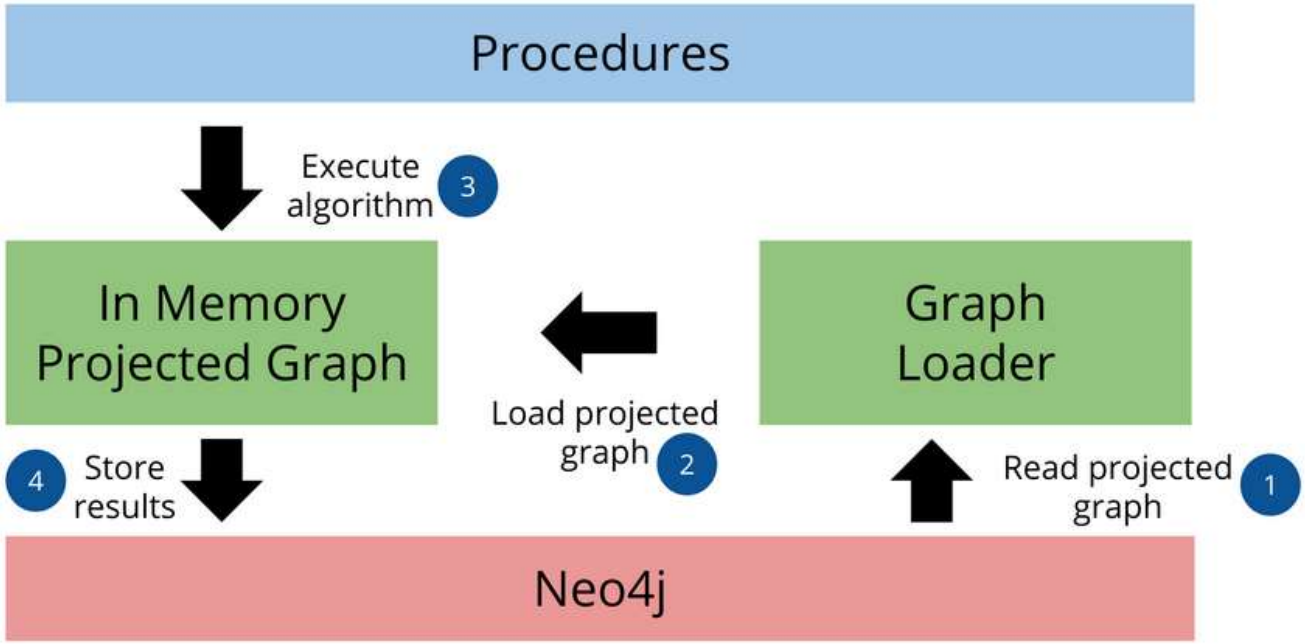
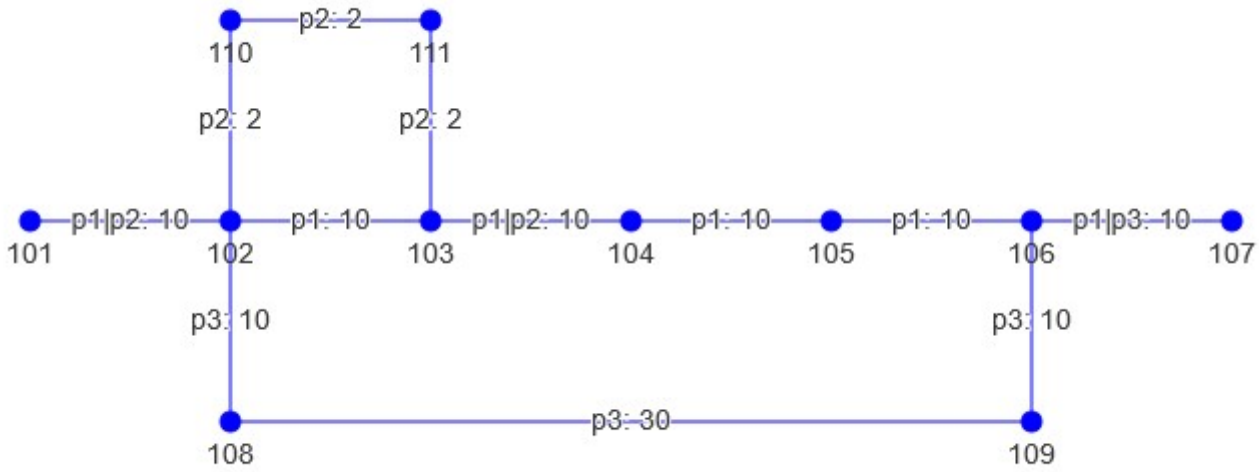
https://neo4j.com/docs/graph-data-science/current/



Algorithmen-Ausprägungen

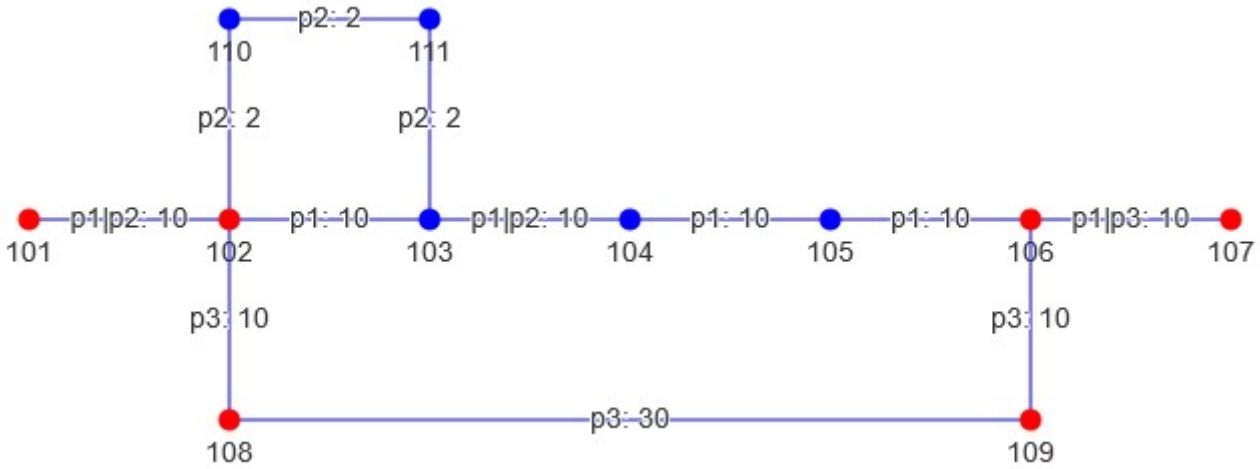
- stream
  Liefert ein Ergebnis wie eine normal Cypher Query
- mutate
  Schreibt Ergebnisse in den In-Memory Graph
- write
  Schreibt Ergebnisse in die Neo4j-Datenbank

https://neo4j.com/docs/graph-data-science/current/algorithms/dijkstra-source-target/



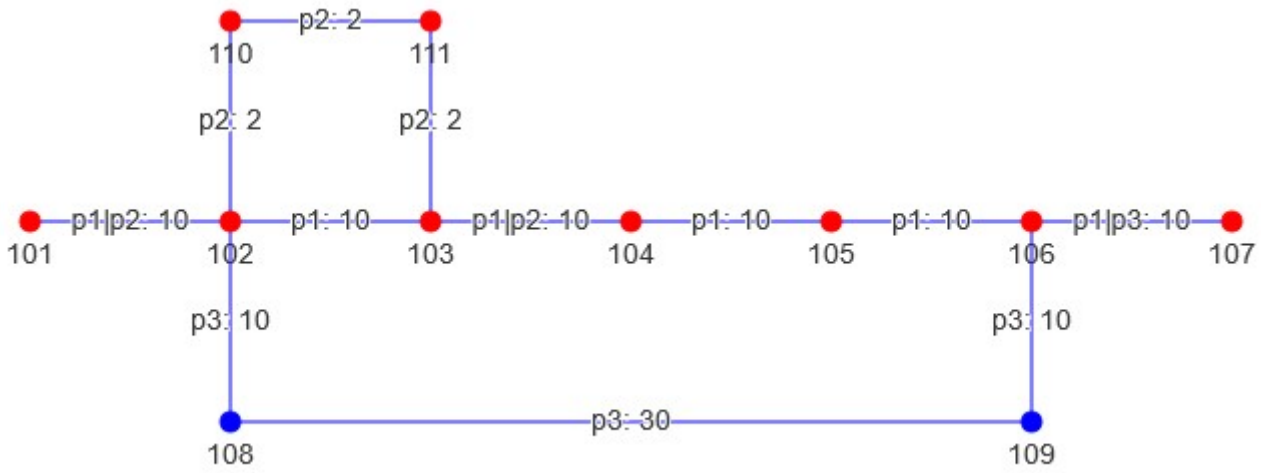
```
MATCH (n1:Node {l: '101'}), (n2:Node {l: '107'})
CALL gds.shortestPath.dijkstra.stream('g', {
   sourceNode: n1,
   targetNode: n2
})
YIELD index, sourceNode, targetNode, totalCost, nodeIds, costs, path
with [nodeId IN nodeIds | gds.util.asNode(nodeId).nid] AS p
with p
UNWIND p as nid
RETURN  nid;
```

"nid"
101
102
108
109
106
107

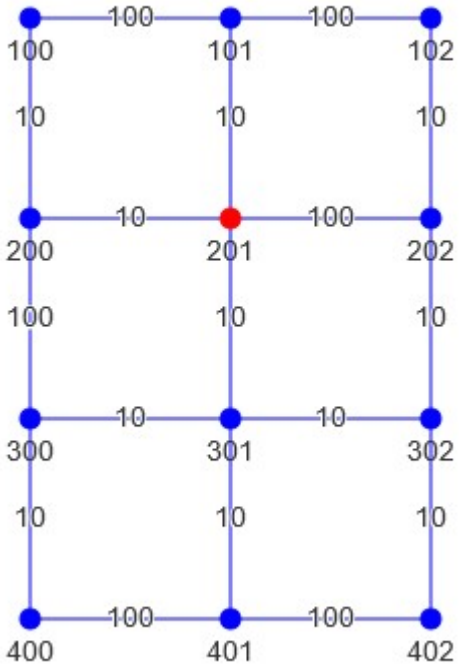


```
MATCH (n1:Node {l: '101'}), (n2:Node {l: '107'})
CALL gds.shortestPath.dijkstra.stream('g', {
    sourceNode: n1,
    targetNode: n2,
    relationshipWeightProperty: 'w'
})
YIELD index, sourceNode, targetNode, totalCost, nodeIds, costs, path
with [nodeId IN nodeIds | gds.util.asNode(nodeId).nid] AS p
with p
UNWIND p as nid
RETURN  nid;
```

"nid"
101
102
110
111
103
104
105
106
107



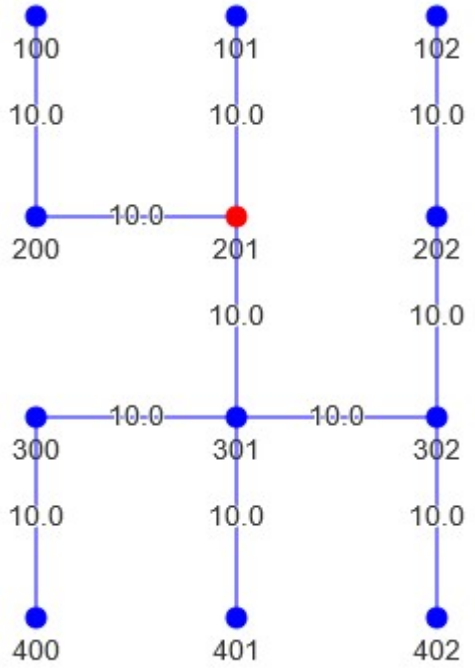
https://neo4j.com/docs/graph-data-science/current/alpha-algorithms/minimum-weight-spanning-tree/



Schreibt in den Graphen hinein

- Ursprungsgraph hat Kantentyp Edge
- Neue Kanten zum Kantentyp Edge1 werden angelegt

```
MATCH (n:Node {nid: 201})
CALL gds.alpha.spanningTree.minimum.write('g', {
   startNodeId: id(n),
   relationshipWeightProperty: 'w',
   writeProperty: 'Edge1',
   weightWriteProperty : 'w'
})
YIELD effectiveNodeCount
return effectiveNodeCount;
```



Graph mit Edge1 wird ausgelesen und angezeigt

Closeness Centrality

https://neo4j.com/docs/graph-data-science/current/algorithms/closeness-centrality/

$$C(u) = \frac{n-1}{\sum_{v=1}^{n-1} d(u,v)}$$

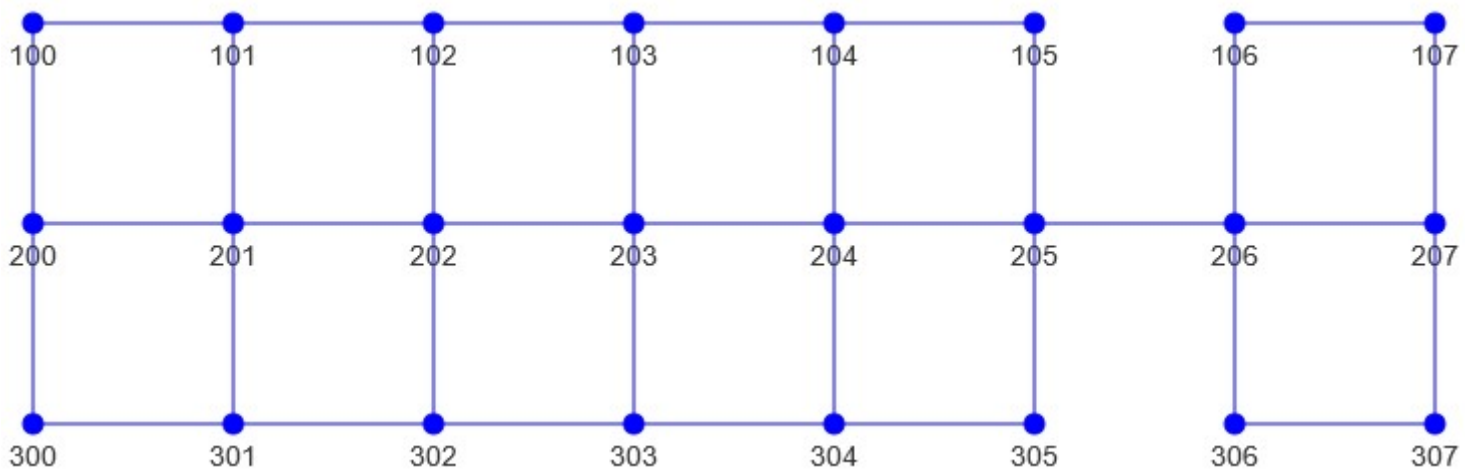
u	Knoten
n	Anzahl Knoten
d(u,v)	Distanz des kürzesten Pfades zwischen u und v

Betweeness Centrality

https://neo4j.com/docs/graph-data-science/current/algorithms/betweenness-centrality/

$$B(u) = \sum_{s \neq u \neq t} \frac{p(u)}{p}$$

u	Knoten
p	Anzahl der kürzesten Pfade zwischen s und t
p(u)	Anzahl der kürzesten Pfade zwischen s und t



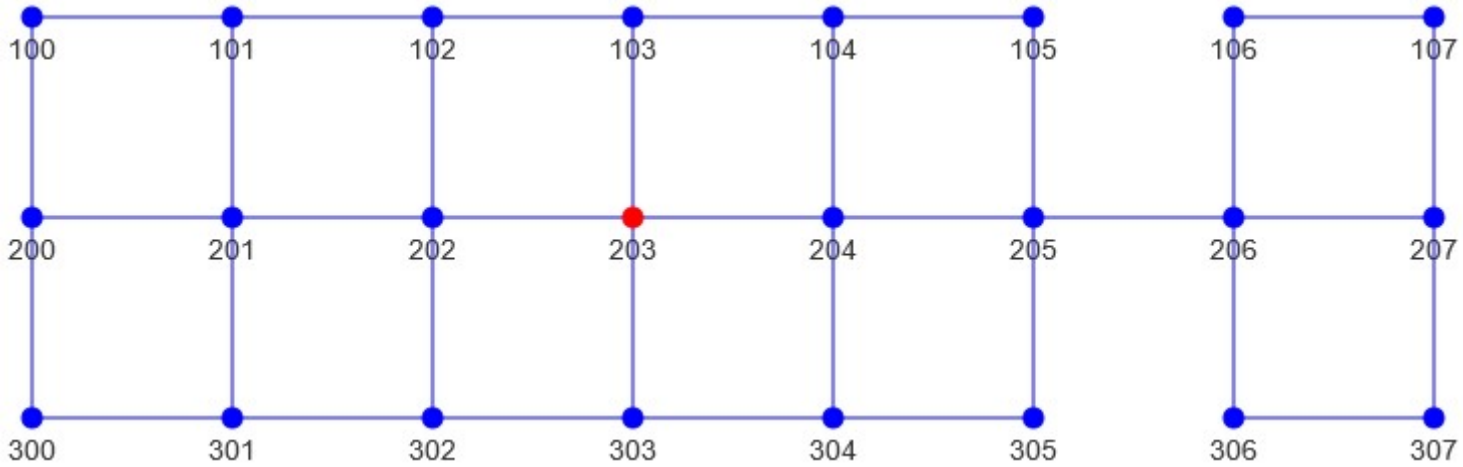
Closeness Centrality - Solution

Prof. Dr. Ingo Claßen

Mittwoch, 16. März 2022 15:45

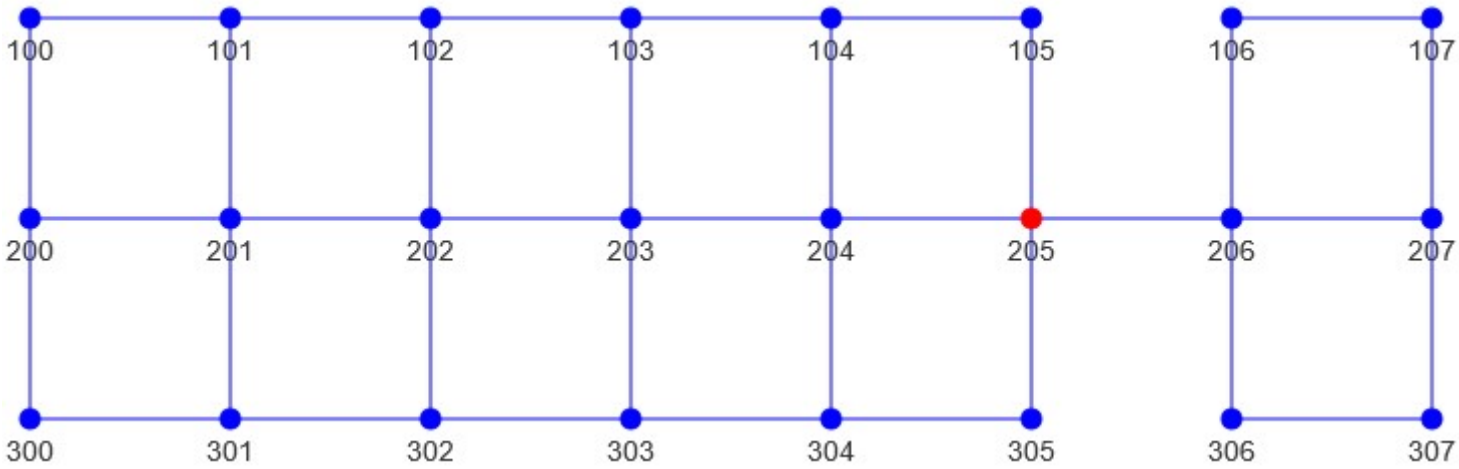
	nid	cc
0	203	0.359375
1	204	0.359375
2	202	0.328571
3	205	0.328571
4	103	0.302632
5	104	0.302632
6	303	0.302632
7	304	0.302632
8	102	0.280488
9	105	0.280488
10	201	0.280488
11	206	0.280488
12	302	0.280488
13	305	0.280488
14	101	0.244681
15	301	0.244681
16	200	0.230000
17	207	0.230000
18	106	0.225490
19	306	0.225490
20	100	0.205357
21	300	0.205357
22	107	0.191667
23	307	0.191667

```
CALL gds.alpha.closeness.stream('g')
YIELD nodeId, centrality
RETURN gds.util.asNode(nodeId).nid AS nid, centrality as cc
ORDER BY cc DESC;
```

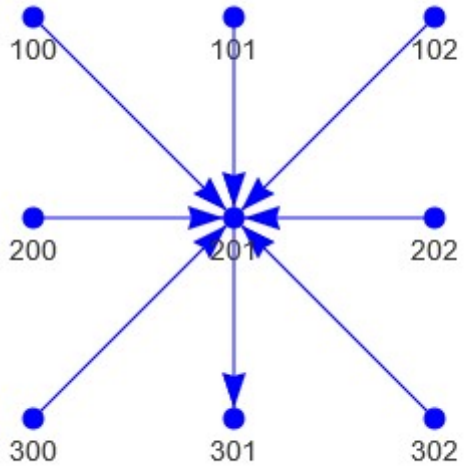


	nid	bc
0	205	220.542857
1	204	189.504762
2	206	186.666667
3	203	162.885714
4	202	128.085714
5	201	81.104762
6	103	65.490476
7	303	65.490476
8	302	60.890476
9	102	60.890476
10	104	53.514286
11	304	53.514286
12	207	42.666667
13	101	40.714286
14	301	40.714286
15	105	21.728571
16	305	21.728571
17	200	20.542857
18	106	19.666667
19	306	19.666667
20	300	4.328571
21	100	4.328571
22	107	1.666667
23	307	1.666667

```
CALL gds.betweenness.stream('g')
YIELD nodeId, score
RETURN gds.util.asNode(nodeId).nid AS nid, score as bc
ORDER BY score DESC;
```

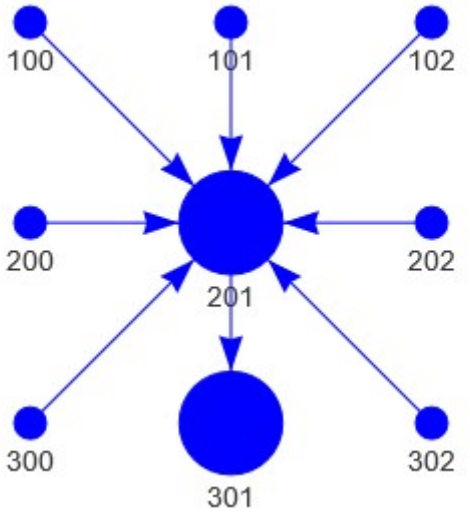


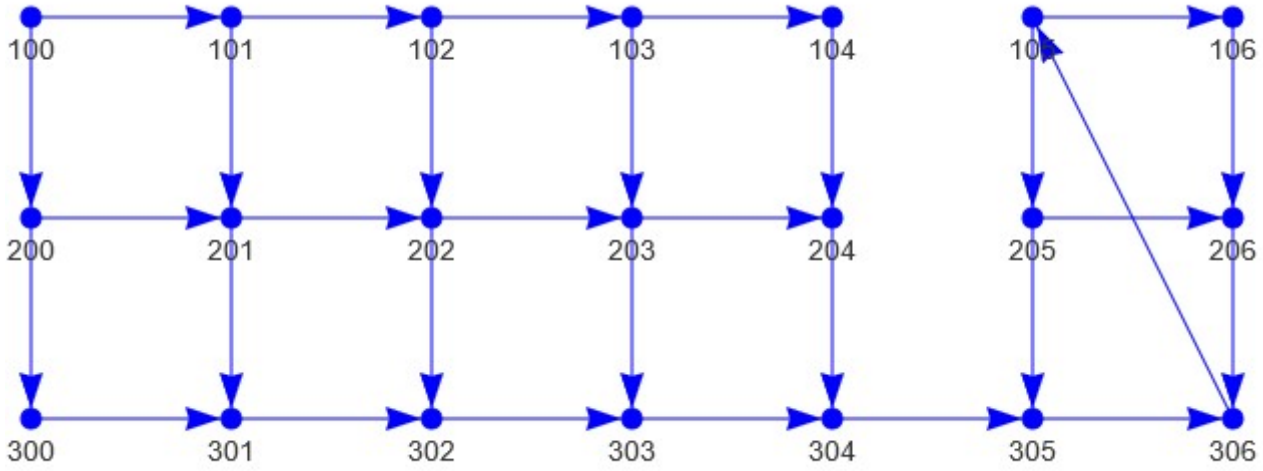
https://neo4j.com/docs/graph-data-science/current/algorithms/page-rank/



$$PR(A) = (1-d) + d(\frac{PR(T_1)}{C(T_1)} + ... + \frac{PR(T_n)}{C(T_n)})$$

```
CALL gds.pageRank.stream('g')
YIELD nodeId, score
RETURN gds.util.asNode(nodeId).nid AS nid, score
ORDER BY score DESC;
```

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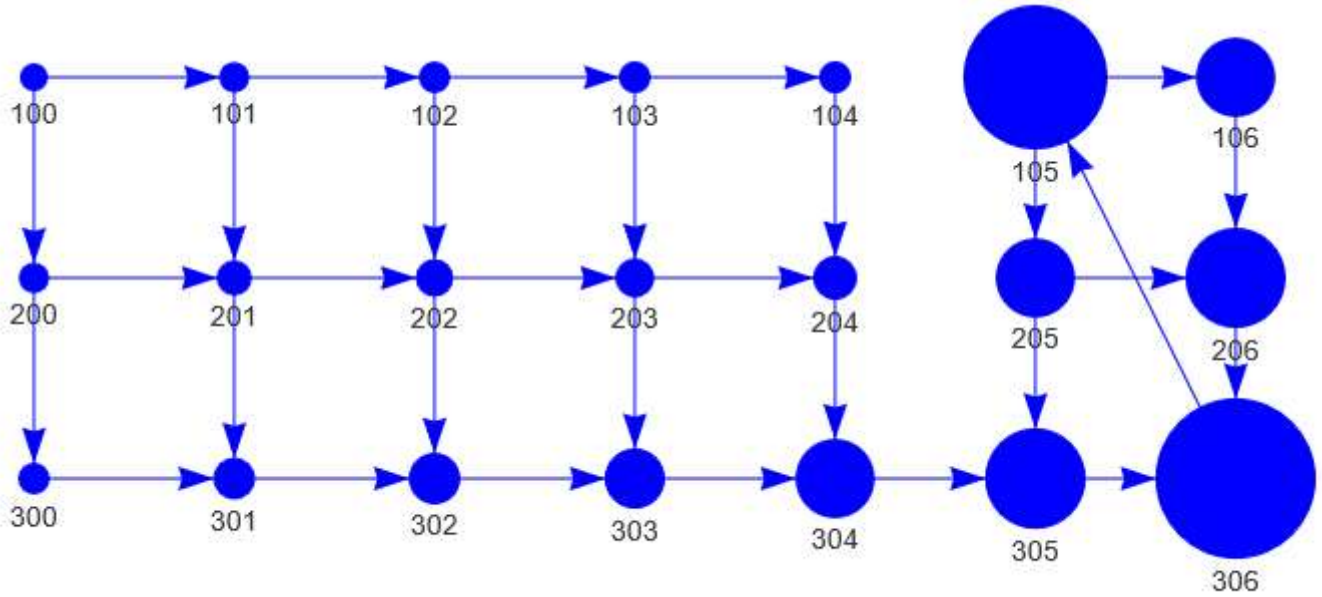
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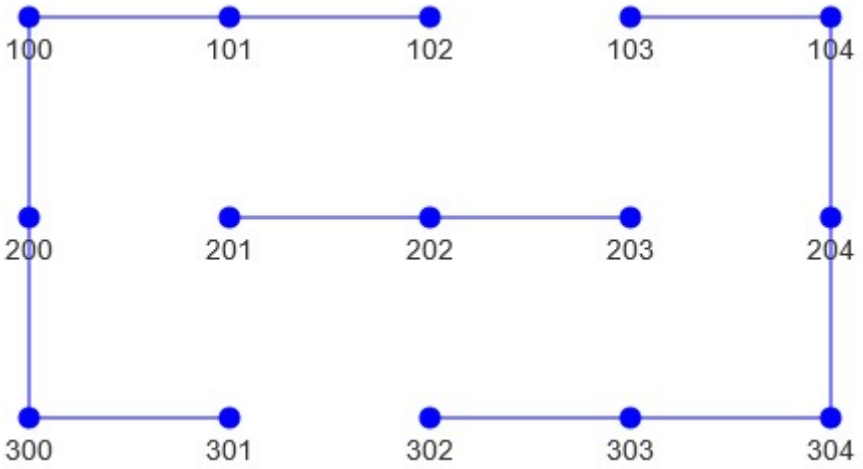
https://neo4j.com/docs/graph-data-science/current/algorithms/strongly-connected-components/



```
CALL gds.alpha.scc.stream('g')
YIELD nodeId, componentId
RETURN gds.util.asNode(nodeId).nid AS nid, componentId AS cid
ORDER BY cid;
```