREU`, contains more details of the program including summaries of the 2005 and 2006 programs.

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