Department of Mathematics
University of Utah

Committee Member,

I aim to enroll at the University of Utah to become quantitatively literate. As I want to examine how we, humans, co-create our environment, I am attracted to Utah's research groups in Multiscale Analysis and Computations (MAC) and Material Science. I would like to be considered for a teaching assistantship. Upon completion of a master's degree, I plan to complete a Ph.D. and enter an ecological industry.

Here are two motivated descriptions of my research interests.

Sediment Transport In Idaho's Treasure Valley, farmers use a network of reservoirs and canals to suspend and divert the Boise river. To understand how this irrigation regime sweeps up and transports material, I would numerically simulate water's energy and turbidity in flood irrigated fields. Following up, I would classify how turbid water settles. Modeling regions of low-velocity flow, I could determine where (and which) sediments fall out of suspension.

Ground Water Contamination With the Army's decision not to grant an easement for the Dakota Access Pipeline (DAPL), I have a redoubled interest in contaminant diffusion. If I were contributing to an environmental impact statement for DAPL, I would (i) consider geomorphic stresses on the pipeline and (ii) model hydrocarbon dispersion through sand, shale or clay at points of stress. I imagine characterizing the geometric structure of sand/shale/clay mixtures via inverse homogenization.

I share two examples of my relevant research experience.

Galois Theory & Fuchsian Equations Following Michio Kuga's analysis of Fuchsian-type differential equations, I parameterized the solution space of the hypergeometric equation. For 5 interesting cases, I found the monodromy representation at singular points. I presented my method, its history and a potential application to fluid flow at The College of Idaho's 2016 student research conference.

Igneous Dikes in Scotland Relying on N. L. Bowen's *The Evolution of the Igneous Rocks*, I modeled the cooling of plagioclase feldspar magma. I proposed that my geology abroad group in Scotland visit Glen Sligachan, a significant site for Bowen's field observations. On June 4^{th}, noticing rough shards of buoyantly exposed olivine lodged within dense clusters of plagioclase crystals, we validated Bowen's hypothesis that molten plagioclase carried partially solidified mafic minerals into the crust.

I summarize what has prepared to teach.

Tutoring & Grading I tutored calculus students one-on-one and graded physics coursework. I guided small groups through problems in elementary electromagnetism. I heard out my peers in introductory topology and posed constructive questions. As a Heritage Scholar at The College of Idaho, I led discussions in colloquium. In seminar, I organized half-hour workshops on the logistic equation and the heat equation. I also delivered an hour presentation on epidemiological modeling.

Time Away from School In the last year, I volunteered on a ranch in Germany and worked at a refugee resettlement office in Texas. Here are two examples of how these experiences refined my teaching ability. First, while I learned LaTeX to typeset proofs in analysis and topology, I have also used it to create form letters and bus guides in Arabic. Second, while I was exposed to G. Polya's guided problem solving and R. L. Moore's inquiry based method at college, I have applied their pedagogy to my work across language barriers: I plan ahead, relax (despite misunderstanding) and ask plenty of questions.

Presently, I am a fellow in the Texas Episcopal Service Corps. I live in Houston with two other fellows and work as a refugee medical care intern. This work demonstrates extraordinary qualifications. I advocate for clients in emergencies and help them navigate the U.S. health-care system. As well, I am facilitating a transition of client data into SQL and uploading our emergency assistance resources to an online repository.

I am confident that I would contribute formidably to your program. Thank you for your consideration.

Respectfully Submitted,
Colton Grainger