Homework–2A Geography Video
Fall 2024: CS 313: Computational Complexity Theory

Due: Monday, Nov 4, 2024. Total Marks: 50

This homework can be attempted individually or in groups of two.

Introduction and Motivation

In this assignment, you will explore the complexity of a 2-player game: Generalized Geography. Instead of a traditional proof, you will create a short instructional video explaining why Generalized Geography is **PSPACE**-Complete. This exercise is designed to deepen your understanding of **PSPACE**-Completeness by engaging with the material in a creative and explanatory format.

Creating this video will help you learn how to:

- Conduct literature review on the given theoretical problem, a crucial skill in research.

- Utilize visual aids like diagrams or animations to clarify your explanation.

- Structure and narrate your thoughts logically, which is invaluable in both academic and professional environments.

Assignment Prompt

Your task is to create a 5-6 minute instructional video explaining why Generalized Geography is **PSPACE**-Complete. The video should be clear, engaging, and accurate. Make sure to cover the following points:

1. Problem Definition

- Define the Generalized Geography game. This requires you to conduct your own literature review. Feel free to verify your definition with the instructor if unsure.

- Explain the rules and structure of the game both in the context of two-player turn-taking, as well as,

- Formulate the problem as a graph decision problem and discuss how it fits into the **PSPACE** class.

2. Reduction from Another PSPACE-Complete Problem

- Choose an appropriate **PSPACE**-Complete problem for reduction.

- Clearly define the chosen problem and outline its rules.

- Explain the steps of reducing this problem to Generalized Geography, with diagrams where useful to illustrate the reduction process.

3. Correctness of the Reduction

- Provide a detailed explanation of why your reduction is valid.

- Demonstrate the logical relation between the problems, explaining why a solution to Generalized Geography would also solve the reduced problem.

4. Space (and Time) Complexity Analysis

- Analyze both the space and time complexity (both needed in different parts of the explanation), considering relevant data structures or representations.

5. **Explanation of PSPACE-Completeness**

   - Summarize why Generalized Geography is **PSPACE**-Complete, emphasizing that it belongs to **PSPACE** and that you have provided a reduction from a **PSPACE**-Complete problem.

6. **Video Presentation, Audio, and Visual Aids**

   - The video can be any format of your choice, allowing you to be creative. Consider using diagrams, charts, or animations to enhance clarity.

   - Ensure the video has a logical structure, flowing smoothly from one concept to the next, in a way that is engaging and accessible.

Submission Guidelines

   - The video should be around 5-6 minutes long.

   - Use clear language while maintaining formal definitions and reasoning.

   - Submit your video link on the course platform by the due date. Ensure the link is accessible without needing to log in, regardless of the plaftorm it is hosted on.

   - You are urged, but not required, to make the video publicly available.

Good Luck!

Category	Points	Criteria for Full Points
Problem Definition	10	Correctly defines the Generalized Geography problem. Explains the rules clearly and formulates the problem as a decision problem, showing how it fits into **PSPACE**.
Reduction from **PSPACE**-Complete Problem	10	Selects an appropriate **PSPACE**-Complete problem for reduction. Accurately explains the rules of the chosen problem and demonstrates a clear, logical reduction from it to Generalized Geography.
Correctness of the Reduction	5	Provides a detailed explanation of why the reduction is valid, demonstrating the logical connection between the two problems.
Space (and Time) Complexity Analysis	10	Accurately analyzes the space and time complexity and considers relevant data structures.
Visual Aids and Presentation	5	Uses diagrams, charts, or animations effectively to explain concepts, especially the reduction and time complexity.
Clarity and Structure	5	The video is structured logically, easy to follow, and free of excessive jargon. Concepts flow smoothly.
Engagement and Creativity	5	The video is engaging and creatively presented, with narration that holds the viewer's interest.

AI Acknowledgement

ChatGPT has been used to help modify the text of this prompt.