Statement of Purpose

I am a second-year undergraduate student at the University of Illinois Urbana-Champaign. My research interests lie between mathematics and computer science, which include combinatorics, graph theory, algorithms, and game theory. My motivation for wanting to study these fields comes from both the connectedness and the beauty they have. Graphs are very powerful objects in computer science and are used for a wide range of seemingly unrelated tasks, like finding an optimal route, ranking webpages, or scheduling final exams. Like many combinatorial structures, many problems involving graphs are easy to state and understand, but require plenty of creativity and ingenuity to solve, making combinatorics and graph theory very beautiful fields. My goal as a researcher is to understand the properties of graphs better, and to utilize graphs to improve algorithms in theoretical computer science.

I am currently researching extremal graph theory under Peter Bradshaw as part of the ICLUE program at UIUC, and algorithmic game theory under Ruta Mehta as part of the CS STARS program. My research with Dr. Bradshaw focuses on improving upper bounds for graph coloring and its variants, like list coloring and paintability, on certain types of graphs, while my research with Prof Mehta focuses on using graphs to better understand fair division problems and improve fair division algorithms.

I have taken various math courses ranging from analysis to differential equations, and many math-related courses ranging from quantum and thermal physics to algorithms and models of computation. To support my research interests, I completed a graduate course on extremal graph theory taught by Alexandr Kostochka, and am currently taking a graduate course in combinatorics taught by Jozsef Balogh and a graduate course on randomized algorithms taught by Sariel Har-Peled.

Combinatorics has always fascinated me ever since I was a high schooler. Initially, it was the field of math that I couldn't understand, due to how different it was from the math taught in school. Despite my initial struggle, I still attempted to self-study combinatorics anyways. Due to the fact that many solutions in combinatorics tend to be hidden behind small tricks, learning combinatorics pushed me to think in more clever and creative ways, leading me to love the subject. When I arrived at UIUC as a freshman, I took the midterm of an upper level undergraduate combinatorics course to test my skills and received an A, despite not being enrolled in the class. I took a graph theory course in hopes to expand my combinatorics knowledge outside enumeration, and I was fascinated after seeing how graphs interacted computer science, leading me to pursue research in both graph theory and theoretical computer science.

Apart from taking classes and research, I am passionate about encouraging more women to enter math and computer science. For many courses the honors math sequence, there were at most two women enrolled when I took the course, and there have been times where I am the only woman in the class as well. The first math course I took at UIUC was an honors course intended to introduce students to mathematical proofs, which was taught by Prof. Tolman. Prof. Tolman was very supportive of her students, and due to this I never felt intimidated by the low gender diversity of the course. I was inspired by Prof. Tolman and wish to pursue a mathematics PhD to become a professor like her one day, and at the same time I hope to create a more positive environment for women in math like she did for me.

I have engaged in various outreach events through CS STARS, including welcoming prospective students to UIUC, and giving advice to incoming freshmen majoring in Computer Science on how to navigate college. Besides helping new students at UIUC, I also tutor my classmates in algorithms, combinatorics, and graph theory.

By attending the DIMACS REU, I hope to get more perspectives in combinatorics and discrete math, and mentorship that will help me become more prepared for graduate school. I am especially interested in the project on cuts/flows in graphs

by Zihan Tan, as knowledge of flows on graphs has helped people with understanding the structure of graphs in general, like the case of Menger's Theorems or bipartite matching. I am also interested in project on Algorithmic Game Theory by Daniel Schoepflin, as game theory is a field that preserves the beauty of algorithms and math, while still being applicable in the real world. I believe that the courses I've taken in combinatorics and computer science give me a solid foundation to understand research projects in these areas, and my research experience under Dr. Bradshaw and Prof. Mehta gives me the ability to make a meaningful contribution to a research project. In return, it would advance me further in my goal to attend graduate school and eventually become a professor. Thank you for your time and consideration for this opportunity.