

SUMSRI Journal

Introduction

The Summer Undergraduate Mathematical Sciences Research Institute (SUMSRI) is a program designed to prepare participants for the rigor and pace of graduate school. Because of the small number of African Americans, Latinos and Native Americans with doctoral degrees in the mathematical sciences, we are particularly interested in these undergraduate students. In order to prepare these students, the Institute offers short courses, research seminars and colloquia for seven weeks. It is an intense program in which the undergraduate participants learn what it means to focus entirely on mathematics and statistics as one would do during a graduate program. Each course, seminar and colloquia is designed to fulfill the following goals:

- Address the shortage of underrepresented minorities and women mathematicians by producing minority and women research mathematicians.
- Provide the participants with a research environment and improve their research abilities.
- Improve the participants' ability to work in groups and give them a long term support group.
- Provide role models.
- Improve the participants' technical writing skills.
- Give the participants an opportunity to give a talk and to write a technical research paper.
- Familiarize the participants about graduate school and inform them about available financial aid for graduate school.
- Make the participants an awareness of career opportunities in the mathematical sciences.
- Prepare the participants for the GRE.

This preparation will, hopefully, permit the SUMSRI participants to successfully compete and complete graduate school.

In the summer of 2009, the Institute offered research seminars in number theory, advanced algebra and multivariate statistics. Participants also attended workshops in mathematical writing, GRE preparation, two short courses in algebraic topology and real analysis as well as 10 colloquium talks.

Applications for participation in the institute came from across the nation. In order to be chosen, each applicant had to be a U.S. citizen or permanent resident and must have completed college level introductory mathematics and/or statistics courses and at least one proof-based mathematics course. Each applicant wrote a brief essay on why they wished to participate in the Institute. Two recommendation letters from faculty members from the applicant's home institution were received for each applicant. In 2009, fifteen participants were accepted. The average GPA in the mathematical sciences for this summer's participants was 3.73. Five of the participants were African American, one was Hispanic, one was Asian American, and eight were Caucasian. Nine of the 15 participants were female.

Research seminar instructors suggested topics that would challenge students to work in teams, draw on their critical thinking and research skills, familiarize them with current literature on the topic, set parameters of the research and utilize computer modeling programs.

Nicole Cleary, Brittany DiPietro, Alexander Hill, Gerard Koffi, and Beihua Yan joined Dr. Lakeshia Legette in taking a look at the ABC Conjecture via Elliptic Curves. They studied the connection between elliptic curves and ABC triples. Two important results are proved. The first gives a method for finding new ABC triples. The second result states conditions under which the power of the new ABC triple increases or decreases. Finally, they presented two algorithms stemming from these two results.

The linear chromatic number of a graph was researched by Daniel Caproni, Joshua Edgerton, Margaret Rahmoeller, Mychael Sanchez and Anna Tracy. They studied linear colorings and the linear chromatic number of graphs and described a strategy used to find linear colorings of graphs. They computed the linear chromatic number for specific graphs and briefly discussed linear N -graphs. They then found bounds on the linear chromatic number of graphs.

Virginia Ahalt, Ramone Gordon, Dusti Nisbet and Lauren Vollmer used multivariate statistical analysis to discover a new way to classify nations into developed, developing or underdeveloped. They performed principal component analysis and factor analysis to reveal themes and underlying factors. Then they used two discriminant analyses to classify each of 170 countries. The first discrimination rule used a published list of the current world divisions and the second discrimination rule relied on divisions based on the first principal component generated in the principal component analysis. They compared the two analyses and concluded that their classification system more accurately described the current state of world development.

Final presentations of the research projects were given using Power Point slides. Members of the Miami University Mathematics and Statistics Department attended these presentations. It is hoped that many of these students will attend regional and national mathematics and statistics meetings in order to present the results of their work.

By providing this intensive research program, SUMSRI faculty endeavored to encourage those who attend SUMSRI to pursue advanced degrees.

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