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 2017. 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 2017. Interested students must submit their application materials to the Math Department office in WRT 220 by 5 pm on March 1st, 2017.

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 2017. For more information on a particular project, contact the faculty member listed.

Project #1: 3D Design of Knots as Butterflies (Prof Hitchman)

Abstract: We will make 3D printable designs of knots in a special format called “butterfly representation.” The goal is to make some special examples, and to produce code that would generate designs of other knots in similar families. No knowledge of knot theory, programming or 3D printing is required, but a willingness to engage with writing code is important.

Project #2: Walking Knots (Prof Hitchman)

Abstract: There is a special design of a trefoil knot that has “no tritangent planes,” which means that a model of the knot will roll across the table if given a little nudge. (It works! I have one!) We will investigate if it is possible to make similar walking representations of other knots, using the concept of a “petal knot.” If we succeed, we will 3D print some!

Project #3: Squigonometry (Prof Wood)

Abstract: The classical trigonometric functions sine and cosine can be defined as the functions returning the coordinates of a point on the unit circle. We can generalize these functions to apply to curves other than the unit circle. This project will explore a class of these functions that parameterize "squircles," which look like squared-off circles and actually are the circles of a geometry called the p-norm. We will discover properties of these functions and apply them to find formulas for length, area, volume, and hyper-volume of some interesting mathematical objects, calculate some nifty integrals, and hopefully make new connections to the theory of special functions. Applicants should have completed Calculus II, but Differential Equations and/or Calculus III would be helpful. Experience with or willingness to learn a computer algebra system such as Mathematica or Sage is also a plus.

Project X: *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*