Introduction to Database Systems: CS312 Neo4j; Building Your Own Graph

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Databases, Visually

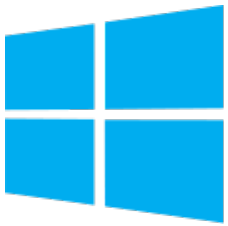
Neo4J
Start Neo4j in Docker
Killing a container
Cypher Code
Orchestra Graph
Graphgists Projects
Shutting Down
Consider This

- 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/`



Run batch file to create a Docker container from DockerHub for Neo4j: Windows.

```
run_neo4j_windows.bat
```

Run sh file to create a Docker container from DockerHub for Neo4j: MacOS and Linux.

```
sh run_neo4j_macOSAndLinux.sh
```

Command to start Neo4j inside files

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

Killing a Docker Container

Container name *already in use*? Stop, Destroy and Relaunch

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Find out the container's ID

```
docker ps
```

Your container's ID. This one is; 662a6801959f

```
CONTAINER ID        IMAGE
662a6801959f        neo4j:latest
```

Stop Neo4j container

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

Remove Neo4j container

```
docker rm 662a6801959f # Windows
sudo docker rm 662a6801959f # MacOS and Linux
```

You should now be able to run your run and execute commands from above.

Login

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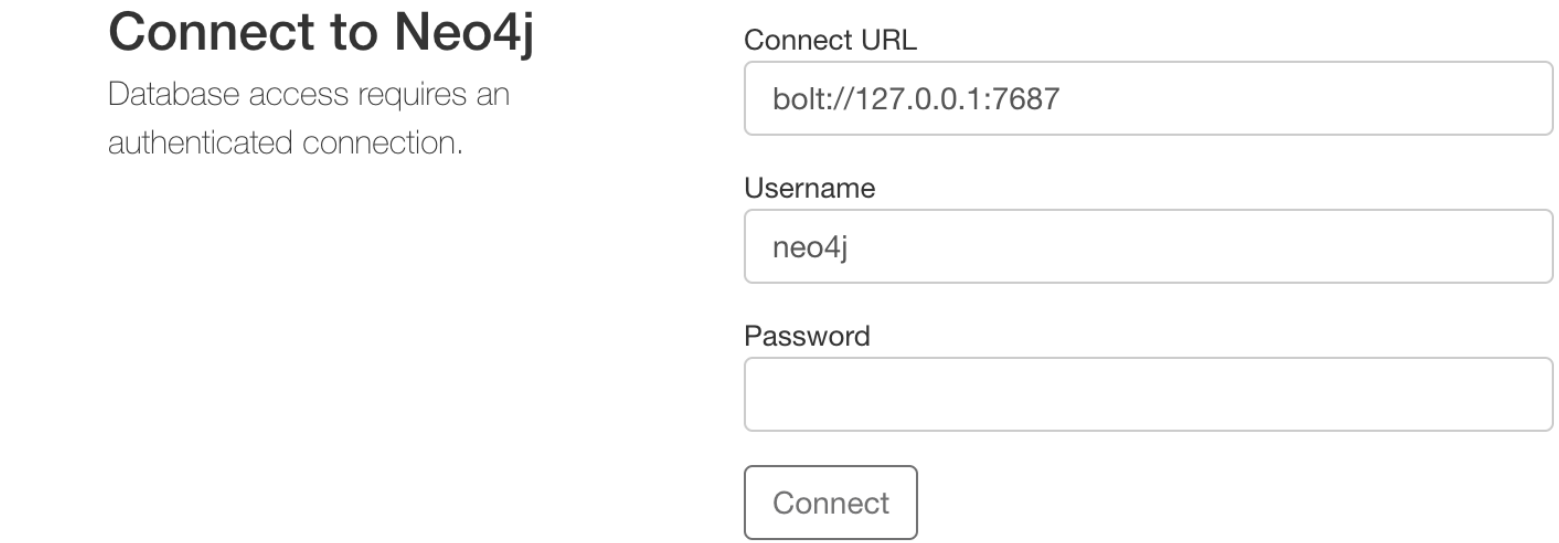
```
$ :server connect
```



- Open your browser and head to: `http://127.0.0.1:7474/browser/`
- Your first login
  - **User**: `neo4j`
  - **Password**: `test`

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 a Teacher, a TA and five Student nodes, with some sample data

Show the Nodes

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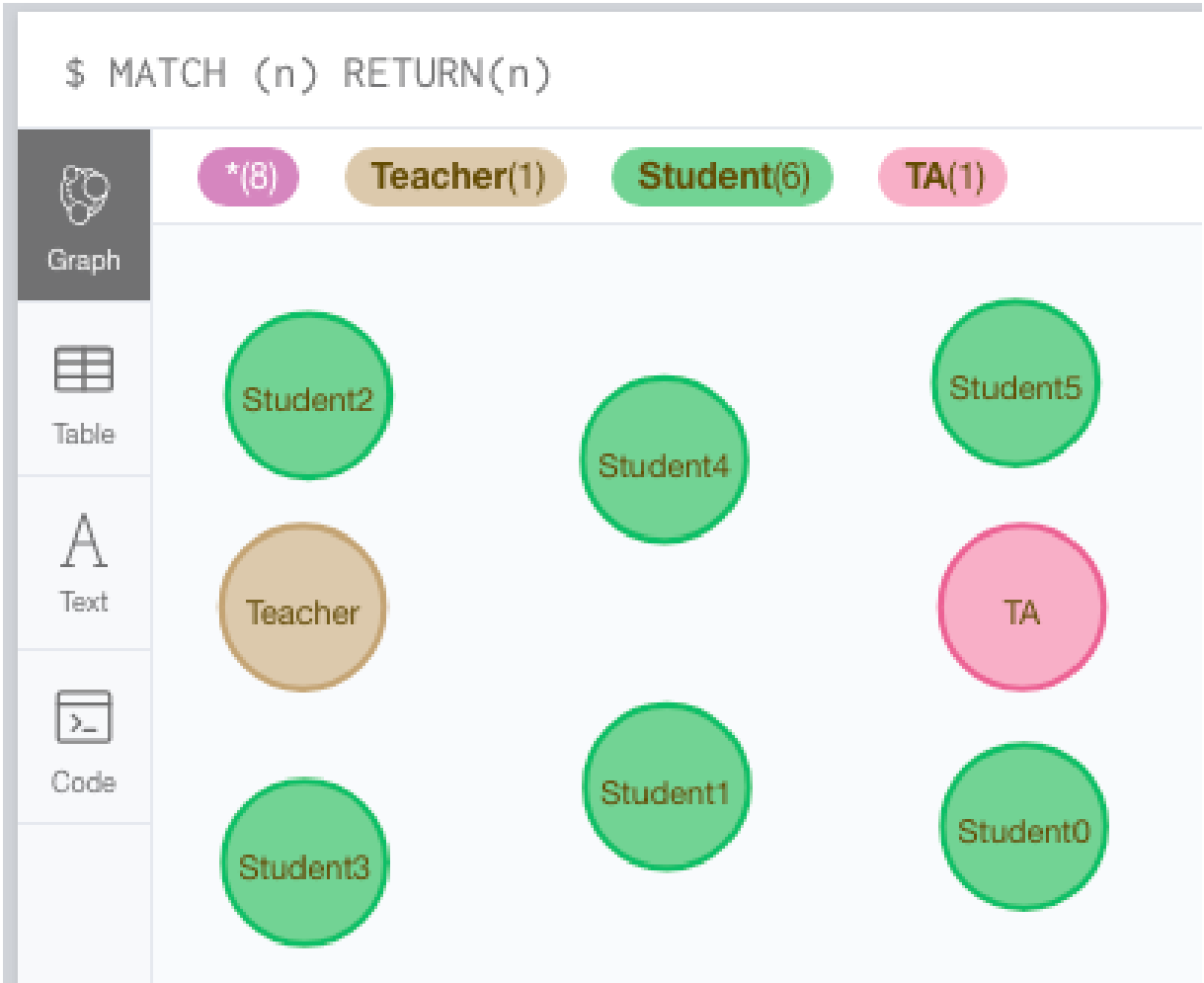
Show the unconnected graph

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



Add Edges

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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

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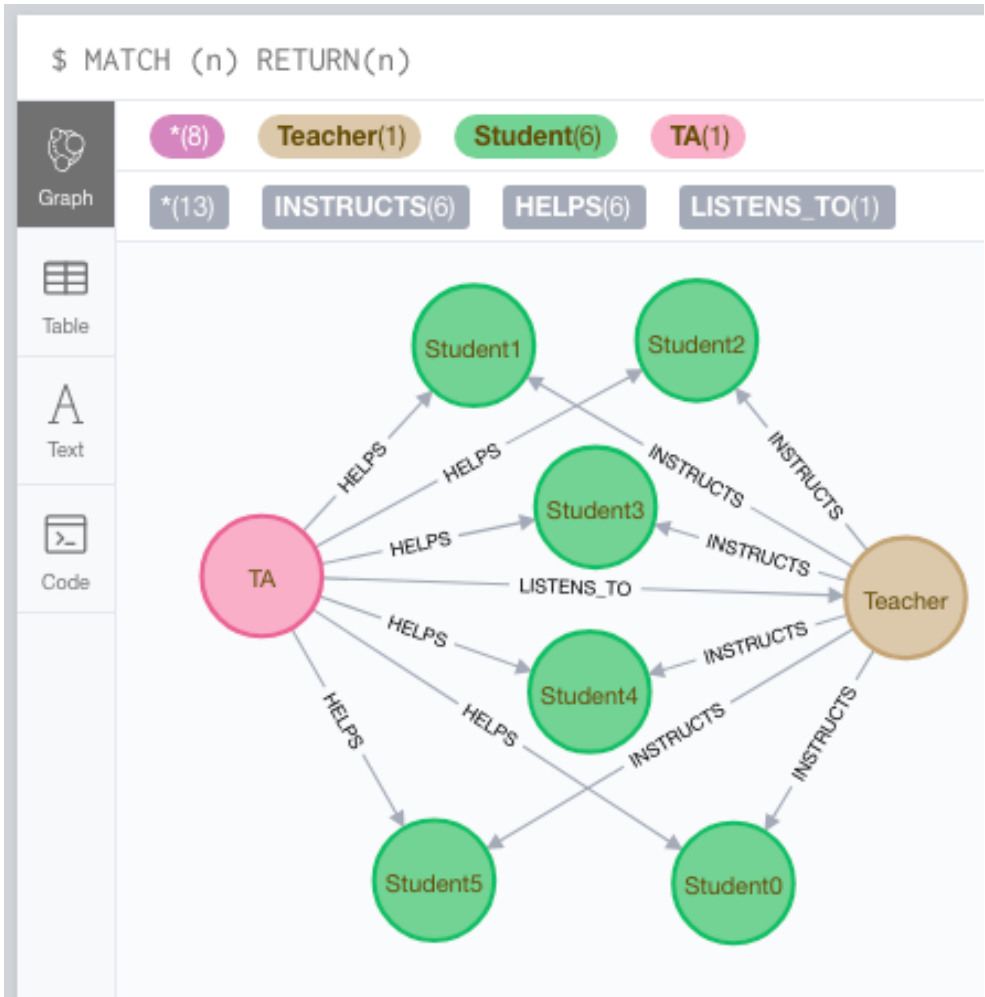
Show the connected graph

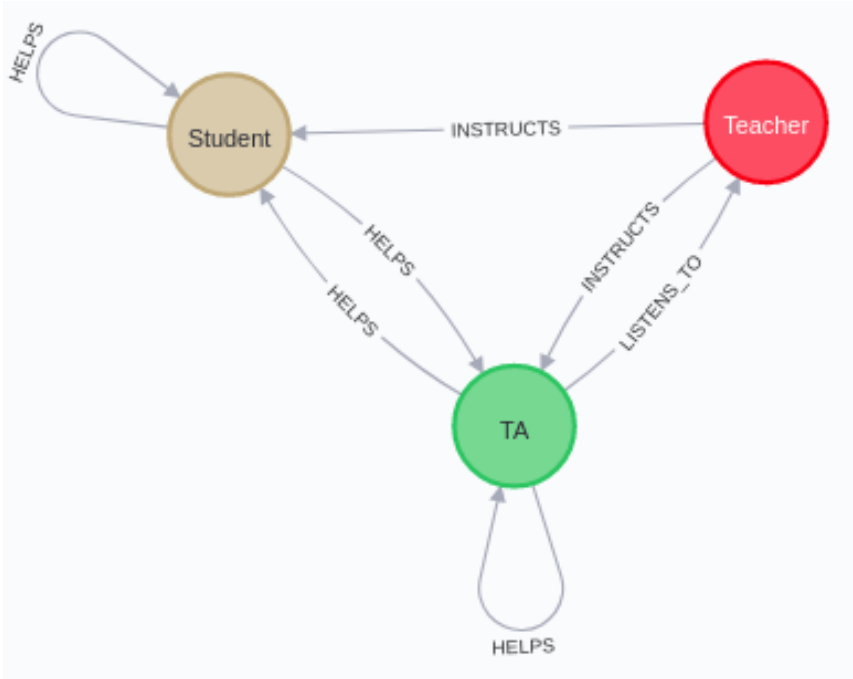
```
MATCH (n) RETURN (n)
```



Schema

Show the schema

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

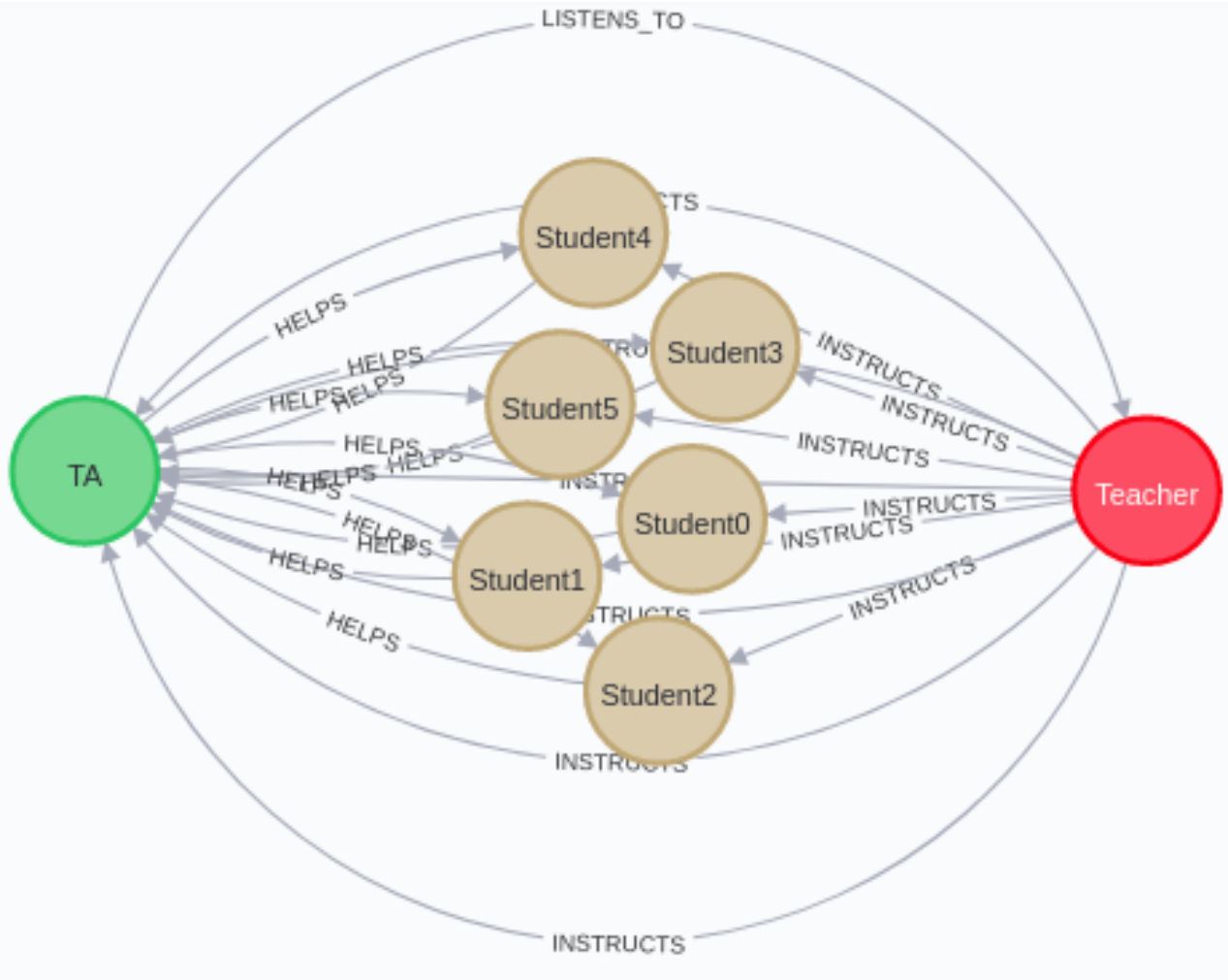


- The `Teacher` Instructs each `Student`
- The `Student` is **Instructed** and **Helped** by `Teacher`
- The `TA` is **Instructed** by `Teacher` and **Listens to** `Teacher`, **Helps** `Student` and self.

Relationship Queries

Who instructs whom?

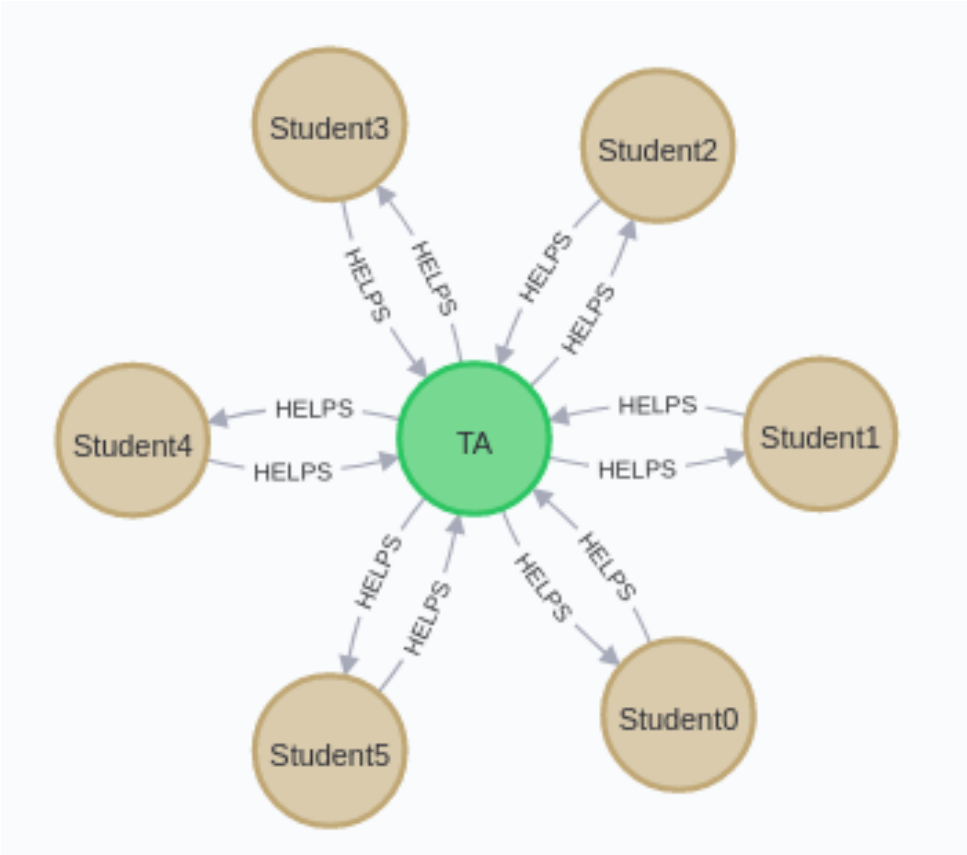
```
MATCH t=()-[s:INSTRUCTS]->() RETURN t
```



Relationship Queries

Who helps whom?

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



Relationship Queries

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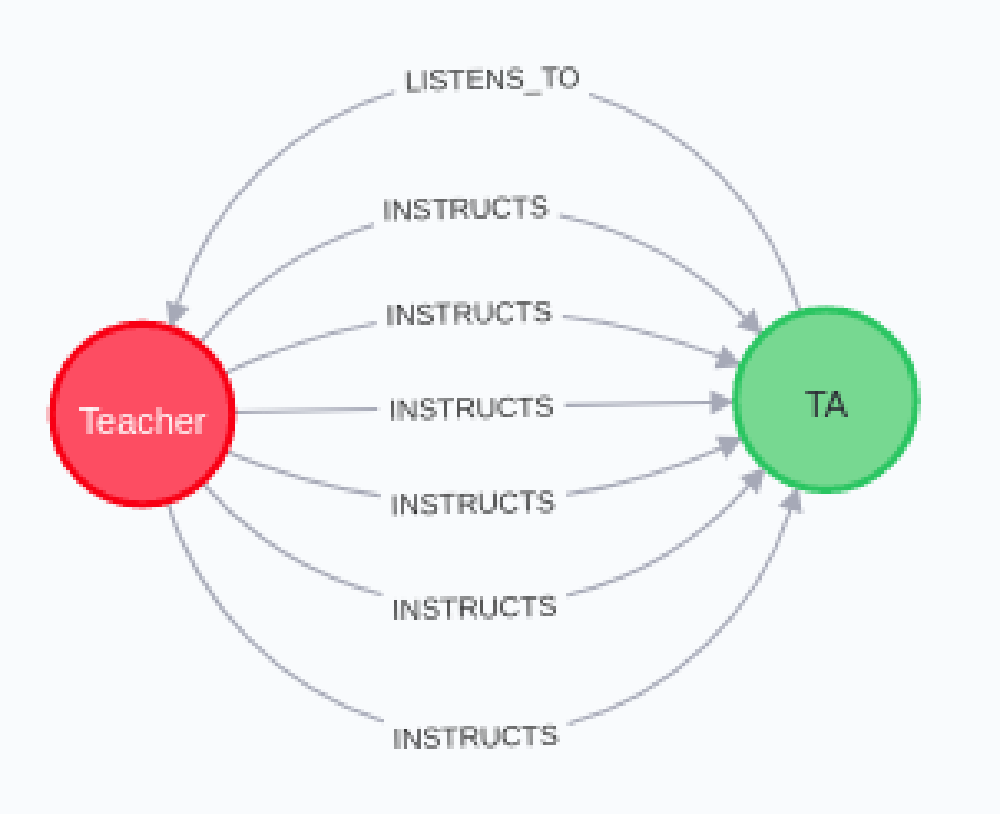
Who listens to whom?

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



Commonly Used Commands

Sample code in Cypher script

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

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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
```

Orchestral Connections

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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"}
 )
```

All the node creation code from this slide and the next should be entered into same page in Neo4j.

Orchestral Connections

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Create nodes

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

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

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

Orchestral Connections

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Define Node Variables

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

Define Edges

```
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)
```

Orchestral Connections

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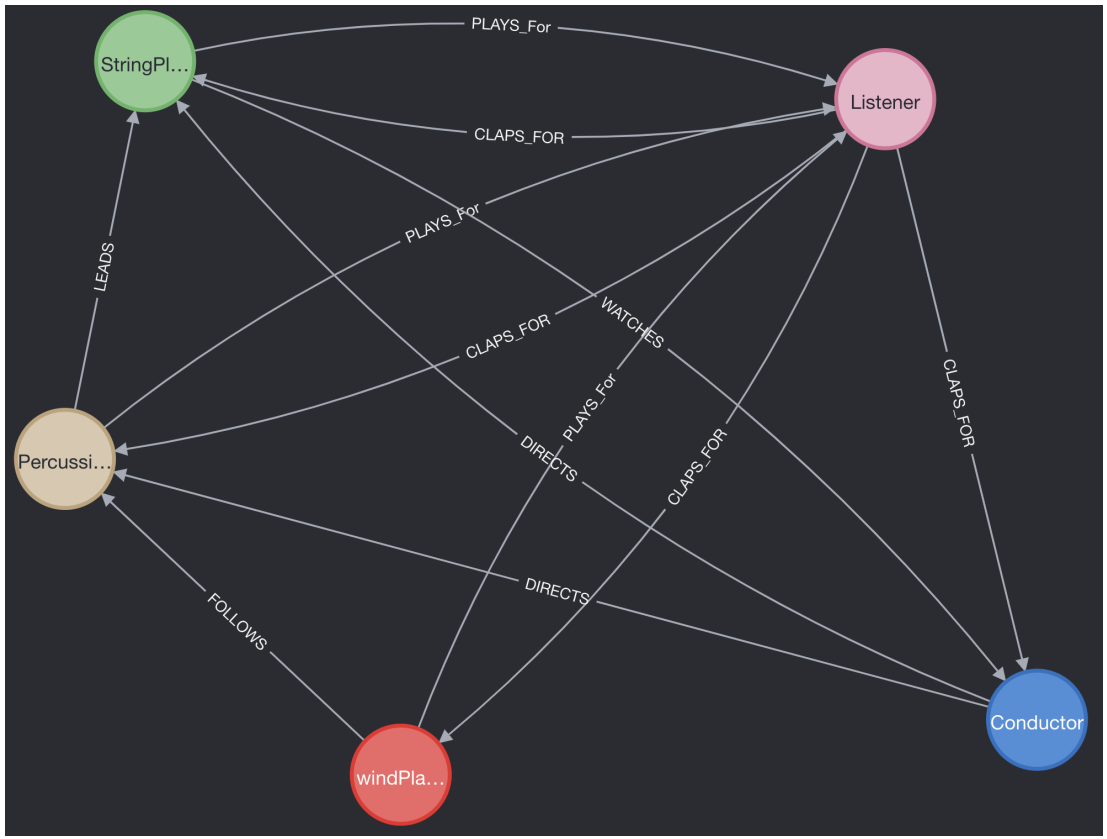
Show the graph

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



What is the Schema?

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

Spend Some Time Playing With Other Graphs ...

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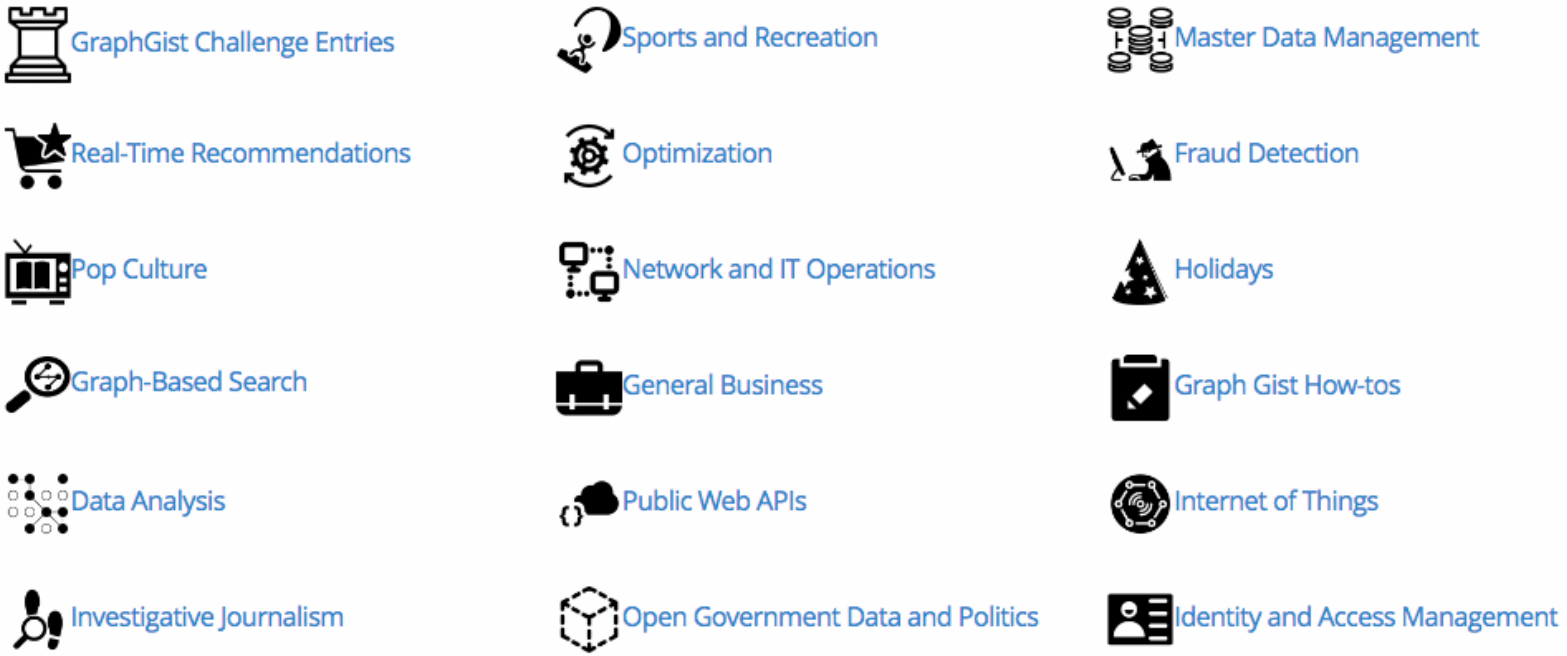

- See What the community has done with Neo4j
- Graphgists Projects: `https://neo4j.com/graphgists/`

How To Shut Down a Session

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Stop Neo4j container

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

Remove Neo4j container (if necessary!)

```
docker rm containerID # Windows
sudo docker rm containerID # MacOS and Linux
```

Consider This...

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