

VIGRE Funding Report

(due 30 days after semester of support)

Semester/Summer and Year:

Fall 2007

DB

Name: Daniel Reich

List the graduate courses you have taken this semester (including independent studies), your grades, and the instructors:

Course	Title	Grade	Instructor
Math 563	Probability Theory	A	Tom Kennedy
SIE 649	Topics of Optimization	A	Guzin Bayraksan
Math 920	Dissertation	K	Leo Lopes

List the title, date and location of any talks you have given, either here or elsewhere:

"The Most Likely Path" (poster presentation), 11/29/07, Engineering Building, University of Arizona

If you are working on your dissertation, include a one paragraph description of your research progress. If you have not yet begun dissertation research, describe your progress toward finding a dissertation topic and advisor and beginning that research.

In Spring 2007, I began conducting research on a stochastic network flow problem, which my advisor and I refer to as the Most Likely Path (MLP). By the end of this past Summer, we identified the difficulties of obtaining exact solutions to the MLP on the class of series-parallel networks, on which we have been focusing our efforts. Over the course of this Fall semester, we identified analytical lower and upper-bounds for solving the MLP on this network class and proved the validity of these bounds. We compute these bounds without the need for multivariate integration, which ensures that our method is computationally tractable. In the past few weeks, we have extensively tested our implementation for both accuracy and efficiency. We are currently writing about this work, and will be submitting this paper for publication by February 1, 2008.

List publications, if any.

Check all activities you completed during the funded period:

Academics:

- Independent Study
- Oral Comprehensive Exam
- Commence Thesis Research
- Conference attendance
- Conference participation
- Complete PhD

Professional development and outreach:

- AP Calculus Visit
- High School Workshops
- Undergraduate Research Project
- Undergraduate Research Seminar
- Super TA
- Mentoring junior graduate students for the qualifying exams
- RTG (help organize)
- Research Seminar (help organize)

Other (please specify)

Reviewed linear algebra with graduate students in Math 575A, in several weekly sessions throughout the Fall semester.

Attach a brief statement about your academic progress and professional development during the period of support.

VIGRE Report: Fall 2007

Daniel Reich

January 8, 2008

In Spring of 2007, Dr. Leo Lopes and I began conducting research on a stochastic network flow problem, which we refer to as the Most Likely Path (MLP). Over the course of Summer 2007, we worked to develop a computationally tractable method of solution to the MLP on the class of series-parallel networks. In doing so, we discovered the difficulty in providing exact solutions to the MLP, even on specialized classes of networks.

At the start of this Fall semester, our goal was to identify lower and upper-bounds for the MLP, which could be computed in a highly efficient manner. We have accomplished this goal, have implemented routines to compute these bounds, and have extensively tested our implementation. We are currently writing about this work and our other results relating to the MLP, and will be submitting this paper for publication by February 1, 2008. Portions of this work have already been included in two NSF proposals, which Dr. Lopes recently submitted. I have also submitted an abstract on this work to the Informs Optimization Society for an invited talk, which I will be presenting in their March 2008 conference at the Georgia Institute of Technology.

In the Spring 2008 semester, I will be continuing my dissertation research on the MLP. We will be focusing our attention on developing efficient sampling methods for identifying optimal solutions to the MLP. I will be expanding our probabilistic analyses to incorporate statistical methods.

As part of my Fall VIGRE professional development activities, under the direction of my advisor, I supervised a research project with Andrew Friedman, a senior undergraduate student majoring in Engineering. In previous semesters, Dr. Lopes had worked directly with Andrew on undergraduate research projects. At the start of the Fall semester, Dr. Lopes arranged for the three of us to meet, and Andrew and I outlined general plans for his project, including connections from his work to my own. My advisor and I discussed Andrew's project throughout the semester, and my interactions with Andrew were guided by our discussions. Andrew worked through a series of questions, which aimed to provide him with an intuitive understanding of both the Central Limit Theorem and properties of sums of independent identically distributed random variables.

In addition to working with Andrew, I reviewed linear algebra with graduate students in Math 575a, in several weekly review sessions throughout the Fall semester. Both of my Fall professional development activities allowed me to expand the scope of my teaching experience, which I hope to continue to build upon as a mentor for the Spring 2007 Mathematical Modeling course projects.