ORCA Travel Grant Recipient An Interview with Emily Hoard

Emily Hoard

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Tell us about yourself and what brought you to Murray State University?

As a high schooler, I knew I had a love of learning and wanted to pursue college. Murray State was a good fit for my needs. The campus was comfortable, and I was offered support that would make my undergraduate years easier. It also helped that my brother was also attending, and Murray was close enough to home to make visiting simple but far enough that I could test my independence.

Why did you choose your major, and how did this affect how you chose your research topic?

I was originally a Chemistry major pursuing the Biochemistry track, which I chose primarily because I had a love for both biology and chemistry. During my first year of classes, my experiences in the calculus sequence fostered my love of mathematics and resulted in me adding Mathematics as a second major. I was particularly drawn to the intricacy, logic, and creativity abounding in this field, which serve as the foundation for any mathematical research topic. Unsure where to turn at first, I asked my advisor if there were any problems in her field of Graph Theory that were approachable for an undergraduate, and we eventually landed on the Southwesterly Snakes project.

Who are your research mentors, and how are they helping you in the research process?

My research mentor is Dr. Donovan, who has been incredibly supportive and effective in guiding me through this entire process from day one. From helping me get my feet underneath me after jumping into Graph Theory to helping me ask the right questions, Dr. Donovan has been integral in every step of my journey through math research. Effective research also requires effective communication, and Dr. Donovan has encouraged me at every opportunity to get involved in conferences and is the driving force behind the multiple poster presentations and talks I have given.

Can you describe the general outline and goal of your research?

This research project was focused on determining the solutions to a game called Southwesterly Snake, with the goal to transform one game piece (a “partition”) to another using a limited set of “snake moves.” The first step was to carefully define the different aspects of the game including the partitions and allowable moves along with each step of a map used to transform a snake partition to a lattice partition, a game piece for an analogous game using simpler moves. Visualizing the possible outcomes by building graphs with vertices representing partitions and edges representing valid moves was useful in understanding the problem and how we could determine solutions. The main part of the project was to mathematically prove that the map from the snake partitions to the lattice partitions was an “isomorphism,” or a way of moving between these two different sets while maintaining relationships between partitions and without losing any information. Since the map itself was multistep, proving the isomorphism required splitting the problem into several smaller ones, each of which had to be proven independently.

What is your general hypothesis, and what do you plan to do with the results of your research?

The goal of this project was to answer multiple questions about the Southwesterly Snake game, particularly with determining whether the game can always be won for any two partitions, how many
snake-moves it requires, and exactly which snake moves will win any given game. We were able to determine that any game can be won, and we found a way to describe how many and which moves are needed to beat any game. Next, we plan to look at a different, possibly simpler way, to gain the same information, using matrices.

You presented at the 2019 Joint Mathematics Meeting, Mathematical Association of America and the American Mathematical Society. Can you describe your experience?

The most succinct way to describe my experience at the conference is to say that I was able to see a ton of cool math and meet a lot of mathematicians at all levels—undergraduate, graduate, and faculty—from all over the country. I was able to attend talks on a vast array of different subjects and I learned a tremendous amount. One of the best aspects, though, was that I was able to give a talk on my research, which was a great experience for me both personally and professionally.

How helpful was the travel grant when it came to conducting your research?

The Travel Grant gifted from the Office of Research and Creative Activity was very helpful in getting me to the JMM and allowing me to see other people’s fantastic research. As a large conference taking place far away, the cost of travel was a significant hurdle, and this Travel Grant made the issue of making it to the conference much more approachable.

Any advice for students interested in research?

If you think you might be at all interested in doing research, do it. Find some ideas, find a mentor, and find the courage to start. It will be hard, but it will be worth it. You will make mistakes, you will hit dead ends, and at times it will really hard. But if you stick with it, you will eventually succeed.

Also, know that research is incredibly diverse and can look very different in different fields. It’s not all just mixing solutions in test tubes or staring at a computer screen. Even if you think you’re not interested in research, consider giving it a shot anyway, or if it’s not for you, see if you can become more involved in your field in another way.

What are your plans after you graduate from Murray State?

Once I graduate from Murray in May, 2019, I plan to attend graduate school to pursue a PhD. in Mathematics. After that, I am interested in finding a career that will allow me to continue doing mathematical research, whether that is in an academic or an industrial setting.

Emily’s Travel Grant is located at
https://digitalcommons.murraystate.edu/orcagrants/33/