

## UTMOST application

**Will Murray**

**California State University, Long Beach**

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I would like to apply to participate in the UTMOST project during 2017-19.

- (a) I regularly teach both Linear Algebra (MATH 247 at CSULB) and Abstract Algebra (MATH 444 at CSULB) and I would be available to teach either one during any semester of the project (Fall 2017, Spring 2018, Fall 2018, Spring 2019). Both courses run in small sections here at CSULB. We typically offer four sections of Linear Algebra per semester with about 35 students per section. We typically offer one or two sections of Abstract Algebra per semester with 20-30 students per section. I would very much prefer to teach a section using Sage, as I am very interested in the system and in incorporating it into my classes. However, I would also be willing to teach a control section.
- (b) I have taught Linear Algebra twice at CSULB, most recently in 2014, and several times at Berkeley. I have taught Abstract Algebra four times at CSULB, most recently in 2015.

My teaching style is generally traditional, with lectures and student participation in class and homework, quizzes, and exams. In Linear Algebra I use online homework via WebAssign. In Abstract Algebra students complete written problem sets that are mostly proofs but also include some computations.

With that said, CSULB is extremely supportive of faculty creativity in developing nontraditional teaching methods, and I have experimented at various times with video lectures, student presentations, research projects, group quizzes, and so on. Our department is currently developing a new degree option in computational mathematics, and one of my goals for the UTMOST project is to learn how to incorporate significant computation on an open source platform into my classes.

- (c) In both classes I allow but have not actively promoted the use of mathematical software by the students. I do use software myself (mostly Mathematica) in creating examples and demonstrations, and I share these with students and encourage them to experiment on their own.

I have used software extensively in a graduate class in Elliptic Curves, which I created ten years ago and have now taught three times. There I make heavy use of Pari/GP, a specialized package for number theory and elliptic curves. (Sage uses Pari/GP in the background, but so far in my class we have worked directly with Pari/GP; we have not gone through Sage.) I teach the students how to install the software, make simple calculations, and ultimately write programs for more elaborate computations.

- (d) I have not used Sage or SageMathCloud directly. However, as detailed above, I have made frequent use of Pari/GP, which has been folded in as one of the components of Sage.

CSULB is a large (36,000 students), extremely diverse, urban, comprehensive public university in Los Angeles. We have been designated since 2005 as a Hispanic Serving Institution with approximately 25% Latino population.

Most of the approximately 280 students per year who take Linear Algebra are sophomore majors in our many engineering departments (Aerospace, Chemical, Civil, Electrical, Mechanical, etc.) or in the various options in our math department (general, math ed, applied math, statistics). Many of the engineers are planning a minor in applied math. Almost all of these students have had the full three-semester calculus sequence, but no formal training in writing proofs.

Most of the approximately 80 students per year who take Abstract Algebra are senior majors in math or math ed. A few applied math majors also take it, but it is not required for them. We also have a few beginning graduate students who have been conditionally admitted to our Masters program based on successful completion of Abstract Algebra. Most students in this course have taken a bridge “how to write a proof” course and almost all have taken at least one prior proof-based course, usually Number Theory. Even so, Abstract Algebra is the most abstract course most students have taken so far, and many of them struggle with the proofs.

Please find attached a letter of support from my department chair, Tangan Gao. Thank you very much for considering my application.



CALIFORNIA STATE UNIVERSITY, LONG BEACH

DEPARTMENT OF MATHEMATICS

December 11, 2015

Rob Beezer  
University of Puget Sound

Dear Dr. Beezer,

I am writing to express departmental support for Will Murray's application to the UTMOST program. Will has described the program activities and requirements to me. We support the incorporation of software into our courses and we will make every effort to facilitate his participation in UTMOST.

We normally offer four sections of Linear Algebra and one to two sections of Abstract Algebra every semester at CSULB. Will is an expert in algebra and a highly accomplished teacher who has led both classes multiple times. He is a natural fit for these classes and we will do our best to assign him whichever one is necessary for participation in the program.

Tangan Gao  
Professor and Chair