

Introduction to Neo4j - Lab exercise

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1 Introduction

Nowadays, the links between the data are of high importance to enterprises. Many applications need real-time insights into these relationships, and not data alone. Graph databases use graph structures with nodes, edges, and properties to store and retrieve data along with the relationships. In this exercise we will explore graph databases. As in the lectures, the database covered is Neo4j. To get some hands on experience with this NoSQL database, we'll start by installing *Neo4j* and then use its query language *Cypher* to explore an interesting dataset.

2 Dataset

If you made it till the end of last session exercise, you noticed that what was trending on Twitter (except Trump) is Game of Thrones season 7. Let's keep up with the trends and explore how Neo4j capabilities can help in analyzing relationships between GoT characters.

Andrew Beveridge and Jie Shan published "Network of Thrones" where they analyze a network of character interactions from the novel "A Storm of Swords", the third book in 'A Song of Ice and Fire' and the basis for the Game of Thrones TV series. In their [paper](#) they detail how they constructed the network of character interactions by using text analysis and entity extraction to find characters mentioned together in the text. The csv file we will use has the following structure:

Source, **Target**, **Weight** where Source and Target represent characters from the books, while the weight quantifies the number of interactions between the them two.

3 Getting started

Setup Neo4j by running `neo4j_installer_sur_mon_home.sh` in a shell. At the end of the session, run `neo4j/bin/neo4j stop`.

Open the Neo4j application and click on the 'Start' button to lunch the Neo4j server. Next, you can open the provided URL (by default: <http://localhost:7474/browser/>) in a local web browser. You can use the existing 'neo4j' account. With this setup you can use the browser for importing data, executing [Cypher queries](#), and getting preview of results in tabular or graph formats. You can follow the option "Write Code" that takes you to some sample datasets to play with. You can start by getting familiar with Cypher exploring the movie dataset.

4 Analyzing the Graph of Thrones

4.1 Import dataset

The first part of the data for this exercise will be directly imported from the authors' website. We will convert the adjacency list from the file into a simple data model (Figure 1):

```
(:Character {name})-[:INTERACTS {weight}]->(:Character {name})
```



Figure 1: Data model for Network of thrones

Nodes with label 'Character' represent characters from the text, and we have a single relationship type 'INTERACTS' which connects characters who have interacted in the text. We'll store the character's name as *property-name* on the node and the number of interactions between two characters as a *property-weight* on the relationships.

To assure integrity of our schema, we first create a constraint for uniqueness of the character names:

```
CREATE CONSTRAINT ON (c:Character) ASSERT c.name IS UNIQUE;
```

Question: Does imposing this constraint improve the performance in a way other than integrity?

Once the constraint is created we can use the Cypher `LOAD CSV` statement to import the data:

```
LOAD CSV WITH HEADERS FROM
"https://www.macalester.edu/~abeverid/data/stormofwords.csv" AS row
MERGE (src:Character {name: row.Source})
MERGE (tgt:Character {name: row.Target})
MERGE (src)-[r:INTERACTS]->(tgt)
ON CREATE SET r.weight = toInt(row.Weight)
```

4.2 Analyzing the network

With the dataset loaded we can start exploring the graph. Start by visualizing the dataset. Next, write Cypher queries to answer the following questions (you can use the [Cypher Reference Card](#) for quick help on syntax):

- How many characters appear in the graph?

- Get summary statistics for the minimum, maximum and average number of characters each character has interacted with.
- Find the shortest path from Arya to Ramsay. Consider the possibility of having few paths of same length. List all of them in the result. You can use the functions 'shortestPath' and 'allShortestPaths' provided in Cypher.
- What is the longest shortest-path distance between any two characters ?
- How many characters are there with interaction distance 4 to Cersei Lannister?

4.3 Expanding the graph

Next, we'll enrich our graph by adding information on the family ties between the characters. Import the second data set using the following command:

```
LOAD CSV WITH HEADERS FROM "file:///family_ties.csv" AS row
MERGE (src:Character {name: row.character1})
MERGE (tgt:Character {name: row.character2})
MERGE (tgt)-[r:RELATIONSHIP]->(src)
ON CREATE SET r.tie = row.tie
```

With the new dataset included we extend out model to the following (Figure 2):

```
(:Character {name})-[:RELATIONSHIP {tie}]->(:Character {name})
```



Figure 2: Data model for Network of thrones and Family ties

If you visualize the graph, when you hover over links named 'relationships', you should be able to see the ties. Can you answer the following question:

- Who are Jon Snows' parents?
- You can notice that sibling relationships are missing. Try to create them by finding common parents for the ties we have already in the graph.
- Are there any children of incestuous relationships?