Summer Undergraduate Research in Mathematics at UNI

UNI Mathematics has funding for two undergraduate students to work on research projects under the direction of a faculty member during the summer of 2013. Each student will receive a stipend of $3,000 and the research is to be conducted over an eight week period. Student researchers are required to present a poster on their work at the College of Natural Sciences poster session in August.

The program is open to all students with a declared major or minor in a program offered by the Math Department, and who will still be in residence (including student teaching) in the fall of 2013. Interested students must submit their application materials to the Math Department office in WRT 220 by 5 pm on March 6th, 2013.

A complete application consists of all of the following documents:

- Applicant Information Form, including names of references
- Unofficial transcript
- Letter of application

Your letter of application should be a short statement (one page or less) explaining why you are interested in doing research this summer and why the project(s) you listed appeal to you. You are also welcome to describe a project (other than one of those listed) that you would like to work on this summer with a faculty mentor in the Math Department.

A copy of the Applicant Information Form is available at

http://www.uni.edu/theron/SURP/index.html

For more information about the program, contact Prof. Theron Hitchman:
theron.hitchman@uni.edu

Possible Research Projects:

This is a partial listing of possible research projects available to students in the summer of 2013. For more information on a particular project, contact the faculty member listed.

Project #1: Curriculum Development for Advanced Mathematics Courses

Abstract: We will develop two 10-day courses for the Michigan Math and Science Scholars High School Summer Program. http://www.math.lsa.umich.edu/mmss/ One course will be on Combinatorial Game Theory, and one will be on Graph Theory. Each one will consist of 40 hours of instruction + homework over 10 days. The project will involve learning some fascinating mathematics well enough to plan rich lessons, and must be complete by June 22. The opportunity will exist to travel to Ann Arbor, Michigan to be the teaching assistant for the courses, but that is completely optional. (Prof. Shaw, shaw@math.uni.edu)

Project #2: Understanding and Assessing Mathematical Knowledge Needed for Teaching

Abstract: We will study how the mathematical knowledge that is specific and useful to teaching students mathematics is understood in the field, examine available assessment items that were designed to assess these different kinds of mathematical knowledge special to teaching elementary/middle school mathematics, and analyze sample teacher responses which were collected from a previous project. (Prof. Noh, jihwa.noh@uni.edu)

Project #3: Routes to Reason: Proportions

Abstract: How do middle school students reason about proportion problems? Do strategies change depending on the numbers involved? Are students more successful in some contexts than others? How do strategies change between 5th graders and 8th graders? Is there one route most students travel as they grapple with the concepts of proportionality? Can we determine a student's understanding based on written work and suggest appropriate next steps? We have data from about 450 middle school students on a 26 item instrument. Summer activities will involve examining student strategies and coding them. Specific research questions will be developed as we strive to tell the story of these students' reasoning about proportionality.

An interest in mathematics education (any level) and mathematics education research is needed. (Profs. Riehl, riehl@math.uni.edu, and Steinthorsdottir, olly.steintho@uni.edu)

Project #4: Mean Curvature Transformation for Polyhedra

Abstract: The mean curvature flow of a surface is a kind of way to average out the bending of that surface and make it more symmetrical. But what if your surface isn't smooth, but instead made up of lots of triangles, or other polygons? It would be nice to have a reasonable way to define a similar transformation, and show that it makes some sense for simple examples. We will spend our time working on lots of simple examples, trying very basic things out, and making a lot of pictures. (Prof. Hitchman, theron.hitchman@uni.edu)

Project #5: Models of Discrete Geometry

Abstract: Suppose we have a graph whose boundary is rectangular and whose faces are all triangles. If I pretend the edges are resistive wires and I connect a battery to one side of the rectangle and a ground to the opposite side, can I estimate the resistance across the graph? Can one use the graph to arrange circles at each vertex in the plane so that adjacent circles are all tangent and the centers of the boundary circles lie on a rectangle? Could I do it with squares instead of circles? Can I determine how long it will it take a random walker to wander from one side of the graph to the other? The answer to all of these questions is "yes" but the more interesting answer is "yes, because they are all the same question... almost." This project will explore how these and other discrete models approximate the same geometric phenomena in different ways. The project will likely involve extensive computer experimentation. (Prof. Wood, bill.wood@uni.edu)

Project #6: *Choose your own adventure*

Have an idea for some summer research? Or a professor you would really like to work with? Suggest an idea for summer research and we can try to help you work out the details.

Contact Prof. Hitchman if you are unsure how to get started. theron.hitchman@uni.edu