Math 490 Capstone Weekly Report Week Number: 8

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My goals for this week were to:

1. Understand the following properties that a monoidal category can have: symmetric, closed, and Cartesian. TeX up the definitions with diagrams.

2. Start reading "Categorical Systems Theory." Finish a quick read of the first two chapters to outline the concepts and prepare for a deep dive of chapter 1 next week.

3. Start thinking of applications / systems to simulate.

I made the following progress on these:

I finished all of my goals for this week with some modifications. I've finished my definitions for symmetric and Cartesian monoidal categories but skipped closed since it wasn't needed for the applied sections that are important to the project. I did a quick read of the first three chapters of "Categorical Systems Theory" but skipped the last sections in each chapter, sticking to the material that's most pertinent. I've also made a little bit of progress on what I'd like my case studies to be. For the discrete case I'm thinking I'll set up a composition of Moore machines to model some interacting agents in an environment. For the differential case I want to try to wire up a bunch of simple harmonic oscillators, but I'm worried it's not a sufficiently "useful" toy application.

I have the following questions and concerns I want to discuss with my capstone advisor:

I'm going to ask Dr. Menendez to read through my project summary once I finish it. I'll also probably want to talk over notation choices.

Some tentative goals for the coming week are:

1. Finish all of the definitions for the category of lenses over **Set** and **Euc**.

2. Program the necessary functionality for lenses in Python and/or Julia.

3. Start work on the Moore machine example.

4. Finish the rough draft of my project summary and the introductory sections of my final paper.

5. Decide on consistent, readable notation for all the category theory definitions and diagrams. There are a few options for membership in the class of objects, homsets, composition of morphism, etc.