Thesis Outline

1. Introduction
2. Category Theory
    1. Category Theory Basics
        1. Categories
        2. Functors
        3. Natural Transformations
    2. Universal Properties
        1. Terminal/Initial Objects
        2. (Co)Products
        3. (Co)Equalizers
        4. Pullbacks and Pushouts
        5. (Co)Cones and (Co)Limits
    3. Relations Between Categories
        1. Subcategory
        2. Full Subcategory
        3. Natural Isomorphism
        4. Adjunction
        5. Monad (*)
        6. The Yoneda Lemma (*)
    4. Structure on Categories
        1. Monoidal Categories
        2. Symmetric Monoidal Categories
        3. Cartesian Monoidal Categories
3. Categorical Systems Theory
    1. Abstracting Systems
    2. The Category of Arenas and Lenses
        1. Lenses in an underlying Cartesian monoidal category
        2. Identity Lenses
        3. Lens Composition
        4. The Parallel Product of Lenses
    3. Case Study: Composing Discrete Dynamical Systems
        1. Discrete Dynamical Systems are Lenses over **Set**
        2. The Case Study (+)
    4. Case Study: Composing Differential Systems
        1. Differential Systems are Lenses over **Euc**
        2. The Case Study (+)
    5. Monadic Lenses (*)
    6. Case Study: Composing Markov Processes (*)(+)

(*): These sections might be cut in the final paper.
(+): I don’t know what my case studies will be yet.