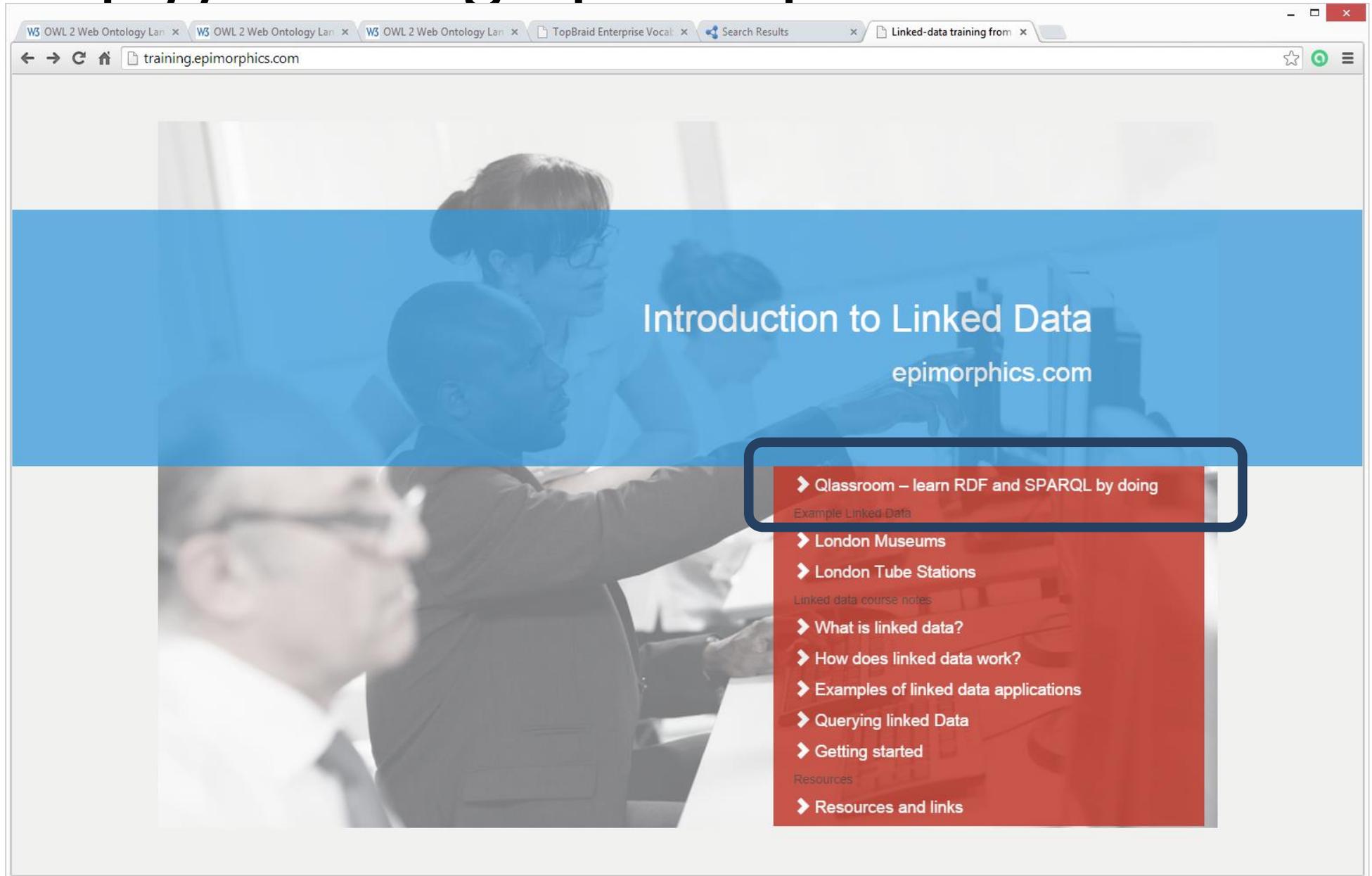


Introduction to linked data

Sparql revisited



http://training.epimorphics.com



training.epimorphics.com

Introduction to Linked Data

epimorphics.com

- ▶ Classroom – learn RDF and SPARQL by doing

Example Linked Data

- ▶ London Museums
- ▶ London Tube Stations

Linked data course notes

- ▶ What is linked data?
- ▶ How does linked data work?
- ▶ Examples of linked data applications
- ▶ Querying linked Data
- ▶ Getting started

Resources

- ▶ Resources and links

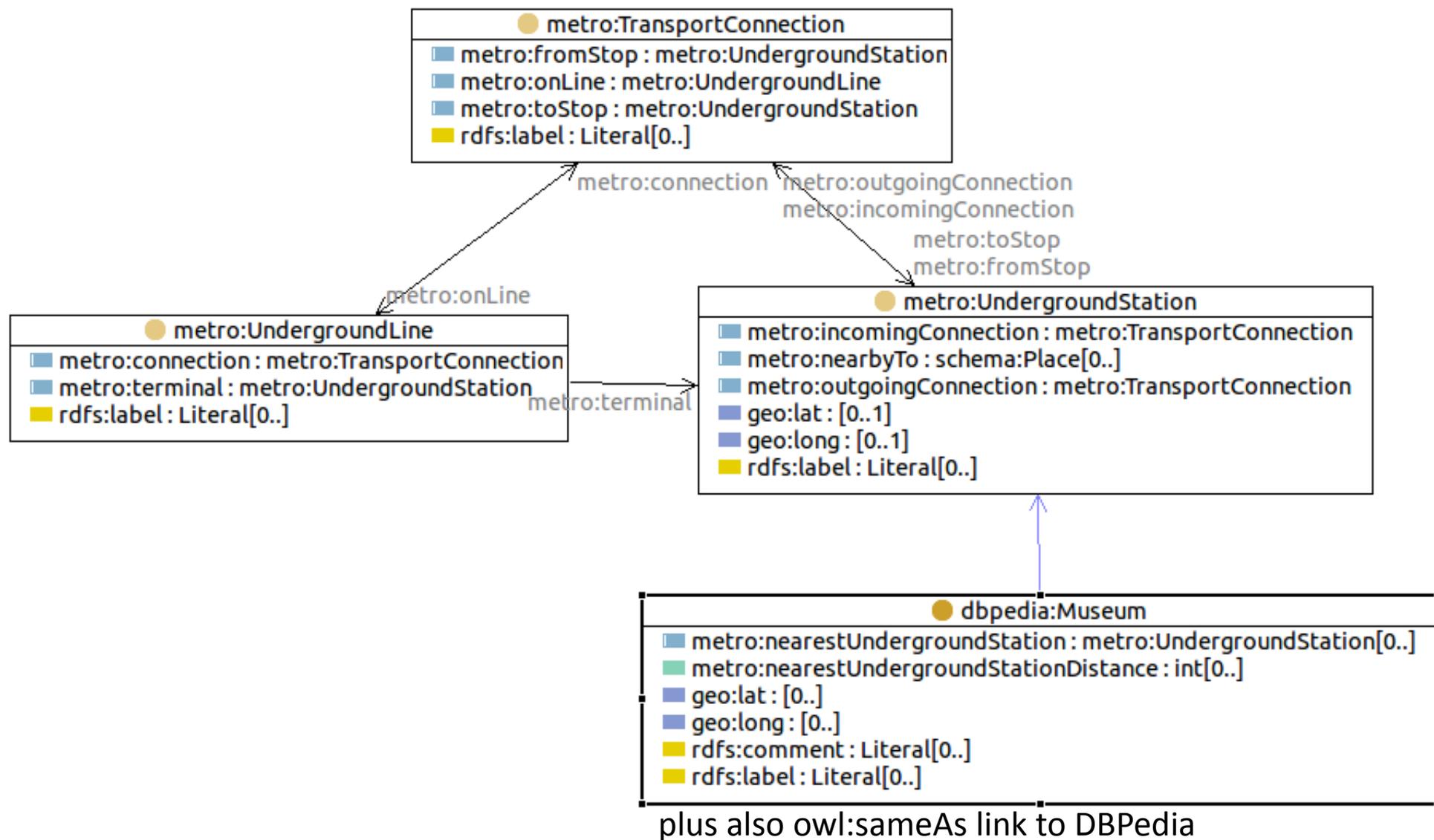
http://training.epimorphics.com/qclassroom

om

The screenshot shows a web browser window with the URL training.epimorphics.com/qclassroom. The page title is "Classroom" with the subtitle "learning linked data". The Epimorphics Ltd logo is in the top right corner. The interface includes several tabs: "RDF data editor", "SPARQL query editor" (highlighted with a red box), and "Prefixes editor". Below the tabs, there are "EXAMPLE QUERIES:" buttons for "Selection of triples" and "all OWL classes". A large text area for writing queries is present, with the number "1" in the top left corner. At the bottom, there is a "SPARQL ENDPOINT" field containing "http://training.epimorphics.com" and a "RESULTS" dropdown menu set to "plain text" (highlighted with a red box). A blue "perform query" button is to the right. On the left, there are "clear" and "add known prefixes" buttons (the latter is highlighted with a red box). Below the endpoint field, a "QUERY RESULTS" section shows a dropdown menu with "London underground" selected (highlighted with a red box) and "RDF data editor" as an option.

Linked data training resources from Epimorphics Ltd

Data Summary



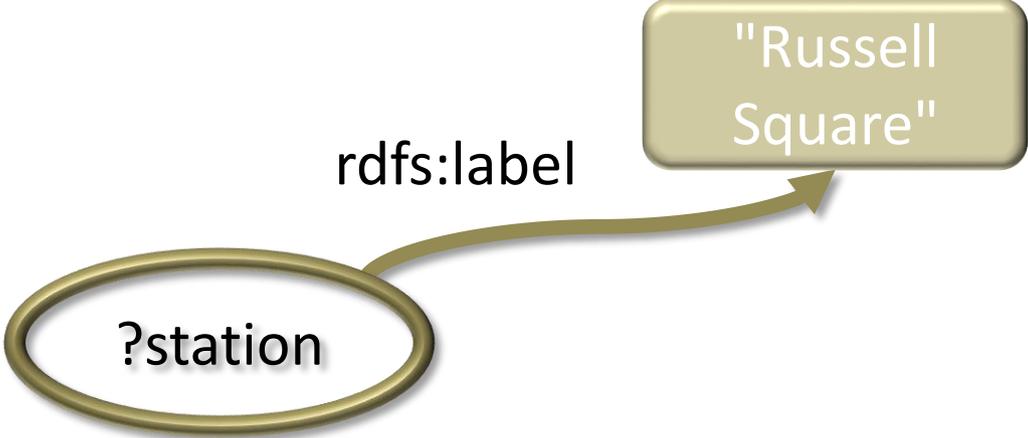
http://training.epimorphics.com/transport/london-underground/station/russell_square

http://training.epimorphics.com/transport/london-underground/line/piccadilly_line

http://training.epimorphics.com/transport/london-underground/connection/piccadilly_line/acton_town/ealing_common

http://training.epimorphics.com/culture/london/museum/British_Museum

What is the URI for Russell Square



```
SELECT ?thing {  
  ?thing rdfs:label "Russell Square"  
}
```

```
1 result in 0 min 0.080 s  
1  -----  
2  | thing |  
3  =====  
4  | lu-s:russell_square |  
5  -----  
6
```

Exercises

- What points of interest are nearby Russell Square
- What are the names of the points of interest nearby Russell Square

What Points of Interest are nearby Russell Square?

3 results in 0 min 0.074 s

1	-----
2	poi
3	=====
4	museum:British Museum
5	museum:Foundling Museum
6	museum:October Gallery
7	-----
8	

```
SELECT ?poi {  
  lu-s:russell_square metro:nearbyTo ?poi .  
}
```

What are the names of the points of interest nearby Russell Square?

```
3 results in 0 min 0.142 s
1  -----
2  | poiName |
3  =====
4  | "British Museum" |
5  | "Foundling Museum" |
6  | "October Gallery" |
7  -----
8
```

```
SELECT ?poiName {
  lu-s:russell_square    metro:nearbyTo    ?poi .
  ?poi                   rdfs:label        ?poiName .
}
```

Language Tags

Find all the properties of the thing whose name in English is "Underground Station"

```
SELECT ?thing ?predicate ?object {  
  ?thing rdfs:label "Underground station"@en  
  ; ?predicate ?object  
  .  
}
```

7 results in 0 min 0.133 s

	thing	predicate	object
1	-----	-----	-----
2	thing	predicate	object
3	=====	=====	=====
4	metro:UndergroundStation	rdf:type	owl:Class
5	metro:UndergroundStation	rdfs:label	"Underground station"@en
6	metro:UndergroundStation	rdfs:subClassOf	<http://schema.org/Place>
7	metro:UndergroundStation	rdfs:subClassOf	owl:Thing
8	metro:UndergroundStation	rdfs:subClassOf	<http://training.epimorphics.c
9	metro:UndergroundStation	rdfs:subClassOf	:b0
10	metro:UndergroundStation	rdfs:subClassOf	_:b1
11	-----	-----	-----

Datatypes

- Write an integer as:

"10"^^xsd:int

- General form is:

"{lexical form}"^^{uri of the datatype}

- Short forms:

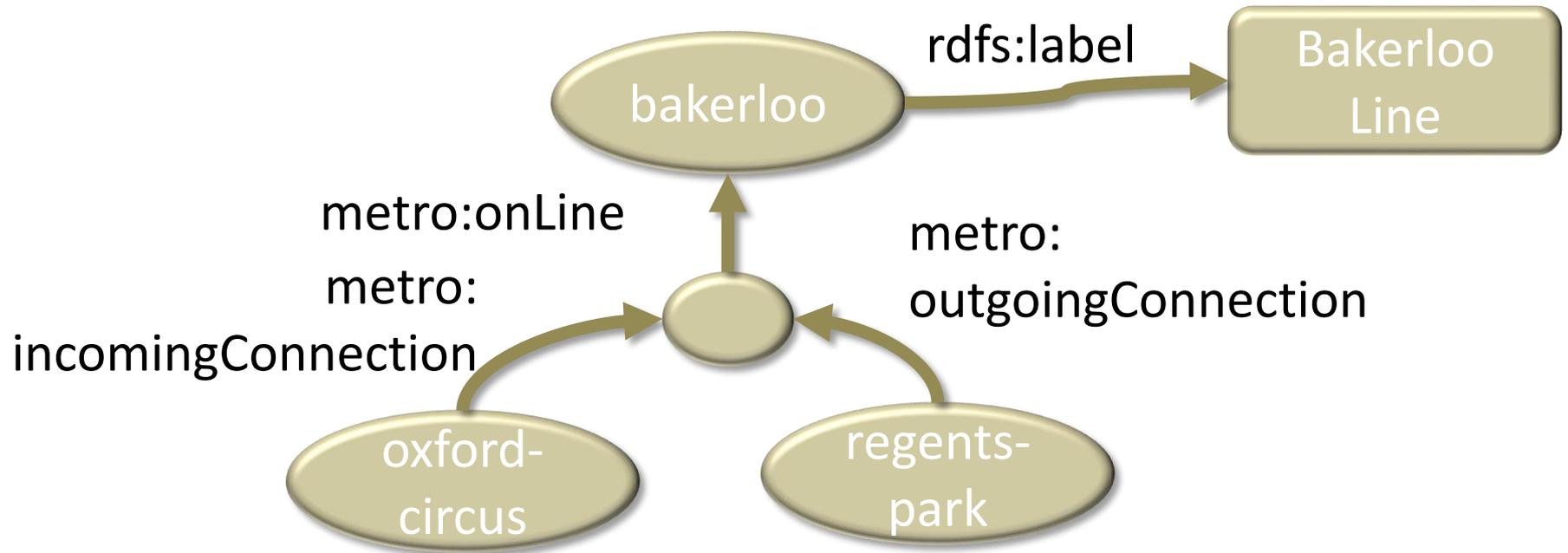
– 10 is "10"^^xsd:integer

– 10.5 is "10.5"^^xsd:decimal

– 10e2 is "10e2"^^xsd:double

– true is "true"^^xsd:boolean

What lines is each station on?



```
SELECT ?stationName ?lineName  
WHERE {
```

```
  ?station  rdf:type          metro:UndergroundStation  
            ;  rdfs:label      ?stationName  
            ;  metro:incomingConnection  ?con .  
  ?con      metro:onLine      ?line .  
  ?line     rdfs:label        ?lineName .
```

Should get something like this

820 results in 0 min 0.179 s

	stationName	lineName
1		
2		
3		
4	"Acton Town"	"District Line"
5	"Acton Town"	"District Line"
6	"Acton Town"	"Piccadilly Line"
7	"Acton Town"	"Piccadilly Line"
8	"Acton Town"	"Piccadilly Line"
9	"Aldgate"	"Circle Line"
10	"Aldgate"	"Circle Line"
11	"Aldgate"	"Metropolitan Line"
12	"Aldgate East"	"District Line"
13	"Aldgate East"	"District Line"
14	"Aldgate East"	"Hammersmith & City Line"
15	"Aldgate East"	"Hammersmith & City Line"
16	"Alperton"	"Piccadilly Line"
17	"Alperton"	"Piccadilly Line"
18	"Amersham"	"Metropolitan Line"
19	"Angel"	"Northern Line"
20	"Angel"	"Northern Line"
21	"Archway"	"Northern Line"
22	"Archway"	"Northern Line"
23	"Arnos Grove"	"Piccadilly Line"
24	"Arnos Grove"	"Piccadilly Line"
25	"Arsenal"	"Piccadilly Line"

Duplicates!

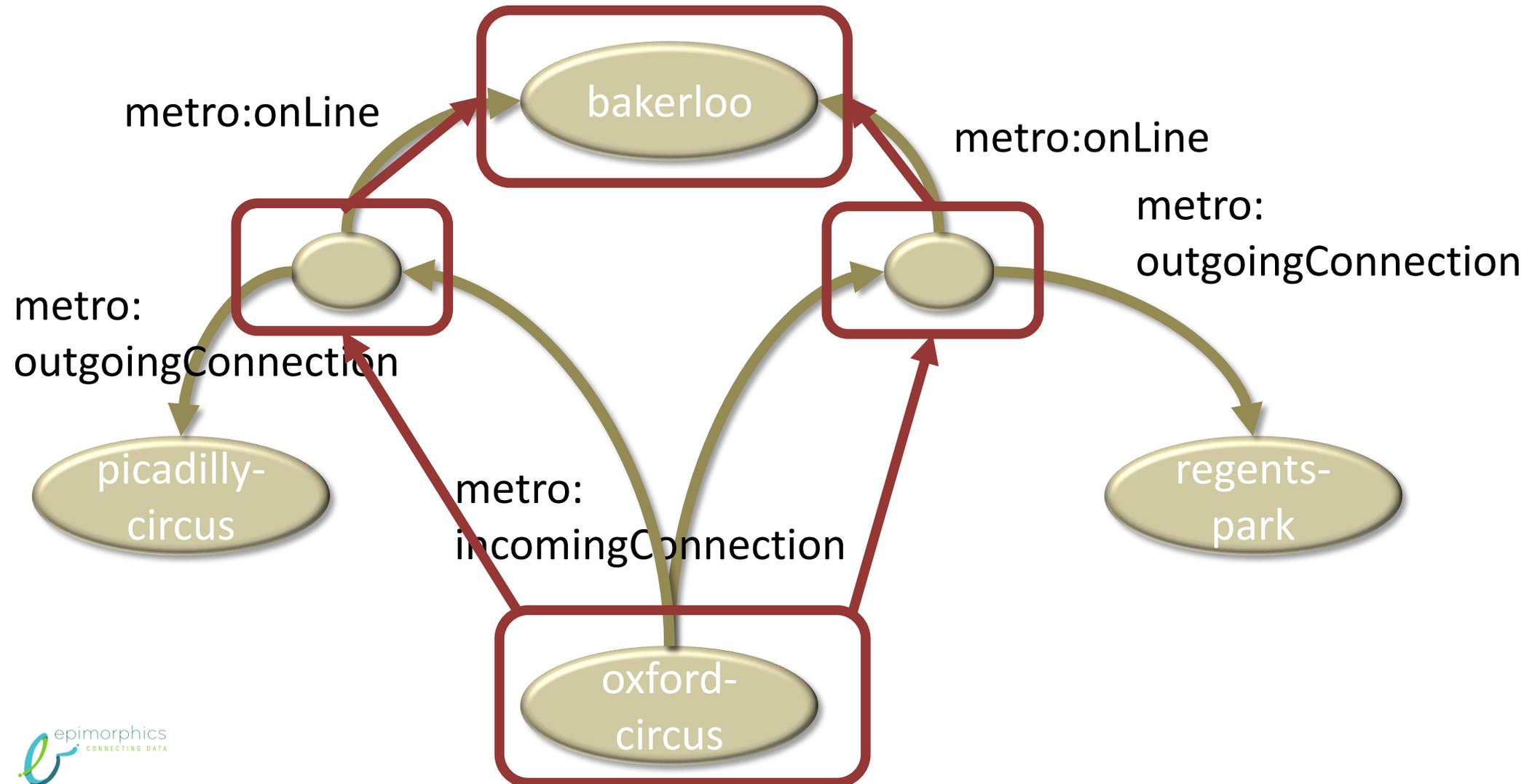
Why did we get duplicates?

?station metro:incomingConnection

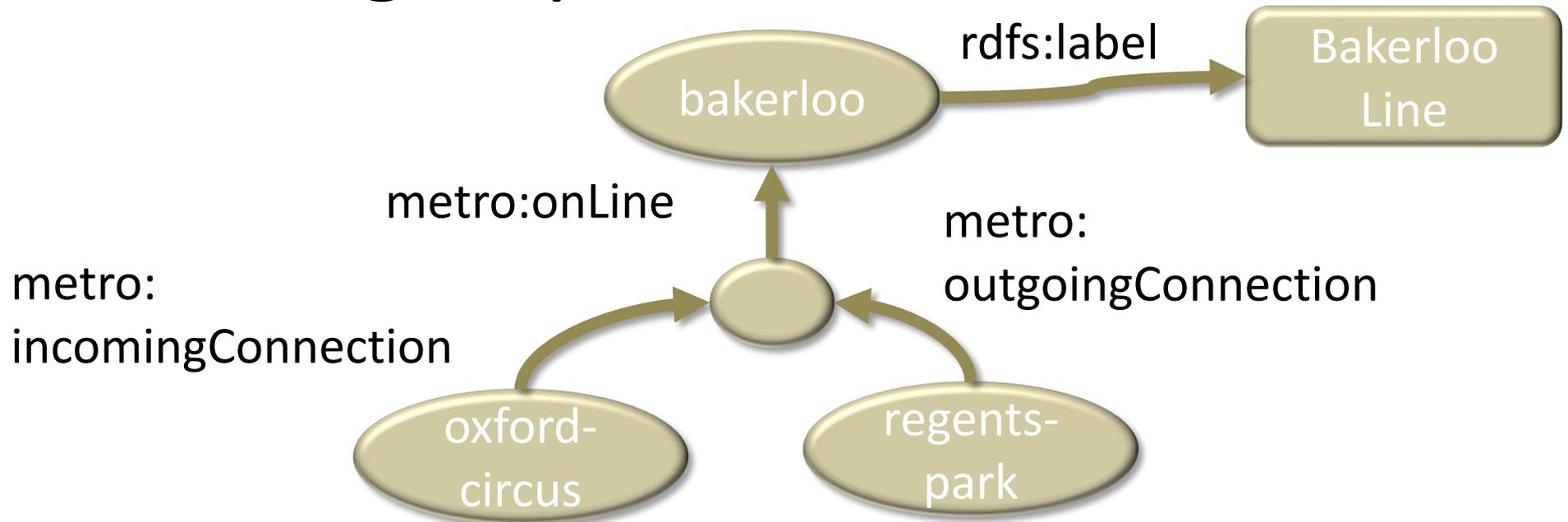
?con .

?con metro:onLine

?line .



Eliminating Duplicates



```
SELECT DISTINCT ?stationName ?lineName
```

```
WHERE {
```

```
  ?station      rdf:type          metro:UndergroundStation
                ;                rdfs:label
                ;                metro:incomingConnection
  ?conn         metro:onLine
  ?line         rdfs:label
```

```
  ?stationName
  ?conn .
  ?line .
  ?lineName .
```

Duplicates have gone

417 results in 0 min 0.181 s

1	-----	
2	stationName	lineName
3	=====	
4	"Acton Town"	"District Line"
5	"Acton Town"	"Piccadilly Line"
6	"Aldgate"	"Circle Line"
7	"Aldgate"	"Metropolitan Line"
8	"Aldgate East"	"District Line"
9	"Aldgate East"	"Hammersmith & City Line"
10	"Alperton"	"Piccadilly Line"
11	"Amersham"	"Metropolitan Line"
12	"Angel"	"Northern Line"
13	"Archway"	"Northern Line"
14	"Arnos Grove"	"Piccadilly Line"
15	"Arsenal"	"Piccadilly Line"
16	"Baker Street"	"Bakerloo Line"
17	"Baker Street"	"Circle Line"
18	"Baker Street"	"Hammersmith & City Line"
19	"Baker Street"	"Jubilee Line"
20	"Baker Street"	"Metropolitan Line"
21	"Balham"	"Northern Line"
22	"Bank"	"Waterloo & City Line"
23	"Bank"	"Central Line"
24	"Bank"	"Docklands Light Railway"
25	"Bank"	"Northern Line"

Can also use **REDUCED** instead of **DISTINCT**

Sorting - Order By

```
SELECT DISTINCT ?stationName ?lineName
WHERE {
    ?station    rdf:type        metro:UndergroundStation
                ;    rdfs:label    ?stationName
                ;    metro:incomingConnection ?conn
                .
    ?conn       metro:onLine    ?line .
    ?line       rdfs:label      ?lineName .
}
ORDER BY ?lineName ?stationName
# ORDER BY DESC(?lineName) DESC(?stationName)
```

Exercise

- Find all the museums and order by distance from the nearest tube station
 - hint: `rdf:type <http://schema.org/Museum>`
- Extra Credit:
 - List all the Bakerloo line stations from North to South
 - hint `geo:lat`

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Find all the museums and order by distance from the nearest tube station

```
SELECT DISTINCT ?museumName ?distance
WHERE {
    ?museum    a <http://schema.org/Museum>
              ;    rdfs:label      ?museumName
              ;    metro:nearestUndergroundStationDistance    ?distance.
} ORDER BY ?distance
```

24 results in 0 min 0.101 s

	museumName	distance
1		
2	museumName	distance
3	-----	-----
4	"Wellcome Collection"	143
5	"Whitechapel Gallery"	160
6	"The Photographers' Gallery"	181
7	"Russian Cultural Centre (London)"	232
8	"Whitfield Fine Art"	256
9	"Saatchi Gallery"	260
10	"October Gallery"	304
11	"Victoria and Albert Museum"	313
12	"Foundling Museum"	316
13	"Art in Perpetuity Trust"	327
14	"National Maritime Museum"	331
15	"Queen's Gallery"	400
16	"British Museum"	431
17	"Institute of Contemporary Arts"	433
18	"Tate Britain"	461
19	"Sartorial Contemporary Art"	491
20	"Tate Modern"	543
21	"Parasol unit foundation for contemporary art"	687
22	"White Cube"	688
23	"De Morgan Centre"	754
24	"Serpentine Gallery"	806
25	"William Morris Gallery"	920
26	"Geffrye Museum"	977
27	"Dulwich Picture Gallery"	2684
28	-----	-----

FILTERS: only show the ones within 500M

```
SELECT DISTINCT ?museumName ?distance
WHERE {
    ?musuem    a <http://schema.org/Museum>
    ;         rdfs:label    ?museumName
    ;         metro:nearestUndergroundStationDistance    ?distance.
    FILTER ( ?distance <= 500 )
} ORDER BY ?distance
```

16 results in 0 min 0.100 s

	-----	-----
	museumName	distance
	-----	-----
1		
2		
3	-----	-----
4	"Wellcome Collection"	143
5	"Whitechapel Gallery"	160
6	"The Photographers' Gallery"	181
7	"Russian Cultural Centre (London)"	232
8	"Whitfield Fine Art"	256
9	"Saatchi Gallery"	260
10	"October Gallery"	304
11	"Victoria and Albert Museum"	313
12	"Foundling Museum"	316
13	"Art in Perpetuity Trust"	327
14	"National Maritime Museum"	331
15	"Queen's Gallery"	400
16	"British Museum"	431
17	"Institute of Contemporary Arts"	433
18	"Tate Britain"	461
19	"Sartorial Contemporary Art"	491
20	-----	-----
21		

LIMIT: show only 10 results

```
SELECT DISTINCT ?museumName ?distance
WHERE {
    ?musuem    a <http://schema.org/Museum>
              ;    rdfs:label      ?museumName
              ;    metro:nearestUndergroundStationDistance      ?distance.
    FILTER ( ?distance <= 500 )
} ORDER BY ?distance
LIMIT 10
```

10 results in 0 min 0.098 s

	-----	-----
	museumName	distance
	-----	-----
4	"Wellcome Collection"	143
5	"Whitechapel Gallery"	160
6	"The Photographers' Gallery"	181
7	"Russian Cultural Centre (London)"	232
8	"Whitfield Fine Art"	256
9	"Saatchi Gallery"	260
10	"October Gallery"	304
11	"Victoria and Albert Museum"	313
12	"Foundling Museum"	316
13	"Art in Perpetuity Trust"	327
14	-----	-----
15		

OFFSET: start at result 10

```
SELECT DISTINCT ?museumName ?distance
WHERE {
    ?musuem    a <http://schema.org/Museum>
              ;    rdfs:label    ?museumName
              ;    metro:nearestUndergroundStationDistance    ?distance.
    FILTER ( ?distance <= 500 )
} ORDER BY ?distance
LIMIT 10
OFFSET 10
```

6 results in 0 min 0.101 s

	museumName	distance
	-----	-----
1		
2		
3	-----	-----
4	"National Maritime Museum"	331
5	"Queen's Gallery"	400
6	"British Museum"	431
7	"Institute of Contemporary Arts"	433
8	"Tate Britain"	461
9	"Sartorial Contemporary Art"	491
10	-----	-----
11		

List the Bakerloo line stations from north to south

<http://www.w3.org/TR/sparql11-query/>

25 results in 0 min 0.161 s

1	-----		
2	stationName	lat	
3	=====		
4	"Harrow & Wealdstone"	51.5925	
5	"Kenton"	51.5816	
6	"South Kenton"	51.5701	
7	"North Wembley"	51.5621	
8	"Wembley Central"	51.5519	
9	"Stonebridge Park"	51.5439	
10	"Harlesden"	51.5362	
11	"Kilburn Park"	51.5351	
12	"Queen's Park"	51.5341	
13	"Willesden Junction"	51.5326	
14	"Kensal Green"	51.5304	
15	"Maida Vale"	51.53	
16	"Warwick Avenue"	51.5235	
17	"Regent's Park"	51.5234	
18	"Baker Street"	51.5226	
19	"Marylebone"	51.5225	
20	"Edgware Road (Bak)"	51.5199	
21	"Paddington"	51.5154	
22	"Oxford Circus"	51.515	
23	"Piccadilly Circus"	51.5098	
24	"Charing Cross"	51.508	
25	"Embankment"	51.5074	

geo:lat, geo:long

metro:

UndergroundStation

List the Bakerloo line stations from north to south

```
SELECT DISTINCT ?stationName ?lat
WHERE {
    ?station rdf:type metro:UndergroundStation
        ; rdfs:label ?stationName
        ; metro:incomingConnection/metro:onLine
            lu-line:bakerloo_line
        ; geo:lat ?lat .
}
order by desc(?lat)
```

List all the stations and their nearby points of interest

```
SELECT DISTINCT ?stationName ?poiName {  
  ?station rdf:type metro:UndergroundStation  
    ; rdfs:label ?stationName  
    ; metro:nearbyTo ?poi  
  .  
  ?poi rdfs:label ?poiName .  
} ORDER BY ?stationName
```

We Get

24 results in 0 min 0.109 s

	stationName	poiName
2		
3		
4	"Aldgate East"	"Whitechapel Gallery"
5	"Angel"	"Sartorial Contemporary Art"
6	"Blackfriars"	"Tate Modern"
7	"Bond Street"	"Whitfield Fine Art"
8	"Brixton"	"Dulwich Picture Gallery"
9	"Cutty Sark"	"National Maritime Museum"
10	"Deptford Bridge"	"Art in Perpetuity Trust"
11	"East Putney"	"De Morgan Centre"
12	"Euston Square"	"Wellcome Collection"
13	"Holborn"	"Russian Cultural Centre (London)"
14	"Lancaster Gate"	"Serpentine Gallery"
15	"London Bridge"	"White Cube"
16	"Old Street"	"Geffrye Museum"
17	"Old Street"	"Parasol unit foundation for contemporary art"
18	"Oxford Circus"	"The Photographers' Gallery"
19	"Piccadilly Circus"	"Institute of Contemporary Arts"
20	"Pimlico"	"Tate Britain"
21	"Russell Square"	"British Museum"
22	"Russell Square"	"Foundling Museum"
23	"Russell Square"	"October Gallery"
24	"Sloane Square"	"Saatchi Gallery"
25	"South Kensington"	"Victoria and Albert Museum"
26	"Victoria"	"Queen's Gallery"
27	"Walthamstow Central"	"William Morris Gallery"
28		

That is not enough stations!

Using OPTIONAL to List all the stations and their nearby points of interest

```
SELECT DISTINCT ?stationName ?poiName
WHERE {
    ?station rdf:type metro:UndergroundStation
             ; rdfs:label ?stationName .
    OPTIONAL {
        ?station metro:nearbyTo ?poi .
        ?poi rdfs:label ?poiName .
    }
} ORDER BY ?stationName
```

Now we Get

 309 results in 0 min 0.176 s

	stationName	poiName
1		
2	stationName	poiName
3	-----	-----
4	"Acton Town"	
5	"Aldgate"	
6	"Aldgate East"	"Whitechapel Gallery"
7	"All Saints"	
8	"Alperton"	
9	"Amersham"	
10	"Angel"	"Sartorial Contemporary Art"
11	"Archway"	
12	"Arnos Grove"	
13	"Arsenal"	
14	"Baker Street"	
15	"Balham"	
16	"Bank"	
17	"Barbican"	
18	"Barking"	
19	"Barkingside"	
20	"Barons Court"	
21	"Bayswater"	
22	"Beckton"	
23	"Beckton Park"	
24	"Becontree"	
25	"Belsize Park"	
26	"Bermondsey"	
27	"Bethnal Green"	
28	"Blackfriars"	"Tate Modern"

UNION: Find the names of all lines and the names of all stations

```
SELECT DISTINCT ?thing ?name
WHERE {
  {
    ?thing rdf:type metro:UndergroundStation .
  } UNION {
    ?thing rdf:type metro:UndergroundLine .
  }
  ?thing rdfs:label ?name
  ;     rdf:type ?type
} ORDER BY ?type
```

319 results in 0 min 0.131 s

1	-----	-----
2	thing	name
3	-----	-----
4	lu-l:bakerloo_line	"Bakerloo Line"
5	lu-l:central_line	"Central Line"
6	lu-l:circle_line	"Circle Line"
7	lu-l:district_line	"District Line"
8	lu-l:docklands_light_railway	"Docklands Light Railway"
9	lu-l:east_london_line	"East London Line"
10	lu-l:hammersmith_and_city_line	"Hammersmith & City Line"
11	lu-l:jubilee_line	"Jubilee Line"
12	lu-l:metropolitan_line	"Metropolitan Line"
13	lu-l:northern_line	"Northern Line"
14	lu-l:piccadilly_line	"Piccadilly Line"
15	lu-l:victoria_line	"Victoria Line"
16	lu-l:waterloo_and_city_line	"Waterloo & City Line"
17	lu-s:acton_town	"Acton Town"
18	lu-s:aldgate	"Aldgate"
19	lu-s:aldgate_east	"Aldgate East"
20	lu-s:all_saints	"All Saints"
21	lu-s:alperton	"Alperton"
22	lu-s:amersham	"Amersham"
23	lu-s:angel	"Angel"
24	lu-s:archway	"Archway"
25	lu-s:arnos_grove	"Arnos Grove"

Aggregation - Count the stations

```
SELECT (COUNT( DISTINCT ?station) AS ?count)
WHERE {
    ?station rdf:type metro:UndergroundStation
}
```

1 result in 0 min 0.162 s

1	-----
2	count
3	=====
4	306
5	-----
6	

Count the stations on each line

```
SELECT ?lineName (COUNT(DISTINCT ?station) AS ?numStations)
WHERE {
    ?station rdf:type metro:UndergroundStation
            ; rdfs:label ?stationName
            ; metro:incomingConnection/metro:onLine ?line .
    ?line rdfs:label ?lineName .
}
GROUP BY ?lineName
ORDER BY ?numStations
```

Should get something like this

13 results in 0 min 0.174 s

1	-----		
2	lineName	numStations	
3	=====	=====	=====
4	"Waterloo & City Line"	2	
5	"East London Line"	9	
6	"Victoria Line"	16	
7	"Bakerloo Line"	25	
8	"Circle Line"	27	
9	"Jubilee Line"	27	
10	"Hammersmith & City Line"	28	
11	"Metropolitan Line"	34	
12	"Docklands Light Railway"	38	
13	"Central Line"	49	
14	"Northern Line"	50	
15	"Piccadilly Line"	52	
16	"District Line"	60	
17	-----		

Aggregate Functions

- COUNT(?var)
- SUM(?var)
- AVG(?var)
- MIN(?var)
- MAX(?var)
- GROUP_CONCAT(?var; separator=" ")
- SAMPLE(?var)

Exercises

- Count all the stations on the Bakerloo line
- Which station has the most nearby POI
- Extra credit
 - List all the stations and their nearby points of interest, one line per station

Count all the stations on the Bakerloo line

```
SELECT (COUNT(DISTINCT ?station) AS ?numStations)
WHERE {
    ?station rdf:type metro:UndergroundStation
        ;    metro:incomingConnection/metro:onLine
            lu-l:bakerloo_line
        .
}
```

1 result in 0 min 0.065 s

1	-----
2	numStations
3	=====
4	25
5	-----
6	

Which station has the most nearby POI

```
SELECT ?stationName
      (COUNT( DISTINCT ?poi) AS ?count)
WHERE {
  ?station rdf:type metro:UndergroundStation
           ; rdfs:label ?stationName
           ; metro:nearbyTo ?poi
           .
} GROUP BY ?stationName
   ORDER BY DESC(?count)
# LIMIT 1
```

21 results in 0 min 0.064 s

	stationName	count
1		
2	stationName	count
3	-----	-----
4	"Russell Square"	3
5	"Old Street"	2
6	"Aldgate East"	1
7	"Angel"	1
8	"Blackfriars"	1
9	"Bond Street"	1
10	"Brixton"	1
11	"Cutty Sark"	1
12	"Deptford Bridge"	1
13	"East Putney"	1
14	"Euston Square"	1
15	"Holborn"	1
16	"Lancaster Gate"	1
17	"London Bridge"	1
18	"Oxford Circus"	1
19	"Piccadilly Circus"	1
20	"Pimlico"	1
21	"Sloane Square"	1
22	"South Kensington"	1
23	"Victoria"	1
24	"Walthamstow Central"	1
25	-----	-----

Federated Query

```
SELECT ?label ?lang ?comment {  
  ?station rdfs:label      "Russell Square"  
    ;      metro:nearbyTo  ?poi .  
  ?poi rdfs:label ?label  
    ; owl:sameAs ?poiDBP .  
  
SERVICE <http://dbpedia.org/sparql> {  
  ?poiDBP rdfs:comment ?comment .  
  BIND(LANG(?comment) AS ?lang)  
  FILTER(?lang = 'fr' || ?lang = 'de' || ?lang = 'es')  
}  
}
```

Datasets and Named Graphs

```
SELECT * {  
  GRAPH <http://example.org/graph> {  
    ?s ?p ?o  
  }  
}
```

And you should get something like

4 results in 0 min 0.289 s

```
1 -----  
2 | label                | lang | comment  
3 =====  
4 | "British Museum"     | "de"  | "Das British Museum (BM; de  
5 | "British Museum"     | "es"  | "El Museo Británico (en ing  
6 | "British Museum"     | "fr"  | "Le British Museum (qui peu  
7 | "Foundling Museum"   | "es"  | "El Museo Foundling de Lond  
8 -----  
9
```

label	lang	comment
"British Museum"	"de"	"Das British Museum (BM; de
"British Museum"	"es"	"El Museo Británico (en ing
"British Museum"	"fr"	"Le British Museum (qui peu
"Foundling Museum"	"es"	"El Museo Foundling de Lond

ASK

```
ASK {  
  lu-s:oxford_circus ?p ?o .  
}
```

Response in 0 min 0.062 s

1 yes

DESCRIBE

DESCRIBE lu-s:oxford_circus

```
18
19 lu-station:oxford_circus
20     a                transport:UndergroundStation ;
21     rdfs:label       "Oxford Circus" ;
22     transport:incomingConnection <http://training.epimorphics.com/transport/london-underground/connection/central_line/tottenham_court_
23     transport:nearbyTo <http://training.epimorphics.com/culture/london/museum/The_Photographers'_Gallery> ;
24     transport:outgoingConnection <http://training.epimorphics.com/transport/london-underground/connection/victoria_line/oxford_circus/g
25     geo:lat          51.515 ;
26     geo:long         -0.1415 .
27
```

CONSTRUCT

```
CONSTRUCT {  
  ?station metro:nameOfNearbyPOI ?poiName .  
} WHERE {  
  ?station a metro:UndergroundStation ;  
           metro:nearbyTo/rdfs:label ?poiName  
}
```

```
17 @prefix rdf:    <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .  
18  
19 lu-station:victoria transport:nameOfNearbyPOI  
20     "Queen's Gallery" .  
21  
22 lu-station:blackfriars  
23     transport:nameOfNearbyPOI "Tate Modern" .  
24  
25 lu-station:south_kensington  
26     transport:nameOfNearbyPOI "Victoria and Albert Museum" .  
27  
28 lu-station:piccadilly_circus  
29     transport:nameOfNearbyPOI "Institute of Contemporary Arts" .  
30  
31 lu-station:russell_square  
32     transport:nameOfNearbyPOI "October Gallery" , "Foundling Museum" , "British Museum" .  
33
```

UPDATE

```
INSERT {  
  ?station metro:nameOfNearbyPOI ?poiName .  
} WHERE {  
  ?station a metro:UndergroundStation ;  
           metro:nearbyTo/rdfs:label ?poiName  
}
```

Extension Points - Magic Properties

```
SELECT DISTINCT ?poiName {  
  ?station metro:nearbyTo ?poi .  
  ?poi      rdfs:label      ?poiName .  
  FILTER( CONTAINS(LCASE(?poiName), "gallery") )  
}
```

- A typical implementation will retrieve all the labels and run the CONTAINS function on them one at a time
- Ok for our London Tube data – not so good if you have a lot of data e.g. the addresses of all houses in the UK

```
SELECT DISTINCT ?poiName {  
  ?poiName text:query "gallery" .  
  ?station metro:nearbyTo ?poi .  
  ?poi      rdfs:label      ?poiName .  
}
```

SPARQL

- Graph patterns
- Filters
- Union and Optional
- Solution Modifiers
- Aggregation
- Datasets and named graphs
- Sub queries
- ASK, DESCRIBE, CONSTRUCT
- UPDATE
- Query federation

<http://www.w3.org/TR/sparql11-query/>

Questions?



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List all the stations and their nearby points of interest, one line per station

 20 results in 0 min 0.100 s

1	-----	
2	stationName	POIs
3	-----	
4	"Aldgate East"	"Whitechapel Gallery"
5	"Angel"	"Sartorial Contemporary Art"
6	"Blackfriars"	"Tate Modern"
7	"Bond Street"	"Whitfield Fine Art"
8	"Brixton"	"Dulwich Picture Gallery"
9	"Cutty Sark"	"National Maritime Museum"
10	"Deptford Bridge"	"Art in Perpetuity Trust"
11	"East Putney"	"De Morgan Centre"
12	"Euston Square"	"Wellcome Collection"
13	"Holborn"	"Russian Cultural Centre (London)"
14	"Lancaster Gate"	"Serpentine Gallery"
15	"London Bridge"	"White Cube"
16	"Old Street"	"Geffrye Museum Parasol unit foundation for contemporary art"
17	"Oxford Circus"	"The Photographers' Gallery"
18	"Pimlico"	"Tate Britain"
19	"Russell Square"	"British Museum Foundling Museum October Gallery"
20	"Sloane Square"	"Saatchi Gallery"
21	"South Kensington"	"Victoria and Albert Museum"
22	"Victoria"	"Queen's Gallery"
23	"Walthamstow Central"	"William Morris Gallery"
24	-----	

List all the stations and their nearby points of interest, one line per station

```
SELECT ?stationName
      (COUNT( DISTINCT ?poi) AS ?count)
WHERE {
    ?station rdf:type metro:UndergroundStation
             ; rdfs:label ?stationName
             ; metro:nearbyTo ?poi
             .
} GROUP BY ?stationName
ORDER BY ?stationName
# LIMIT 1
```

Count the connections between each pair of lines

56 results in 0 min 0.259 s

	line1Name	line2Name	count
1			
2			
3			
4	"Circle Line"	"District Line"	18
5	"District Line"	"Hammersmith & City Line"	14
6	"Circle Line"	"Hammersmith & City Line"	10
7	"Circle Line"	"Metropolitan Line"	9
8	"District Line"	"Piccadilly Line"	8
9	"Hammersmith & City Line"	"Metropolitan Line"	8
10	"Metropolitan Line"	"Piccadilly Line"	8
11	"Bakerloo Line"	"Northern Line"	4
12	"Northern Line"	"Victoria Line"	4
13	"Bakerloo Line"	"Circle Line"	3
14	"Central Line"	"District Line"	3
15	"Circle Line"	"Northern Line"	3
16	"Circle Line"	"Piccadilly Line"	3
17	"Docklands Light Railway"	"Jubilee Line"	3
18	"Jubilee Line"	"Metropolitan Line"	3
19	"Piccadilly Line"	"Victoria Line"	3
20	"Bakerloo Line"	"District Line"	2
21	"Bakerloo Line"	"Hammersmith & City Line"	2
22	"Bakerloo Line"	"Jubilee Line"	2
23	"Central Line"	"Circle Line"	2
24	"Central Line"	"Docklands Light Railway"	2
25	"Central Line"	"Hammersmith & City Line"	2
26	"Central Line"	"Jubilee Line"	2
27	"Central Line"	"Northern Line"	2
28	"Circle Line"	"Jubilee Line"	2

Count the connections between each pair of lines

```
SELECT DISTINCT ?line1Name ?line2Name
              (COUNT(DISTINCT ?station) AS ?count)
WHERE {
    ?station rdf:type metro:UndergroundStation
            ; rdfs:label ?stationName
            ; metro:incomingConnection/metro:onLine ?line1
            ; metro:incomingConnection/metro:onLine ?line2
            .
    FILTER( ?line1 != ?line2 )
    ?line1 rdfs:label ?line1Name .
    ?line2 rdfs:label ?line2Name .
    FILTER (?line1Name < ?line2Name)
}
GROUP BY ?line1Name ?line2Name
ORDER BY DESC(?cc int)
```