



Shortest path algorithm applied to a Neo4j graph database using the JAVA programming language.

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## Chapter 1

# Introduction to Graph Databases

## 1.1 Graph theory

In the mathematical sense, a graph is a set of nodes and vertices  $G = \{N, \epsilon\}$  with  $N$  being a set of nodes and  $\epsilon$  the set of edges.

We generally distinguish between two types of graphs: directed graphs and undirected graphs

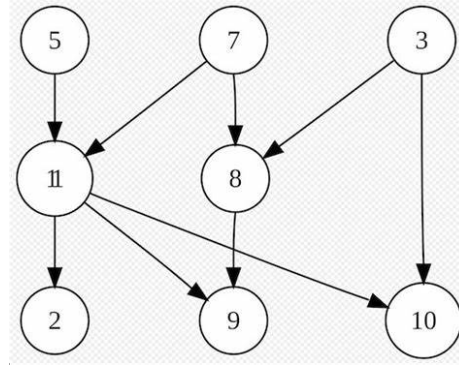


Figure 1.1: Directed graph

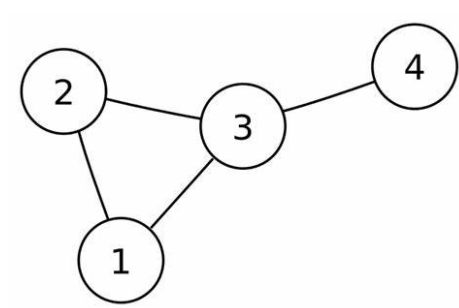


Figure 1.2: Undirected graph

Graph theory is a branch of mathematics that takes interest in the study of such mathematical structure, and during this project it will come in handy.

## 1.2 Graph Databases

### 1.2.1 Introduction

Graph Databases are databases that make use of graphs to represent data points and the relations tying these data points together.

Graph Databases are commonly used for highly connected data and are generally considered to emphasize less the contents of the data.

Generally, data points are represented as nodes with the different relations between nodes being represented by edges.

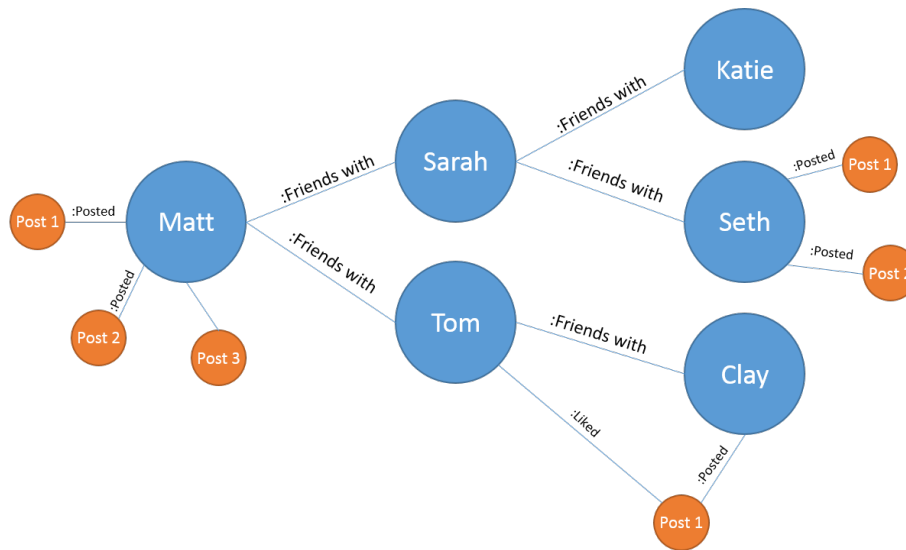


Figure 1.3: Example of a Graph Database

### 1.2.2 Graph Databases vs. Relational Databases

While Relational Databases see more general use than Graph Databases, Graph Databases (or NoSQL Databases) present numerous advantages over the traditional Relational Databases, these advantages include but are not limited to:

1. A clearer representation of Relations and Many to Many relations.
2. Low latency and better scaling.
3. Faster response to complex queries and more performant insertions/deletions.

These performance benefits are inherent to the graph structures, while we get all of those benefits we do suffer from a weaker data representation when compared with traditional SQL tables.

## 1.3 Neo4j

According to the Neo4j product brief, a Neo4j Graph Database is the market leading database that empowers developers to create intelligent applications that harness the rich relationships in your data and answer complex questions with speed that no other database can match. As the heart of the Neo4j Graph Data Platform, Neo4j Graph Database helps enterprises across industries – life sciences, utilities, financial services, cybersecurity, and many more – uncover hidden insights in real time.

Neo4j puts emphasis on the following points:

- Fast Performance
- Unbounded Scale
- Developer Productivity
- Operational Trust

That's why we're going to be using the Neo4j JAVA driver for our project.

## Chapter 2

# Setting up the environment