Week 5: Gödel's First Incompleteness Theorem

Mathematical Logic Course

April 24, 2023

Introduction

- Welcome to Week 5 of our Mathematical Logic Course!
- This week, we'll explore Gödel's First Incompleteness Theorem and its implications.
- We'll cover the following topics:
  - Statement and proof sketch of Gödel's First Incompleteness Theorem
  - Construction of a self-referential sentence (Gödel sentence)
  - Consequences and implications of the theorem

Gödel's First Incompleteness Theorem

- Statement of the theorem
- What does it mean for a formal system to be incomplete?
- Understanding the key insights behind the theorem

The Gödel Sentence

- Constructing a self-referential sentence
- How does the Gödel sentence relate to the theorem?
- Understanding the paradoxical nature of the sentence

Proof Sketch

- A brief overview of the proof of Gödel's First Incompleteness Theorem
- The role of Gödel numbering and representability
- Demonstrating the existence of an unprovable sentence

Implications and Consequences

- What are the implications of Gödel's First Incompleteness Theorem?
- Limits of formal systems and mathematical reasoning
- The impact on foundational mathematics

Summary and Conclusion

- Recap of the topics covered in this lecture
- Gödel's First Incompleteness Theorem and its significance
- Next week, we'll explore Gödel's Second Incompleteness Theorem

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

- Constructing self-referential sentences in Python
- Exploring the limitations of formal systems and consistency proofs