Statement of Purpose

Mans Eternal Quest for happiness naturally culminates into the search of truth, through science and mathematics. To me, a computer, or a piece of algorithm, is the most tangible materialization of the abstract mathematical thought hidden. I wish to stand on the shoulders of giants to look far beyond the horizons of present-day knowledge of theoretical computer science, with a hope that my countrymen and I will be happier tomorrow, if I toil today. Thus my immediate objective is a Ph.D. in computer science.

My interest in natural sciences and mathematics grew as I read great men in school textbooks and could solve problems and do experiments with little hands. I took part in science quizzes and mathematics competitions such as Indian National Math Olympiad, and though I would get 1st prize in most, it was only to realize how much more was left to be learnt ! In my high school, I chose science stream and continued the mathematics that I liked, and attended math symposiums organized by Gujarat Ganit Mandal aimed at finding and helping bright students in math. The same publishes a monthly magazine which contains articles on current research in mathematics by professors all over the state, and we, students, were encouraged to participate in problem solving. This greatly helped me build a strong mathematical foundation, and inspired me to do independent research.

My undergraduate studies have proved fruitful beyond any imagination. Having admitted to the nations best technical institute, Indian Institute of Technology, Bombay, and moreover, to the best computer science department, I had a chance to meet the best minds in the country and sometimes even from other countries. On one hand, I learnt theory of computation, discrete mathematics, design and analysis of algorithms, etc, all having the flavor of the abstract mathematics that I sought after. On the other hand, the principles learnt had application in compilers, numerical computation, operating systems, graphics, databases, artificial intelligence, ...countless. I was taught that the unifying thread was mathematical logic and the development of algorithms based on the mathematical structures hidden in the problem. Problem solving was fun.

My interest in theoretical computer science grew since then. I pursued my B.Tech. Seminar in Randomized Algorithms for Linear Programming under the guidance of Dr. Ketan Mulmuley and Dr. Sundar Vishwanathan, and was greatly attracted by the simplicity and the power randomization gives us. I have continued my preparation by undertaking my B.Tech. Project in Topics in Combina-

torial Optimization under the guidance of Dr. Sundar Vishwanathan. I am delighted by the beauty of the graph theory, as I try to solve the k-well-coverability problem for various graphs. Fascinating results have been found for this problem, including polynomial time algorithms for determining if a graph is well-coverable for comparability graphs, chordal graphs and claw-free graphs. We solved the problem for a fixed k for bipartite graphs, and surprisingly the problem is NP-Complete for arbitrary k for the same. I also studied problem of determination of achromatic number of various graphs, and their approximation algorithms. A recent result [Clairnie, Edwards] has shown that the problem is NP-Complete even for trees, by a reduction from the problem of determination of harmonious chromatic number of trees. This has led us to consider approximation algorithms for determination of harmonious chromatic number of graphs.

Even approximating some of the important optimization problems have turned out to be NP-hard. The importance of this was exhibited in the seminal work of Papadimitriou, Yannakakis (1991) in the recognition of MAX-SNP class, and in Arora, Lund, Motwani, Sudan, Szegedy (1992) in the PCP theorem, subsequently written as NP = PCP(logn,1), and with this tools, one could identify four hardness classes based on the approximation ratio which is hard to achieve. I have been delighted by the possibilities of good algorithm design, as well as by the limitations to it, mainly because it poses the greatest challenge to the former, by way of exhibiting the limitation of the mathematics which we employ to understand these problems.

Woods are lovely, dark, and deep. With this in mind, I am opting for graduate studies, aiming Ph.D., which as someone rightly said, is the rite of passage, through which one becomes the colleague to his teachers, and can stand to do independent research. Having learnt the fundamental principles of computer science at the best undergraduate institution in India, I would like to strenthen, deepen and widen my knowledge of computer science, by pursuing graduate studies at your renouned university. Your department has excellent faculty, whose books and research papers have contributed immensely to the knowledge and scholarship. This inspires me to work with them, while I learn and contribute to the university and to the world.

I believe I have the ability to meet the challanges that research involves. I have the necessary aptitude, exposure, motivation and faith to make contribution in my chosen field. The inspiring atmosphere generated by the presence and hard work of the eminent professors at your department attracts me. I look forward to joining your department.

Akash Nanavati