Project Description: Exploring the Diverse Applications of Graph Theory

Knowledge-Based Systems

December 1, 2024

1 Introduction

As part of this course, students will undertake a project focused on data collection, modeling, and analysis. The aim is to develop a solid understanding of graph-based databases and Cypher queries. Students will identify real-world problems and solve them using graph theory.

2 Select or Collect Data

The data can come from open-source sources. It is important to properly cite these sources. Alternatively, students may collect their own datasets.

3 Create a Data Model

Students will learn the structure of graphs and how to transform traditional tabular datasets into graph formats.

4 Formulate Research Questions

Three central questions should be formulated, which can be answered using Cypher queries. The results of these queries should then be visualized using appropriate visualization tools. Possible tools include:

- Bloom
- NetworkX
- Linkurious
- Hume
- VizNetwork

- Gephi
- D3.js
- Power BI

Note: Argue which tool is chosen and why.

5 Presentation

The presentation should include an overview of the open-source data or collected data, the preprocessing steps carried out, the formulated research questions, and the insights gained. Students should be able to present their findings clearly and concisely. Additionally, a comprehensive documentation of the project is required for evaluation.

The following topics are central application areas of graph theory and are recommended for data and project selection:

1. Social Network Analysis
2. Recommendation Systems
3. Fraud Detection
4. Natural Language Processing (NLP)
5. Biological Network Analysis
6. Anomaly Detection
7. Supply Chain and Logistics Optimization
8. Customer Segmentation and Marketing Analytics