

# Introduction to Database Systems: CS305

## Neo4J: building your own graphs

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# Databases, Visually

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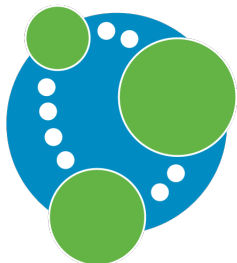
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Consider This



# neo4j

- A visual database system using methods from graph theory to use networks to determine relationships (edges) and discover meaning from connected data-points (nodes). Users are able to interact with the data in a network.

- <https://neo4j.com/>
- Graphgists Projects: <https://neo4j.com/graphgists/>

# Getting started with Neo4j in Docker

These files are located in `sandbox/`



## Windows

```
build_neo4j_windows.bat
```

## MacOS and Linux

```
sh build_neo4j_macOSAndLinux.sh
```

You can **build** and **start** the container with this script. You will have to manually stop the container, as necessary.

# Getting started with Neo4j in Docker

## Specific Terminal commands

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### Terminal Command to START Neo4j

```
docker start testneo4j # windows  
sudo docker start testneo4j # MacOS and Linux
```

### Terminal Command to STOP Neo4j

```
docker stop testneo4j # windows  
sudo docker stop testneo4j # MacOS and Linux
```

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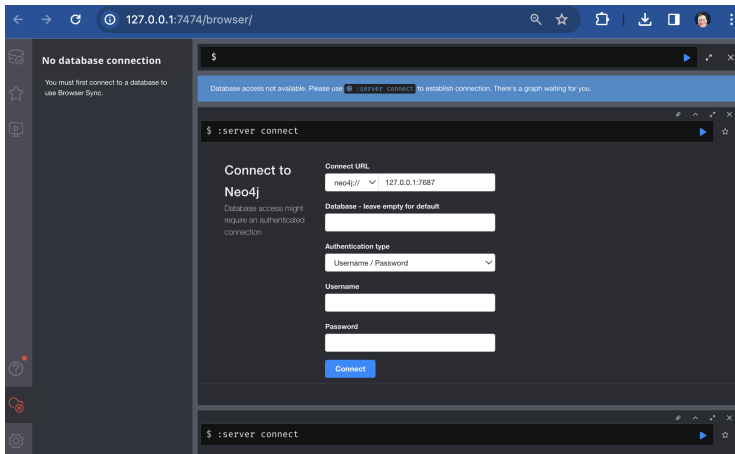
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The screenshot shows a web browser at the address `127.0.0.1:7474/browser/`. The interface is dark-themed. On the left, a sidebar contains icons for database connection, star, and a terminal. The main area displays a message: "No database connection. You must first connect to a database to use Browser Sync." Below this, a section titled "Connect to Neo4j" provides fields for "Connect URL" (set to `neo4j:// 127.0.0.1:7687`), "Database" (set to "leave empty for default"), "Authentication type" (set to "Username / Password"), "Username", and "Password". A blue "Connect" button is at the bottom. A terminal window at the bottom shows the command `$ :server connect`.

● Open your browser and head to: `http://127.0.0.1:7474/browser/`

# User and Password

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Note: The user and password variables are defined in the *build* files we used to create the Docker container.

- Your first login
  - **User:** neo4j
  - **Password:** password

## Parameter in the build file

```
--env NEO4J_AUTH=neo4j/password
```



# Add Nodes

File: sandbox/classroomBuild.txt

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Destroy all nodes in the graph and erase the graph

```
MATCH (n) DETACH DELETE (n)
```

Add the nodes

```
CREATE (
  :Teacher {
    name: "Teacher",
    Jackjet: "green",
    Jeans: "blue",
    MarkerCol: "red"}
)
FOREACH (r IN range(0,5)|
  CREATE (
    :Student { name:"Student" + r,
      extraUtility: "backpack" + r,
      lastTestScore:tan(rand())*100 })
)
CREATE (:TA { name: "TA", Machine: "Laptop"})
```

- Adds nodes with some meta data: a Teacher, a TA and five Student

# Show the Nodes

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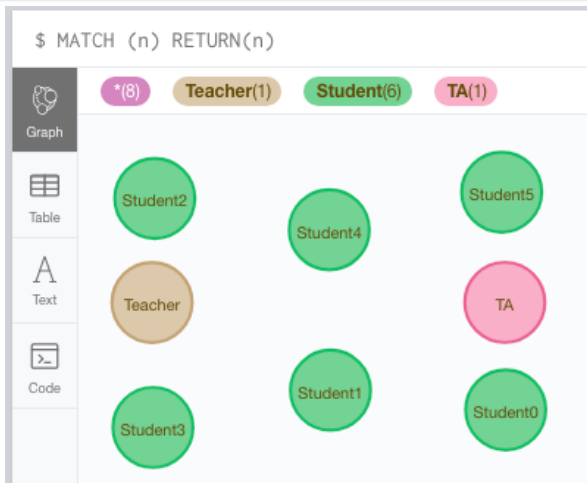
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Consider This

## Show the unconnected graph

```
MATCH (n) RETURN (n)
```





# Add Edges

## Add some connectivity to nodes

```
MATCH (t:Teacher), (s:Student), (a:TA)
MERGE (t) - [:INSTRUCTS] -> (s) <-[:HELPS] - (a)
MERGE (a) - [:LISTENS_TO] -> (t)
MERGE (t) - [:INSTRUCTS] -> (a) <-[:HELPS] - (s)
```

- The Teacher (*t*) and Student (*s*) nodes are linked by *INSTRUCTS* and an arrow to show direction, *- >*
- The TA (*a*) and Student (*s*) nodes are linked by *HELPS* and an arrow to show direction, *< -*
- The TA (*a*) and TEACHER (*t*) nodes are linked by *LISTENS\_TO* and an arrow to show direction, *- >*
- The Teacher (*t*) and TA (*a*) nodes are linked by *INSTRUCTS* and an arrow to show direction, *- >*
- The Student (*s*) and TA (*a*) nodes are linked by *HELPS* and an arrow to show direction, *< -*

# Show The Edges

## Show the connected graph

`MATCH (n) RETURN (n)`

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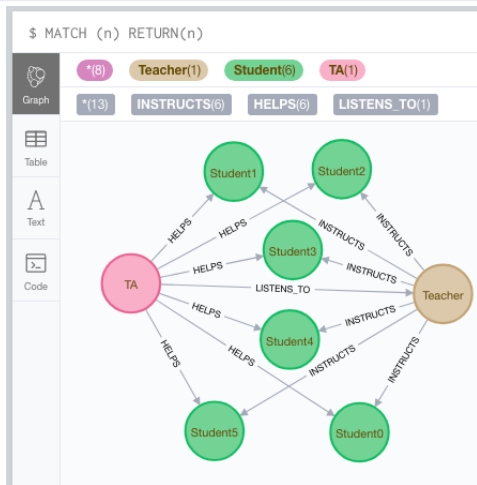
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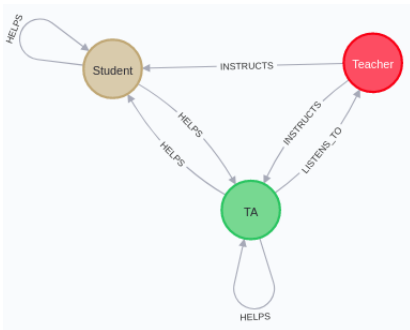
Consider This



# Schema

## Show the schema

```
call db.schema.visualization
```

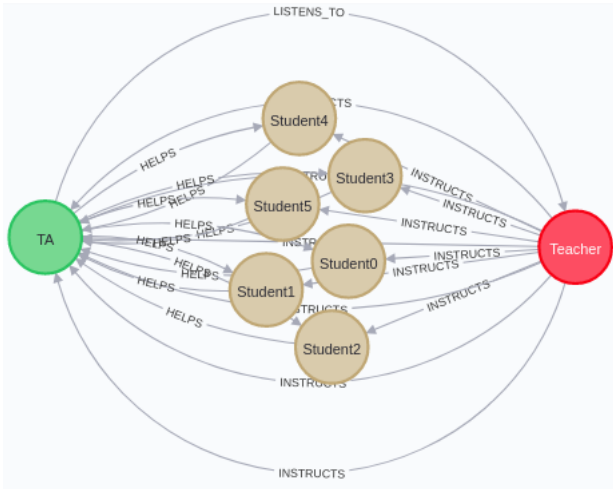


- The Teacher Instructs each Student
- The Student is **Instructed** and **Helped** by Teacher
- The TA is **Instructed** by Teacher and **Listens to** Teacher, **Helps** Student and self.

# Relationship Queries

## Who instructs whom?

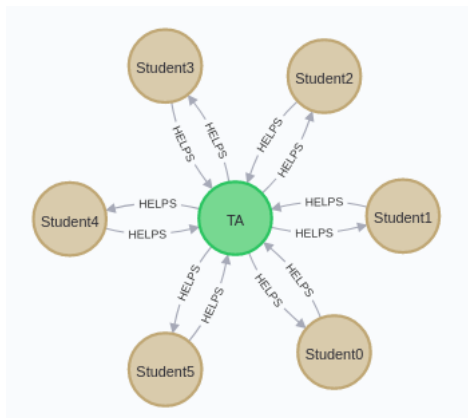
```
MATCH t=()-[s:INSTRUCTS]->( ) RETURN t
```



# Relationship Queries

## Who helps whom?

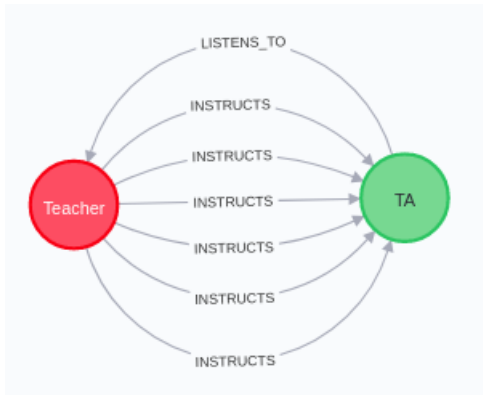
```
MATCH t=()-[s:HELPS]->() RETURN t
```



# Relationship Queries

## Who listens to whom?

```
MATCH t=()-[s:LISTENS_TO]->() RETURN t
```



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# Commonly Used Commands

Sample code in Cypher script

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## What is the Schema?

```
CALL db.schema.visualization
```

## What are the relationship types?

```
CALL db.relationshipTypes()
```

## Display all nodes with their relationships (I)

```
MATCH (n) RETURN n
```

## Display all nodes with their relationships (II)

```
MATCH (a)-[r]-() RETURN a, r
```

# Commonly Used Commands

From last time

## What are the node types?

```
CALL db.schema.nodeTypeProperties
```

## What are the relationship types?

```
CALL db.relationshipTypes()
```

## Display all nodes

```
MATCH (n) RETURN n
```

## Who reviewed what?

```
MATCH p=()-[r:LISTENS_TO]->() RETURN p
```

## Who produced what?

```
MATCH p=()-[r:HELPS]->() RETURN p
```

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Consider This

New Example! New Example! New Example! New Example!

## New Example!

New Example! New Example! New Example! New Example

But this first!

Do not copy and paste this code all at once into Neo4j. All node creation code goes in own field in Neo4j, then the edge creation code follows in the next field.

Or just copy and paste from the build file ...

Build file: `sandbox/orchestralBuild.txt`

# Orchestral Connections

Note: all node and edge code is to be in a single copy-paste

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Clear away previous graph: past into own field in Neo4j

```
MATCH (n) DETACH DELETE (n)
```

Create nodes!

```
CREATE(
  :Woodwinds {
    name:"windPlayer",
    instrument:"clarinet"} )
```

```
CREATE(
  :Percussions {
    name:"PercussionPlayer",
    instrument:"Drum"} )
```

```
MATCH (n) RETURN n
```

# Orchestral Connections

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## Create more nodes!!

```
CREATE(  
  :Strings {  
    name:"StringPlayers",  
    instrument_1:"guitar",  
    instrument_2:"violin"} )
```

```
CREATE(  
  :Audience {  
    name:"Listener"} )
```

```
CREATE(  
  :Conductor {  
    name: "Conductor",  
    instrument_1:"baton"} )
```

```
MATCH (n) RETURN n
```

# Orchestral Connections

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Consider This

## Define Node Variables and Edges

```
MATCH (w:Woodwinds), (p:Percussions),  
      (s: Strings), (a:Audience), (c:Conductor)
```

```
MERGE (w) - [:FOLLOWS] -> (p) <-[:DIRECTS] - (c)
```

```
MERGE (p) - [:LEADS] -> (s) <-[:DIRECTS] - (c)
```

```
MERGE (s) - [:WATCHES] -> (c)
```

```
MERGE (w) - [:PLAYS_For] -> (a)
```

```
MERGE (p) - [:PLAYS_For] -> (a)
```

```
MERGE (s) - [:PLAYS_For] -> (a)
```

```
MERGE (a) - [:CLAPS_FOR] -> (w)
```

```
MERGE (a) - [:CLAPS_FOR] -> (p)
```

```
MERGE (a) - [:CLAPS_FOR] -> (s)
```

```
MERGE (a) - [:CLAPS_FOR] -> (c)
```

## Show the graph

```
MATCH (n) RETURN (n)
```

# Orchestral Connections

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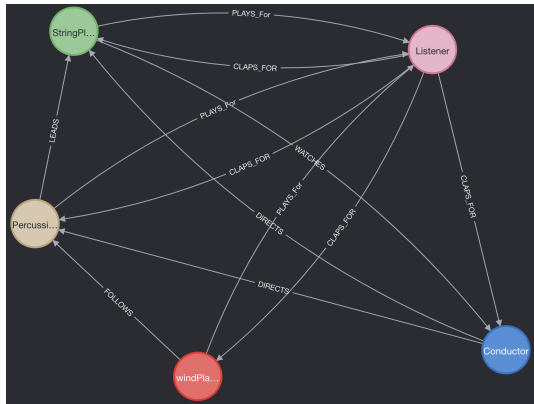
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## What is the Schema?

CALL db.schema.visualization

# Check out this tutorial ...

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## First Steps with Cypher

`https://neo4j.com/graphgists/first-steps-with-cypher/`

Note: Be sure to use your local installation of Neo4J at  
`http://localhost:7474/browser/`  
to run your experiments by copying and pasting code from the  
tutorial.

# Spend Some Time Playing With Other Graphs ...

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GraphGist Challenge Entries



Sports and Recreation



Master Data Management



Real-Time Recommendations



Optimization



Fraud Detection



Pop Culture



Network and IT Operations



Holidays



Graph-Based Search



General Business



Graph Gist How-tos



Data Analysis



Public Web APIs



Internet of Things



Investigative Journalism



Open Government Data and Politics



Identity and Access Management

- See What the community has done with Neo4j
- Graphgists Projects: <https://neo4j.com/graphgists/>

# How To Shut Down a Session

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## Stop Neo4j container

```
docker stop testneo4j # Windows
```

```
sudo docker stop testneo4j # MacOS and Linux
```



# Consider This...

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# THINK

- Can you work with data as nodes and edges in *your own* network?
- Can you discover new relationships between your nodes?