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 2014. 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 2014. Interested students must submit their application materials to the Math Department office in WRT 220 by 5 pm on March 7th, 2014.

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 2014. For more information on a particular project, contact the faculty member listed.

Project #1: Graph Theory Course Development (Prof Shaw)

Abstract:

We will develop a 10-day Graph Theory course for the Michigan Math and Science Scholars High School Summer Program. http://www.math.lsa.umich.edu/mmss/

The graph theory course will consist of 40 hours of instruction and homework over 10 days. This project will involve learning some fascinating mathematics well enough to plan rich lessons, and must be completed by June 22. The opportunity will exist to travel to Ann Arbor, Michigan to be the teaching assistant for the course, but that is completely optional.

Project #2: Discovering Cube Tilings (Prof Wood)

Abstract:

How many ways can you slice a rectangular block of cheese into cubes? If you were asked to actually do this, you'd probably cut along nice evenly-spaced planes in each direction. But are there interesting ways to cut so that some of the cubes are different sizes and don't all line up? Can you minimize the number congruent cubes you get when you are done? We will explore the variety of cube tilings and their properties, which it turns out have some deep and interesting connections to discrete conformal geometry.

This project will likely require computer exploration so some background in programming or computer algebra systems is a plus.

Project #3: Metacognition: It's More than Reflection (Prof Miller)

Abstract:

Reflection has long been called on to distinguish expert teachers from novices. I find the concept of reflection in educational research and practice vague and unhelpful. Instead, metacognition might be the missing link that can distinguish experts from novices. Using the work of Alan Schoenfeld, who established that the difference between expert and novice mathematical problem solvers is metacognition, I will try to problematize teaching to explore this more precise aspect of reflection.

Note: I am beginning this study, the work needed will reflect this. Data will not be collected this summer. Instead, we'll investigate the plausibility of the study presented with a review of literature. If it makes sense to continue, we will need to develop a theoretical framework to use to inform the research and, if time, design a pilot study to use as a start to a more robust research project.

Project #4: Curve Shortening Systems for Polygons (Prof Hitchman)

Abstract:

We will study a system for changing polygons into nicer, "rounder" polygons. This is a smaller, more manageable version of a collection of fancy problems in smooth differential geometry, but the ideas are very accessible. We will build a computer program to model some variants of the system and try to tackle the behavior for non-convex polygons. A background in high school geometry, calculus and linear algebra will be helpful.

Project #5: *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