Statement of Purpose – Adrian Sampson

When I saw my mother after I heard my first NP-completeness proof in my Sophomore-year algorithms course, she asked how my classes were going. My first instinct, of course, was to relate to my mom—a public school child psychologist with a math phobia—the bizarre and thrilling tale of NP-completeness. Her hesitant acknowledgements and supportive but bewildered face betrayed that my explanation needed some work. That curious, surprised face, however, reminded me of my own astonishment at a host of earlier concepts that now seem basic: asymptotic complexity, self-balancing search trees, functional programming, and a litany of others. The repeated feeling of surprise, intrigue, and elation has marked time as I have become entranced with computer science.

My experiences with research and tutoring as an undergraduate have focused my intent to pursue a career in CS. I am applying to the PhD program in CS at the University of Washington in order to eventually become a professor.

My first major research was part of an NSF Research Experience for Undergraduates project after my sophomore year. I worked with two other students and Professor Ran Libeskind-Hadas on algorithm design and complexity analysis in the realm of optical network routing. My colleagues and I started with very little direction, defined our own research area, and constructed a solution start-to-finish. This was my first encounter with the intricacies of constructive, undirected theoretical research and my first large-scale technical writing project.

Our paper, "On-line Distributed Traffic Grooming," was accepted to the IEEE Communications Society's 2008 International Conference on Communications.[1] I traveled to Beijing with Professor Libeskind-Hadas to present it. I prepared the presentation with the help of Professor Libeskind-Hadas but was the sole presenter. The experience exposed the unique difficulty of designing presentations that keep theoretical topics tenable and interesting for an uninitiated audience.

My enthusiasm for this first project ensured that I would pursue research constantly throughout the remainder of my career at Harvey Mudd. I pursued an independent research project with Professor Robert Keller on neural-network techniques for automated processing of structured text. I identified a problem called "adaptive parsing": the interpretation of certain kinds of grammars with minimal knowledge of the grammars themselves. I constructed and implemented a technique based on rival-penalized competitive learning to accomplish a basic adaptive parsing task. Working alone with occasional advice from my advisor, I was entirely responsible for the framing of my problem and the construction of my solution. While the experience was challenging, I proved to myself that I had the motivation required to produce something I consider significant.

More recently, I've conducted research in two fields distant from theory and machine learning: computer security and filesystems. The first, conducted under the supervision of Professor Everett Bull at Pomona College, examined the security implications of a unique storage system called Venti. I proposed a succinct, low-overhead method for implementing capabilities-based security in the

[1] Papers for research projects are available online at `http://www.cs.hmc.edu/~asampson/`

system. During the same time period, I worked with Professor Geoff Kuenning on the structural complications of filesystems with interfaces based on arbitrary, unstructured metadata ("tags") rather than directory hierarchies. I applied the canonical disk-layout techniques from the Berkeley Fast Filesystem (FFS) to outline a filesystem optimized for tag-based storage. The project exposed me to the intricacies of constructive systems research. An enormous range of considerations, from interface to low-level data structures, had to be identified and carefully analyzed in order to create a coherent and useful proposal.

My positive experiences with this wide range of research were enough to convince me to investigate graduate school in CS. During my REU project in particular, it was exhilarating to have intellectual pursuit as my primary day-to-day responsibility, to spend eight hours a day talking to my research team and coming away every day feeling like we invented something clever and insightful. Aside from research, however, my experiences with tutoring both in computer science and in writing have further solidified my intention to become a professor.

I have tutored for Harvey Mudd's CS department and worked as a consultant for the Writing Center for three years. My success in these areas has suggested that I am able to communicate abstract ideas clearly. As a writing consultant, I constantly reflect on the infinite complexities of writing and how to best inspire the same considerations in other students. This year, four other consultants and I presented at the 2008 National Conference on Peer Tutoring in Writing on the relationships between tutoring styles for technical and non-technical exposition. This experience has motivated me to think of teaching, alongside research, as an end goal for my career.

As evidenced by the diversity of my research endeavors, upper-division electives have not helped at all to narrow my enthusiasm for computer science. Every time I take a new course—in filesystems, in complexity theory, in computer security—I plan out a new path through graduate school in another subfield. Only intense consideration has led me to narrow my aspirations to the fields I find most fascinating: theory and systems. While I am fascinated by both of these fields individually, I also see possibility in studying in their intersection.

I want to attend the University of Washington because it is a large university with outstanding programs in many subfields. If I find that systems-based research is not my favorite research area, for instance, UW also has an exceptional theory group. Not only is the department top-ranked, but it also comes highly recommended from professors I trust and respect.

At a large, diverse, and highly-ranked school like UW, I anticipate opportunities to explore many research areas before committing to one. For instance, I am intrigued by Professor Paul Beame's research on modern data structures. His work highlights the interactions between theory and systems by examining the algorithmic implications of realistic instruction sets. This intersection between two disparate fields is attractive for its combination of two different ways of reasoning about the same set of problems. I am applying to UW because of the wide variety of compelling research opportunities like Professor Beame's.