Statement of Purpose

of Abhijit Chowdhary (Applied Mathematics Ph.D. applicant for Fall—2020)

Note to my letter writers: This document is a generic statement of purpose template. It contains the main body of what I'll be presenting in my tailored statement of purposes, which will be adapted slightly depending on the program and university I'm applying to. So for example, in places where I'm applying for computational math, this is good as it stands, but for the CS applications, naturally I'll take a more computational bent, pure dynamical systems the opposite, etc. Also note that Github's pdf viewer doesn't allow one to click on the linked paper's / projects in my statement (highlighted in pink), but if you download the pdf, you can follow the links to the referenced documents.

I must admit, coming into college, let alone liking computational mathematics, I hadn't even heard of its existence. I began as a computer science major, having held hobbies in computers throughout high school, and like all typical incoming freshman, was advised to take linear algebra. At this point, having just learned how to code well, I itched to apply my skills and after being handed a particularly wail-inducing determinant calculation in one of my problem sets, I instead decided to write a script. When I went to office hours to gloat, he pointed to the *Numerical Recipes* text by Press on his shelf; I think that's the moment when I was doomed to love computational math. Although my motivations have matured from those of a lazy freshman, my goal since then has remained the same; I want to become an academic in order to continue to thoroughly enjoy and immerse myself in my research interests. To do so, my second step after my undergraduate education is a Ph.D., which is why I eagerly apply to this program.

After that semester, I had madly dedicated myself to improving my then lacking mathematical ability. Computational mathematics is a field which demands a huge breadth of background in various different subjects, so I intentionally loaded my schedule, took summer courses, and from my sophomore year onward I made sure to take advantage of the accelerated and more detailed graduate courses here at NYU. At the end of my undergraduate career here at NYU, I'll have taken 11 graduate courses in computer science and math, including finishing the introductory numerical analysis sequence offered for incoming Ph.D. students and three advanced topic seminars in computational math topics. In addition, in order to keep my algorithmic skills sharp, I maintained a department tutor position for both the undergraduate and graduate algorithms courses through four semesters, stopping this semester only because my usual professor went on sabbatical.

Although I took many courses, regretfully it didn't leave me much time to branch out for research. However, I do have a few projects and original research under my belt. In my geometric modeling course sophomore year, I investigated and implemented the paper Algebraic Point Set Surfaces by Gunnebaud and Gross, exploring and attempting to optimize the matrix assembly and generalized eigenvalue problem underlying the optimization problem. In my junior year, I wrote a topic paper on Parareal, a parallel finite difference scheme, discussing the details of its implementation, strong and weak scaling properties, and its convergence, efficiency, and stability analysis. Finally, the most formal research experience I've had is in collaborating with Qiliang Wu from Ohio University and another student in the summer of 2019 in an REU on the diffusive stability of the Swift-Hohenberg equation near the Zigzag boundary in 2D. Originally, I was lured into the REU with the promise of a numerical project, but was swiftly distracted onto this topic instead, and despite it being out of my field at the time, the beautiful analysis within the proof we managed to construct nearing the end of project has convinced me to take a closer look at the theoretical approaches to understanding the behavior of troublesome systems; it's why I'm taking a course in pertubative methods now. My favorite part of the program was it's freer structure, as our days would be split into two halves, in the first of which we would research, LaTeX, and push the proof on our own, and in the second part we would gather and try and work out the major difficulties of the proof together. Through this, the REU convinced me that being a researcher is something that I'd not only desire but be good at; the process of going to sleep and waking up with a paper in hand and spending hours locked in a room with a problem and my colleagues was invigorating to the limit. Finally, although the paper is not yet in preprint, it's in the final draft stages and Professor Wu presented the proved result at Miami Universities' recent conference in Differential Equations and Dynamical Systems.

Thus, through these experiences of mine, I've narrowed down my research interests to a couple of subfields. Specifically, I would like to study the numerical approximation of the solutions to PDEs and the theoretical analysis on such methods, as well as the more theoretical dynamical systems and pertubative approach to the analysis on nonlinear PDEs. I've also found lots of interest in the area of high performance and parallel scientific computing, having been sucked in during the studies of the former research interests. Finally, I also have interests in computational number theory and algorithms in algebraic geometry, which explains the otherwise seemingly random foray into algebra on my transcript. During graduate school, I hope to be able make the transition, as I did in my REU, from learning about these subjects and writing survey papers on their topics to producing my own original ideas on the field.