

Combinatorics Reflection

Rippy

May 2022

1 What mathematical ideas are you curious to know more about as a result of taking this class?

One mathematical concept I am curious and would definitely like to learn more about is the Catalan numbers. I was absolutely fascinated by how many places these numbers showed up when you introduced them in class! I want to see what other applications these numbers have. There are many online resources that document places these numbers arise, and who knows, perhaps I will run into the numbers in my future work in grad school? What was so interesting about them to me was not only how many places they appeared, but how many seemingly un-related topics that these numbers connected. It just goes to show just how interconnected our world is in almost magical ways. Something I genuinely believe is that Math is the language of the universe. It can reveal some of the coolest things in nature—the patterns, the sophistication—all can be revealed through the language of math. Something as simple as a sequence of numbers can connect so many things, almost like a mycelium network!

2 Take one of the topics we have studied, and explain how it can be applied to your another math class or another discipline.

One concept, and perhaps the low-hanging fruit here (but nevertheless very interesting) is graph theory. I know for a fact that I will be using graph theory in my future adventures in graduate school and beyond. Graphs are an incredibly dynamic and useful way to express so many structures to help analyze and manipulate them in very useful ways. Take for example my talk and research on Malware detection! Who would have thought that graphs could be used as a means of defending against Malware? Before I started my research, I had no idea! Using the tools I learned in this class about graph structure, I know that I will be able to find even more uses for graphs to computer science. I hope to be able to use graphs in a meaningful way to apply them to machine learning. With the ability to convert graphs to vectors both ways, anything that uses a vector can also use a graph. Being able to jump back and forth between the two, using the properties we learned in this class could help

reveal new and exciting ways to push the field forward! Who knows, graphs might even be what I focus my research on at Carnegie Mellon! What I can be sure of is that I'll be ahead of the curve with all my math background when compared to the pure Computer Science students at CMU, and maybe, just maybe, I'll be able to help some of the super smart CS students with a thing or two in graph theory because of this class!

3 Take one standard you have worked on this semester that you struggled to fully understand, and explain how the struggle itself was valuable.

One of the things I struggled with this semester was the combinatorial proofs. Trying to rephrase one combinatorial thing into another was definitely difficult. However, after struggling and eventually getting it, I have undoubtedly gained something worthwhile. That same core idea of converting one problem into another is present throughout all of computer science. There are many open and unsolved problems that are floating around out there, waiting to be solved! Who knows, perhaps with the skills I have gained in this class, I can write a ground-breaking combinatorial proof that takes an incredibly difficult unsolved problem, and reshapes it into a much easier to understand and solve problem, perhaps one that builds off of instances that have already been solved! The most important thing is the combinatorial link that is begging to be found and proved. Even if it is not some ground breaking proof, it still may help me one night I'm up late to make a seemingly impossible problem, possible. Combinatorics has been an eye-opening math experience that has shown me just how interconnected these problems can be, you just need to sit down and look for the connection that's hiding in plain sight. As a triple major, I think this class fit me very well, since it taught us to look for connections between multiple seemingly disconnected concepts. I can take that core idea away with me, and apply it to use my multi-disciplinary background and continue to connect more subjects together!

4 Pretend there were no guidelines in the syllabus for calculating your final grade. Based on the work you have done all semester and the stated goals for the course, what grade do you think you have earned?

Personally, I think I have earned an A. I have completed every assessment standard that I needed to and I completed all the problem sets to the degree I needed to (with a few hints on questions I was particularly confused on, but eventually got!). I brought the energy to every class and I was always excited to learn the new material in each class. I participated with my heart and soul, and I had a *cool* time with all the *nifty* and *neato* concepts we went over in class. All in all, I think I did well in this class. I learned brand new things, and enjoyed my time doing it. To be honest, I almost wish I could have made it a two hour class instead of going to Econ (don't tell Dr. Saha!) On the assessments that I initially missed,

after talking it over with you and clarifying where I went wrong, I promptly adjusted and learned from the mistakes that I initially made.