CSCI 340: Computational Models

Background

The Theory of Computers

- Form mathematical models that will describe
  - parts of computers
  - types of computers
  - and similar machines
  - ... with varying degrees of accuracy
- Mathematical doesn't necessarily mean geometry or calculus
- Make claims and support them with logic and **proofs**
- The material in this class is timeless – it carries through general theory of computation. Agnostic to:
  - computer architecture
  - programming language
  - operating system

The Building Blocks of Theory of Computation

- Mathematical Logic
- Set Theory
- Mathematical Proofs
- Universal Algorithm Machine
  - Alonzo Church
  - Stephen Kleene
  - Emil Post
  - Andre Markov
  - John Von Neumann
  - Alan Turing

Why is Theory of Computation Important?

1. Because Dr. Schwartz says it is
2. Because MU CS says it is
3. Because computer science is built on mathematics?

Why is Theory of Computation Important?

1. We want to prove proofs in mathematics
2. We want to use mathematics to describe how things work
   - Theory of Computation: modeling **algorithms**
   - "Neural Networks": modeling **thought**
3. We want to understand how computers work from a rigorous logical view rather than from details (See CSCI 362, 370, 380)

Computer Theory

- **Three Primary Components:**
  - Theory of Automata
  - Theory of Formal Languages
  - Theory of Turing Machines
- **General Overview of the Course:**
  - Analyzing different types of theoretical machines
  - Describing these theoretical machines as mathematical models
  - Determine their strengths and weaknesses
  - Discover the concept of *computability*