

Week 7: Church-Turing Thesis and Lambda Calculus

Mathematical Logic Course

April 24, 2023

Introduction

- ▶ Welcome to Week 7 of our Mathematical Logic Course!
- ▶ This week, we'll explore the Church-Turing Thesis and Lambda Calculus.
- ▶ We'll cover the following topics:
 - ▶ Church-Turing Thesis: statement and implications
 - ▶ Introduction to lambda calculus

Church-Turing Thesis

- ▶ What is the Church-Turing Thesis?
- ▶ Alonzo Church and Alan Turing's contributions to computability theory
- ▶ The equivalence of Turing machines, lambda calculus, and recursive functions
- ▶ Implications of the Church-Turing Thesis for the limits of computation

Lambda Calculus

- ▶ What is lambda calculus?
- ▶ Formalization of lambda calculus: syntax and semantics
- ▶ Lambda expressions, abstraction, and application
- ▶ Examples of lambda expressions and their evaluation

Reductions and Combinators

- ▶ Reduction strategies in lambda calculus
- ▶ Normal order, applicative order, and normal forms
- ▶ Introduction to combinatory logic and combinators
- ▶ Examples of combinators and their use in lambda calculus

Summary and Conclusion

- ▶ Recap of the topics covered in this lecture
- ▶ Church-Turing Thesis and its foundational role in computer science
- ▶ Lambda calculus and its expressive power
- ▶ Next week, we'll explore the Halting Problem and Undecidability

Questions and Discussion

- ▶ Do you have any questions about today's lecture?
- ▶ Let's discuss the material and explore any questions you may have

Coding Exercises

- ▶ Implementing lambda expressions and basic evaluation rules in Python
- ▶ Exploring the expressive power of lambda calculus through examples