

# Assignment No. 12

6CS371 : Advanced Database System Lab

Spatial and Geographic Data

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TY CSE

## Aim

This assignment aims to explore spatial and geographic data management within the context of advanced database systems. Specifically, it focuses on utilizing Neo4j and Neo4j Spatial to handle location-based services on the web.

## Introduction

In this task, we will install and configure Neo4j Spatial, a plugin facilitating geospatial operations in Neo4j databases. They will then use Cypher Query Language (CQL) scripts to populate the database with 10,000 randomly generated location points. By leveraging Neo4j's point() and distance() functions, we will analyze spatial relationships within the database, demonstrating practical applications in location-based services on the web.

## Procedure

### 1. Setup Neo4j

#### 1. Download Neo4j

- a. Install OpenJDK 18
- b. Download the neo4j community server (.tar for linux, .zip for windows)

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Enterprise Edition download includes APOC procedures, Bloom and Graph Data Science Library. Additional license keys may be required.


Older Enterprise Edition versions are available at the [Support Portal](#) after logging in.

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Neo4j 5.18.1 Released 18 March 2024

Linux / Mac Executable Neo4j 5.18.1 (tar)

Download 

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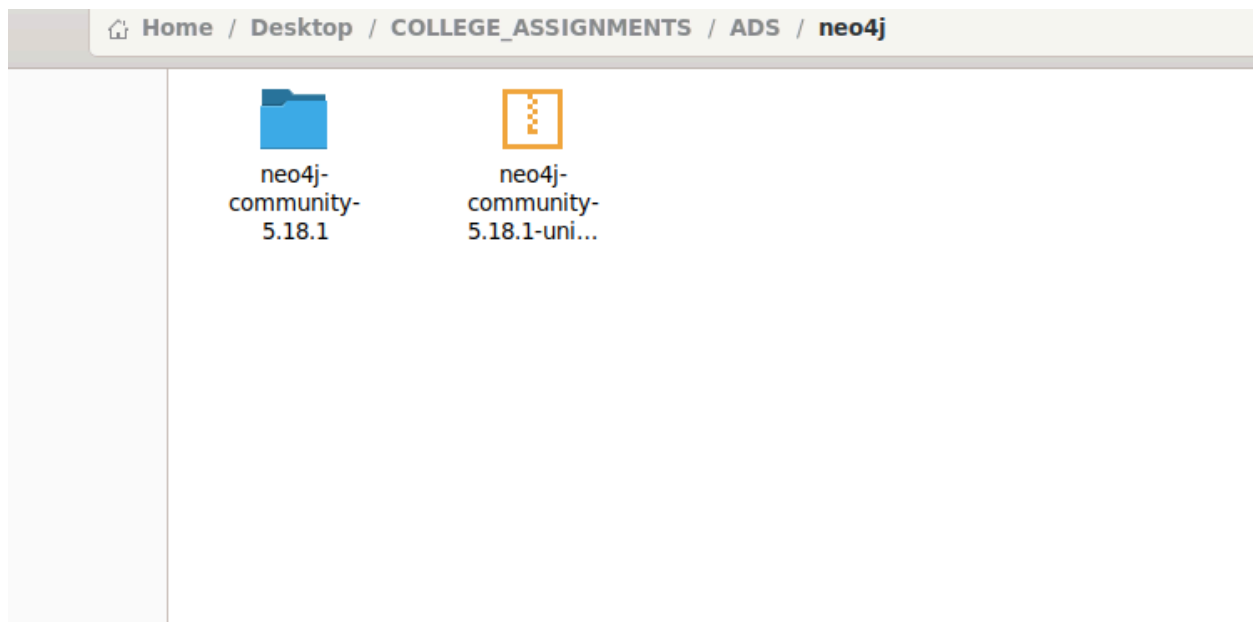
### Neo4j Repositories

Ensure OS dependencies are satisfied and simplify the installation and update of Neo4j by using the official yum and apt repositories for RHEL and Ubuntu/Debian based systems.

Neo4j (Debian / Ubuntu) Apt Repository

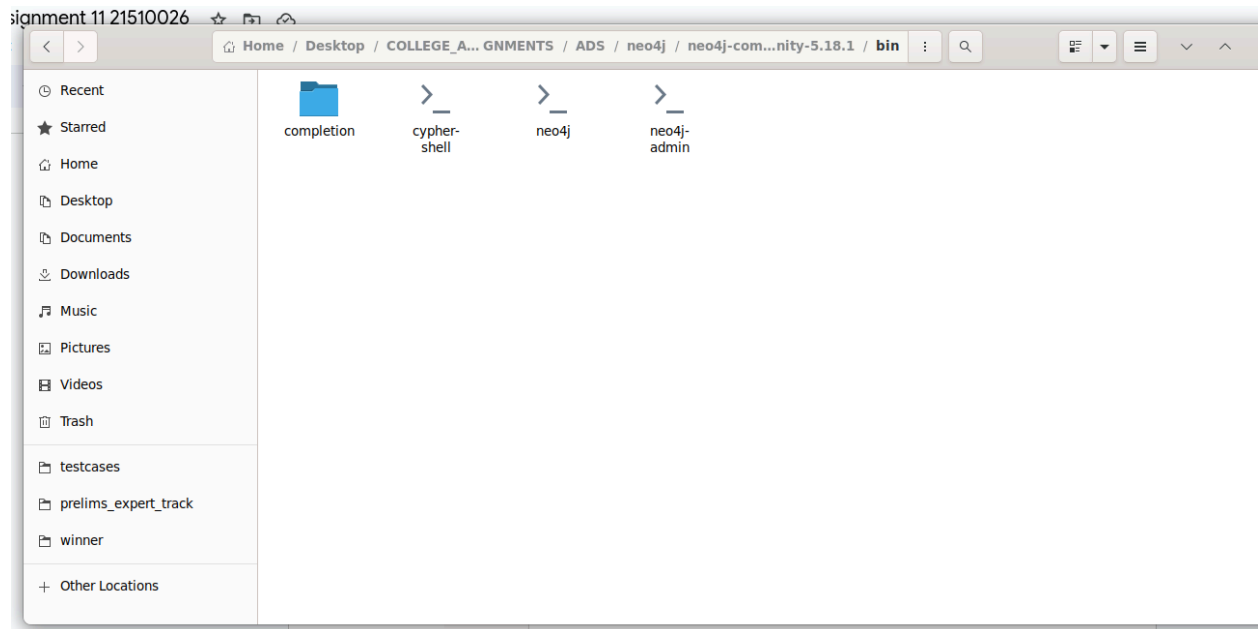
Visit

### c. Extract it to a folder



## 2. Start Neo4j Server

- Navigate to the /bin folder in neo4j server folder

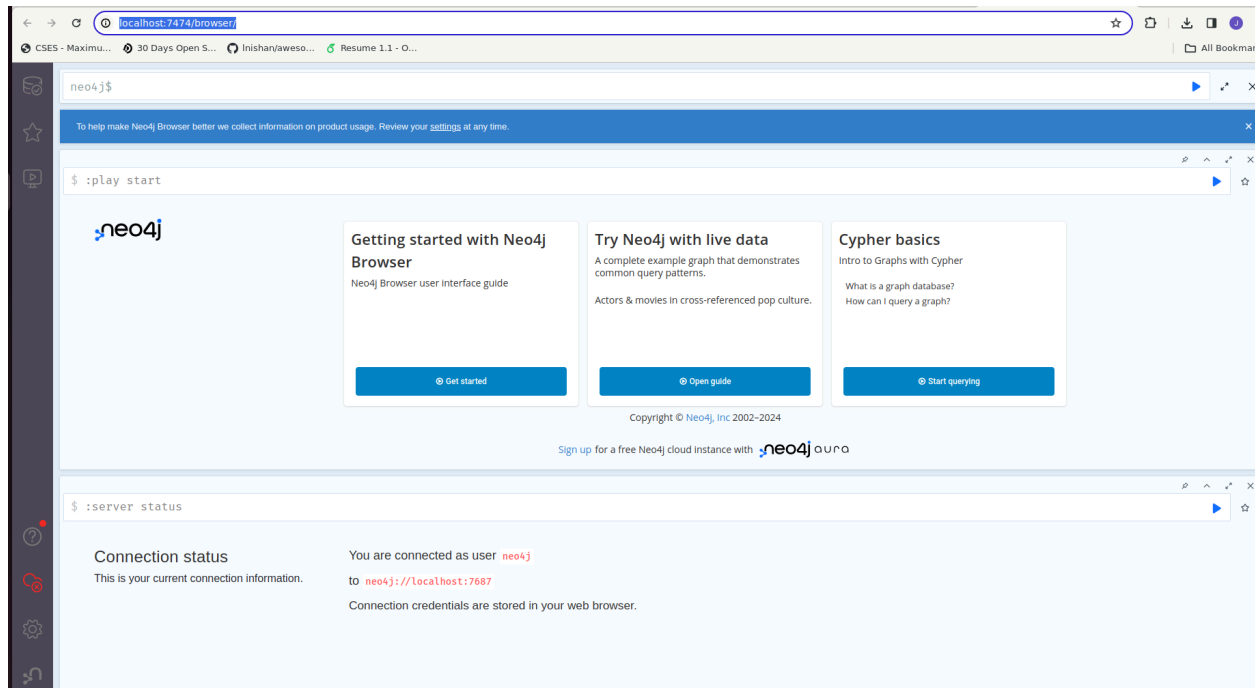


b. Run the neo4j executable with start parameter

```
oneautumleaf@oneautumleaf-IdeaPad-Gaming-3-15IHU6:~/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/bin$ ./neo4j start
Directories in use:
home:           /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1
config:         /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/conf
logs:           /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/logs
plugins:        /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/plugins
import:         /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/import
data:           /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/data
certificates:   /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/certificates
licenses:       /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/licenses
run:            /home/oneautumleaf/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/run
Starting Neo4j.
Started neo4j (pid:7482). It is available at http://localhost:7474
There may be a short delay until the server is ready.
oneautumleaf@oneautumleaf-IdeaPad-Gaming-3-15IHU6:~/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/bin$
```

### 3. Access Neo4j Browser

a. Access neo4j browser from <http://localhost:7474/browser/>



#### 4. Login and Configure

- a. For the first time, the following credentials are to be use

Username: neo4j

Password: neo4j

- b. On the first login password has to be changed.

#### 2. Add the neo4j spatial plugin

- a. Go to <https://github.com/neo4j-contrib/spatial/releases> and install the latest neo4j-spatial-\*.jar file.

One particularly big upgrade was the move from junit4 to junit5 which required changes to every single test class.

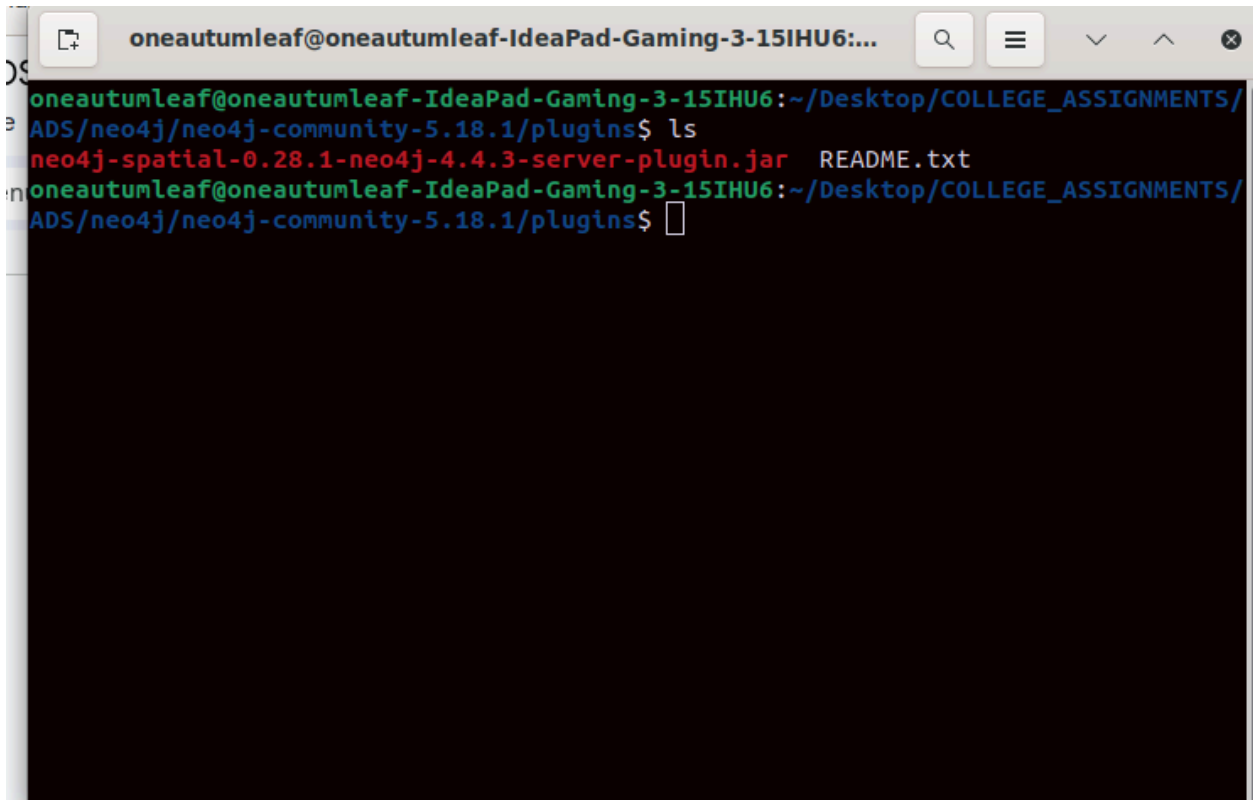
The latest version of Geotools does not support JDK17 and so we will hold off upgrading completely to JDK17 before Geotools has completed their port.

##### ▼ Assets 3

neo4j-spatial-0.28.1-neo4j-4.4.3-server-plugin.jar	20.6 MB	Feb 7, 2022
<a href="#">Source code (zip)</a>		Feb 7, 2022
<a href="#">Source code (tar.gz)</a>		Feb 7, 2022

5 5 people reacted

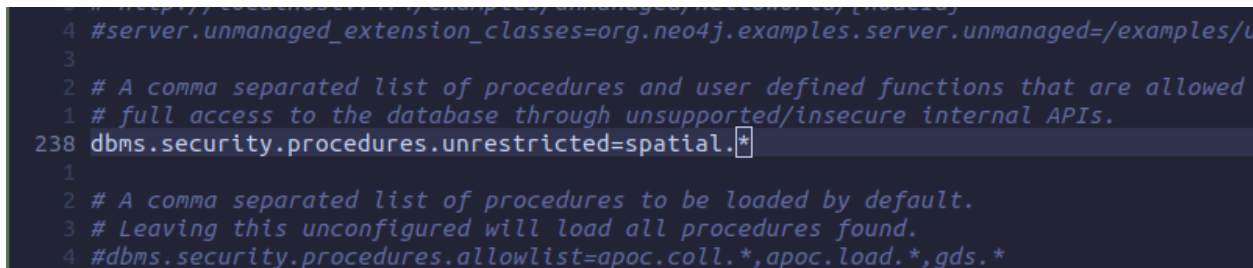
- b. Copy this file to `$NEO4J_HOME/plugins` and we can then use all the neo4j spatial commands.



A terminal window titled "oneautumleaf@oneautumleaf-IdeaPad-Gaming-3-15IHU6:..." showing a file listing command. The prompt is "oneautumleaf@oneautumleaf-IdeaPad-Gaming-3-15IHU6:~/Desktop/COLLEGE\_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/plugins\$". The command "ls" is entered, and the output is "neo4j-spatial-0.28.1-neo4j-4.4.3-server-plugin.jar" and "README.txt".

```
oneautumleaf@oneautumleaf-IdeaPad-Gaming-3-15IHU6:~/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/plugins$ ls
neo4j-spatial-0.28.1-neo4j-4.4.3-server-plugin.jar  README.txt
oneautumleaf@oneautumleaf-IdeaPad-Gaming-3-15IHU6:~/Desktop/COLLEGE_ASSIGNMENTS/ADS/neo4j/neo4j-community-5.18.1/plugins$
```


c. Change the security policy to allow use of spatial procedures



A snippet from a Neo4j configuration file showing the security policy configuration. The line "dbms.security.procedures.unrestricted=spatial.\*" is highlighted.

```
4 #server.unmanaged_extension_classes=org.neo4j.examples.server.unmanaged=/examples/u
3
2 # A comma separated list of procedures and user defined functions that are allowed
1 # full access to the database through unsupported/insecure internal APIs.
238 dbms.security.procedures.unrestricted=spatial.*
1
2 # A comma separated list of procedures to be loaded by default.
3 # Leaving this unconfigured will load all procedures found.
4 #dbms.security.procedures.allowlist=apoc.coll.*,apoc.load.*,gds.*
```

3. Write code to add 10,000 geospatial data point:

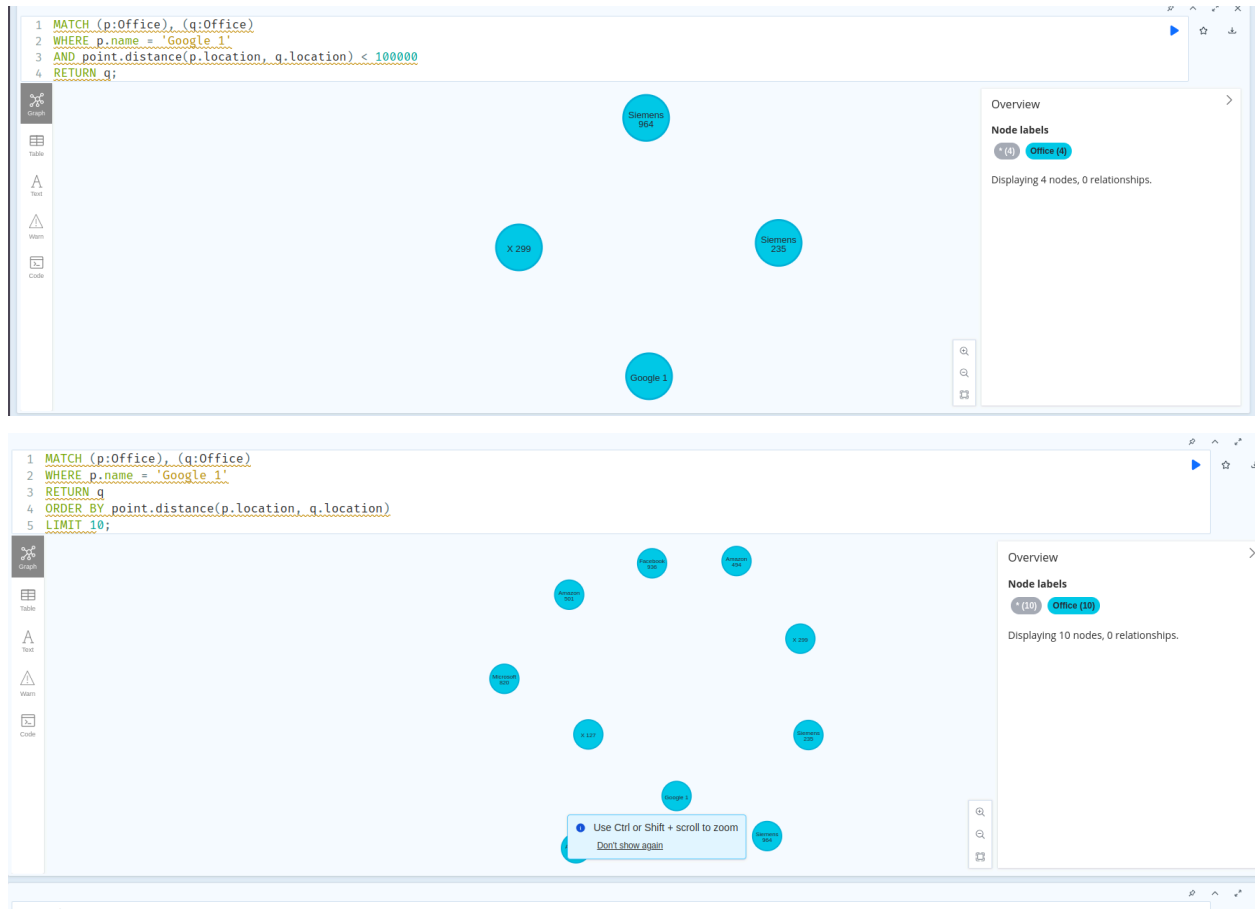


A screenshot of a Neo4j IDE showing a Cypher query to create 10,000 office nodes. The query is as follows:

```
1 // Define a list of cities
2 WITH ['Google', 'Microsoft', 'Amazon', 'Siemens', 'Tata', 'Birla', 'Nike', 'Nestle', 'Facebook', 'X'] AS companies
3
4 // Loop through each city
5 UNWIND companies AS company
6 FOREACH(branch_number IN range(1, 1000) |
7   CREATE (o:Office {
8     name: company + ' ' + toString(branch_number),
9     location: point({
10       latitude: 100 * (rand() - 0.5),
11       longitude: 100 * (rand() - 0.5)
12     })
13   })
```

Below the query, a status bar indicates: "Added 10000 labels, created 10000 nodes, set 20000 properties, completed after 38 ms."

4. Use point.distance to find the closest offices to "Google 1" office



## Conclusion

In conclusion, the implemented Neo4j query efficiently identifies offices closest to a given office, showcasing the practical application of spatial analysis in real-world scenarios. This capability enables companies to optimize their geographic distribution strategically, enhancing operational efficiency and resource allocation. By leveraging spatial data management techniques within advanced database systems like Neo4j, organizations can derive actionable insights to drive informed decision-making and achieve competitive advantage in today's dynamic business landscape.

## References

<https://neo4j-contrib.github.io/spatial/0.24-neo4j-3.1/index.html>