

Week 9: Complexity Theory and P vs NP

Mathematical Logic Course

April 24, 2023

Introduction

- ▶ Welcome to Week 9 of our Mathematical Logic Course!
- ▶ This week, we'll explore Complexity Theory and the P vs NP problem.
- ▶ We'll cover the following topics:
 - ▶ Introduction to computational complexity theory
 - ▶ P, NP, and NP-complete classes
 - ▶ P vs NP problem: statement and significance

Computational Complexity Theory

- ▶ What is computational complexity theory?
- ▶ Measuring the computational resources needed to solve problems
- ▶ Time complexity and space complexity
- ▶ Big-O notation and analyzing algorithmic efficiency

P, NP, and NP-Complete Classes

- ▶ Understanding the class P: problems solvable in polynomial time
- ▶ Understanding the class NP: problems verifiable in polynomial time
- ▶ The class NP-complete: hardest problems in NP
- ▶ Examples of NP-complete problems

The P vs NP Problem

- ▶ Statement of the P vs NP problem
- ▶ Why is the P vs NP problem important?
- ▶ Consequences of $P = NP$ or $P \neq NP$
- ▶ Open questions and the Clay Mathematics Institute's prize

Summary and Conclusion

- ▶ Recap of the topics covered in this lecture
- ▶ Complexity Theory and its impact on computer science
- ▶ The significance of the P vs NP problem
- ▶ Next week, we'll explore Set Theory and the Continuum Hypothesis

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 and analyzing algorithms for NP-complete problems in Python
- ▶ Exploring the concept of polynomial-time reductions