Week 8: Halting Problem and Undecidability

Mathematical Logic Course

April 24, 2023

Introduction

- Welcome to Week 8 of our Mathematical Logic Course!
- This week, we'll explore the Halting Problem and Undecidability.
- We'll cover the following topics:
  - Statement and proof of the Halting Problem's undecidability
  - Reductions and other undecidable problems

The Halting Problem

- What is the Halting Problem?
- Formal definition of the Halting Problem
- Understanding the significance of the Halting Problem in computability theory

Undecidability of the Halting Problem

- Proof sketch of the undecidability of the Halting Problem
- The paradox of the self-referential machine
- Understanding the implications of undecidability

Reductions and Other Undecidable Problems

- The concept of reductions between problems
- Examples of problems that are reducible to the Halting Problem
- Exploring a variety of undecidable problems in computer science

Summary and Conclusion

- Recap of the topics covered in this lecture
- The Halting Problem and its undecidability
- Understanding the limits of algorithmic computation
- Next week, we'll explore Complexity Theory and P vs NP

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

- Exploring examples of undecidable problems in Python
- Understanding the concept of reductions through coding exercises