Lesson Plan: Introduction to Graph Theory

Overview

This lesson plan is tailored for the International Baccalaureate (IB) Diploma Programme (DP) students taking Mathematics, focusing on an introduction to Graph Theory. It is designed to cover the basics and definitions, types of graphs, and the importance of vertices and edges. The session aims to provide students with a foundational understanding of graph theory concepts, preparing them for more advanced topics like adjacency, minimum spanning trees, and solving problems like the Travelling Salesman and Chinese Postman problems.

Objectives

- Understand basic terminology of graph theory including vertices, edges, degrees, and adjacent vertices.
- Differentiate between simple, complete, and weighted graphs.
- Explore directed and undirected graphs, including concepts of in-degree and out-degree.
- Introduce trees and their properties as a type of subgraph.
- Illustrate practical applications of graph theory in solving real-world problems.

Materials

- Whiteboard and markers
- Projector and computer for slideshows and applet demonstrations
- Handouts with definitions, examples of different types of graphs, and practice problems
- Graph paper and pencils for drawing graphs

Lesson Duration

60 minutes

Lesson Structure

1. Introduction to Graph Theory (10 minutes)
   - Brief overview of graph theory and its significance in mathematics and real-world applications.
   - Introduce basic definitions: graphs, vertices (nodes), edges (lines).

2. Types of Graphs (15 minutes)
   - Discuss and provide examples of simple, complete, and weighted graphs.
   - Explain the concepts of directed and undirected graphs, including strong connectivity.

3. Graph Properties (15 minutes)
   - Define adjacent vertices, adjacent edges, and the degree of a vertex with visual examples.
   - Introduce trees as acyclic connected graphs and their importance.

4. Interactive Activity (15 minutes)

- Divide students into groups and provide them with graph paper and pencils.
- Assign each group to draw examples of different types of graphs discussed and identify properties such as degrees of vertices and adjacency.

5. Discussion and Application (5 minutes)
- Discuss the drawn graphs, focusing on their applications and how they illustrate the discussed concepts.
- Briefly introduce how graph theory concepts like Eulerian and Hamiltonian paths are applied in solving problems.

Assessment

- Evaluate students' understanding through their participation in the interactive activity and the correctness of their graph drawings.
- Review and discuss the handouts completed by students as a form of self-checking understanding.

Extensions

- Assign research on the application of graph theory in technology, biology, and logistics for a class presentation.
- Introduce graph theory software tools for creating and analyzing graphs.

Resources

- Slideshows with examples of graphs and their properties.
- Handouts with definitions and characteristics of different types of graphs.
- Online applets or software for graph theory visualization (optional).

This lesson plan aims to build a solid foundation in graph theory for IB DP Mathematics students, stimulating interest and understanding of how graph theory principles apply to mathematical reasoning and problem-solving in various contexts.