

# Week 11: Model Theory and Nonstandard Models

Mathematical Logic Course

April 24, 2023

# Introduction

- ▶ Welcome to Week 11 of our Mathematical Logic Course!
- ▶ This week, we'll explore Model Theory and Nonstandard Models.
- ▶ We'll cover the following topics:
  - ▶ Introduction to model theory: structures and interpretations
  - ▶ Nonstandard models of arithmetic

# Model Theory: Structures and Interpretations

- ▶ What is model theory?
- ▶ Formal definition of structures and interpretations
- ▶ Understanding the relationship between syntax and semantics in logic
- ▶ Examples of structures and models

# Nonstandard Models of Arithmetic

- ▶ Introduction to nonstandard models of arithmetic
- ▶ The concept of nonstandard natural numbers
- ▶ Henkin constructions and the compactness theorem
- ▶ Understanding the properties of nonstandard models

# Gödel's Incompleteness Theorems Revisited

- ▶ The role of nonstandard models in Gödel's Incompleteness Theorems
- ▶ Understanding the limitations of formal systems
- ▶ Exploring the connections between model theory and incompleteness

# Summary and Conclusion

- ▶ Recap of the topics covered in this lecture
- ▶ Model theory and its role in mathematical logic
- ▶ Nonstandard models and their significance
- ▶ Next week, we'll have a Course Summary and work on the Final Project

# 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 structures and interpretations in Python
- ▶ Exploring nonstandard models and their properties through coding exercises