Statement of Purpose

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I am applying to the University of Virginia for admission into the Computer Science Ph.D. program, in order to accomplish my future goals of conducting research and teaching at the university level.

Since elementary school, I have been intrigued by electronics; however, my interest in Computer Science began in earnest when I started taking courses during high school. These courses provided me with an understanding of object-oriented programming in Java. Using this knowledge, I taught myself PHP and developed a database application—a PHP-based front end for a MySQL database—to store and display morning announcements, which my high school still uses.

After graduating from high school, I began attending St. Lawrence University as an undergraduate student of Computer Science, Mathematics, and German Studies, where I am now in my senior year. In addition to taking core Computer Science courses, I have also enrolled in various special topics classes. By the time I graduate from St. Lawrence in May 2014, I will consequently have a very strong foundation in Computer Science. My favorite courses, by far, have been Computer Organization and Database Systems because I find the theory behind bridging logical and physical aspects of programming particularly interesting. Therefore, I am also looking forward to taking Theory of Computation and Programming Languages during the Spring 2014 semester. Additionally, I have continued to take Mathematics courses throughout my college career to help me better understand the theoretical and mathematical underpinnings of Computer Science. In all of these courses, I have received the highest (4.0) grade possible.

To help prepare myself for graduate school, I have fully utilized the research opportunities at St. Lawrence University. During Summer 2012, I was awarded the Phelps Family Research Fellowship, which funded a nine-week project overseen by my academic adviser, Dr. Ed Harcourt. My project, *Developing Interactive Web Tools for Statistics Students*, focused on designing and implementing the comprehensive set of JavaScript-based statistics simulation and data visualization tools known collectively as StatKey. These tools are distributed freely on the internet (`http://www.lock5stat.com/statkey`) and accompany *Statistics: Unlocking the Power of Data* by Lock, Lock, Lock, Lock, and Lock (Wiley, 2013). This project provided me with invaluable experience working in a collaborative environment, designing solutions for unique problems, and presenting my work in a formal setting to my peers in the department. Additionally, I now help to actively maintain the code and continue to make improvements and add additional features. The site has had over 25,000 unique visitors from 102 different countries during the Fall 2013 semester alone.

For my senior honors project, I chose to build upon my interest in databases and computer organization. This year-long project, titled *Accelerating Database Joins Using a General Purpose GPU*, aims to present a method for executing an SQL SELECT statement, which joins two or three tables, on a graphics card. The massively parallel nature of graphics cards makes the device perfect for querying large amounts of data. I am utilizing an experimental database (written by a graduate of UVA) designed to time query execution on both the CPU and an nVidia GPU as the basis of my

code. The software compiles the SQL statement into an opcode program, which is run either on a CPU-based or GPU-based virtual machine, and I am modifying this code to allow for Cartesian products of tables as well as JOIN clauses. In addition to providing me with invaluable, academic research experience, this project has also solidified my belief that my area of specialization should be in Computer Architecture or Programming Languages.

Because of my experiences at St. Lawrence University, I am confident in my decision to pursue a career in academic research and teaching. I have felt the most satisfied while solving complex problems in my research projects, synthesizing theory from many different areas of Computer Science to find an answer. During my time at St. Lawrence, I have also gained three years of teaching experience as a TA for the German Studies program. In this position, I have worked with the program's professors and developed my own curriculum to teach an additional two hours weekly of German language instruction to introductory and intermediate level students. Additionally, I hold review sessions before exams and assign and correct exercises in conjunction with the courses' units. As a TA, I have been exposed to various aspects of teaching, and I particularly enjoy being able to share my knowledge with others and watching as students make connections and realize how much they are learning. Although my teaching experience is not in the Computer Science field, I believe that I will be able to translate the pedagogical skills I have developed to this discipline.

With my goal of teaching at a university in mind, I began searching for my best match in a Ph.D. program. After extensive research of graduate school options, discussions with my academic advisers at St. Lawrence, and perusal of the department's website, I have determined that the University of Virginia would be an ideal fit for me. This university is ranked very high in the nation for both Architecture and Programming Languages, and both research groups are developing very interesting and beneficial projects, such as the MV5 simulator and the Tortola project. Through my professors and senior project, I have learned about the groundbreaking work conducted by faculty at Virginia, and I find this work to be very exciting. I would greatly value the opportunity to work on projects alongside such distinguished professors and researchers. The academic rigor of the doctoral program and intellect of the world-class faculty would provide me with the challenge and opportunity for academic development I am seeking. I believe that both my previous research and teaching experience and my ability to learn topics quickly would allow me to provide constructive contributions to the group I join.

I look forward to joining the department as a graduate student, an experience that would be mutually beneficial for both Virginia and myself. Not only would this opportunity allow me to achieve an important step toward my goal of becoming a professor, but the contributions I make during my graduate studies would also help to support the department's continued progress at the forefront of Computer Science research.