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CO7516 Semantic Web

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Assignment 2

1. Two constraints not achievable with RDFS.

Not possible to express disjointness between Motor and Sailing boats.

Not possible to express cardinality that a Berth can accept only one Boat.

2. SPARQL Queries

Please note that the SPARQL queries were developed against the code provided in assignment1.

Competency Question

If I wanted to hire a cabin cruiser which sleeps 3 people, where could I hire one from?

SPARQL

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

PREFIX boat: <http://www.co7516coursework1.com/jl571/OntologyJl571.rdf#>

SELECT ?brp ?boat ?sleepSpaces ?homeHaven

WHERE {

?brp boat:rentalProviderBoats ?boat.

?boat boat:sleepingSpaces ?sleepSpaces.

```

?boat a boat:CabinCruiser.
?brp boat:rentalProviderHomeHaven ?homeHaven
FILTER (?sleepSpaces = 3)
}

```

Competency Question

If I've hired a Cutter for a vacation, which harbours could I stop at overnight?

SPARQL

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX boat: <http://www.co7516coursework1.com/jl571/OntologyJl571.rdf#>
SELECT ?haven ?berth ?berthLength ?boat
WHERE {
?boat a boat:Cutter.
?boat boat:boatLength ?cutterLength.
?haven boat:havenBerths ?berth.
?berth boat:berthMaxLength ?berthLength.
FILTER (?berthLength = ?cutterLength)
}

```

Competency Question

If I've planned a route from Poole to Swanage, which boats are available to me which don't require crew other than myself?

SPARQL

```

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

```

```

PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX boat: <http://www.co7516coursework1.com/jl571/OntologyJl571.rdf#>

SELECT  ?boat
WHERE
{
  {
    ?route boat:routeHavens ?haven.
    ?haven boat:havenName ?havenName.
    ?haven boat:havenBerths ?berth.
    ?berth boat:berthMaxLength ?berthLength.
    ?boat boat:boatLength ?boatLength.
    ?boat boat:requiresCrew ?crewNum.
    OPTIONAL { ?boat boat:color ?color }.
    FILTER (?berthLength >= ?boatLength)
    FILTER (?crewNum = 0)
    FILTER regex(?havenName, "Poole")
  }
  UNION
  {
    ?route boat:routeHavens ?haven.
    ?haven boat:havenName ?havenName.
    ?haven boat:havenBerths ?berth.
    ?berth boat:berthMaxLength ?berthLength.
    ?boat boat:boatLength ?boatLength.
    ?boat boat:requiresCrew ?crewNum.
    ?boat boat:boatName ?boatName.
    OPTIONAL { ?boat boat:color ?color }.
    FILTER (?berthLength >= ?boatLength)
    FILTER (?crewNum = 0)
    FILTER regex(?havenName, "Swanage")
  }
}

```

GROUP BY ?boat

3. Write one SPARQL which uses all four attributes OPTIONAL, FILTER, GROUP BY, UNION.

The query below answers the same question as above, using all four attributes, and in addition provides a count of the number of berths available to the give boat.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

PREFIX boat: <http://www.co7516coursework1.com/jl571/OntologyJl571.rdf#>

SELECT ?boat (count(?berth) as ?berth_count)

WHERE

{

{

?route boat:routeHavens ?haven.

?haven boat:havenName ?havenName.

?haven boat:havenBerths ?berth.

?berth boat:berthMaxLength ?berthLength.

?boat boat:boatLength ?boatLength.

?boat boat:requiresCrew ?crewNum.

OPTIONAL { ?boat boat:color ?color }.

FILTER (?berthLength >= ?boatLength)

FILTER (?crewNum = 0)

FILTER regex(?havenName, "Poole")

}

UNION

{

?route boat:routeHavens ?haven.

?haven boat:havenName ?havenName.

?haven boat:havenBerths ?berth.

```
?berth boat:berthMaxLength ?berthLength.  
?boat boat:boatLength ?boatLength.  
?boat boat:requiresCrew ?crewNum.  
?boat boat:boatName ?boatName.  
OPTIONAL { ?boat boat:color ?color }.  
FILTER (?berthLength >= ?boatLength)  
FILTER (?crewNum = 0)  
FILTER regex(?havenName, "Swanage")  
}}  
GROUP BY ?boat
```

2. OWL 2

1.

```
<owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#CommercialBoatRentalProvider">
  <rdfs:subClassOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#BoatRentalProvider"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#rents"/>
      <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#CommercialBoat"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```

```
<owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#CommercialRoute">
  <rdfs:subClassOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Route"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#routeHavens"/>
      <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Port"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
```

```

    <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#routeType"/>
    <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#CommercialBoat"/>
  </owl:Restriction>
</rdfs:subClassOf>
</owl:Class>

```

```

<owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Harbour">
  <rdfs:subClassOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Haven"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#acceptsBoatType"/>
      <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#NonCommercialBoat"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

```

<owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#LeisureRoute">
  <rdfs:subClassOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Route"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#routeHavens"/>
      <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Harbour"/>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>

```

```

    <owl:Restriction>
      <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#routeType"/>
      <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#NonCommercialBoat"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>

```

2.

```

<owl:DatatypeProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#berthMaxLength">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Berth"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
</owl:DatatypeProperty>

```

```

<owl:DatatypeProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#hasEngine">
  <rdfs:subPropertyOf rdf:resource="http://www.w3.org/2002/07/
owl#topDataProperty"/>
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#MotorBoat"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
  <owl:propertyDisjointWith rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#hasSails"/>
</owl:DatatypeProperty>

```

```

<owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#routeHavens">

```



```
<rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/  
OntologyJl571.rdf#Route"/>
```

```
<rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/  
OntologyJl571.rdf#Haven"/>
```

```
</owl:ObjectProperty>
```

```
<owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/  
OntologyJl571.rdf#rentalProviderBoats">
```

```
<rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/  
OntologyJl571.rdf#BoatRentalProvider"/>
```

```
<rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/  
OntologyJl571.rdf#Boat"/>
```

```
</owl:ObjectProperty>
```

3.

On Class LeisureRoute :

```
<owl:Restriction>
```

```
<owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/  
OntologyJl571.rdf#routeHavens"/>
```

```
<owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/  
OntologyJl571.rdf#Harbour"/>
```

```
</owl:Restriction>
```

```
</rdfs:subClassOf>
```

```
<rdfs:subClassOf>
```

```
<owl:Restriction>
```

On class Harbour:

```
<owl:Restriction>
```

```
<owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/  
OntologyJl571.rdf#acceptsBoatType"/>
```

```

    <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#NonCommercialBoat"/>
  </owl:Restriction>

```

4.

```

  <owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#MotorBoat">
    <owl:equivalentClass>
      <owl:Class>
        <owl:intersectionOf rdf:parseType="Collection">
          <rdf:Description rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>
            <owl:Restriction>
              <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#hasEngine"/>
                <owl:hasValue rdf:datatype="http://www.w3.org/2001/
XMLSchema#boolean">true</owl:hasValue>
              </owl:Restriction>
            </owl:intersectionOf>
          </owl:Class>
        </owl:equivalentClass>
        <rdfs:subClassOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>
        <owl:disjointWith rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#SailingBoat"/>
      </owl:Class>

```

5.

```

  <owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat">
    <owl:equivalentClass>
      <owl:Class>

```

```

    <owl:unionOf rdf:parseType="Collection">
      <rdf:Description rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#MotorBoat"/>
      <rdf:Description rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#SailingBoat"/>
    </owl:unionOf>
  </owl:Class>
</owl:equivalentClass>
</owl:Class>

```

6.

Exact

```

<owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Berth

```

Min

```

<owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#MotorBoat

```

```

    <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#engine"/>

    <owl:minCardinality rdf:datatype="http://www.w3.org/2001/
XMLSchema#nonNegativeInteger">1</owl:minCardinality>

    </owl:Restriction>

    </rdfs:subClassOf>

    <owl:disjointWith rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#SailingBoat"/>

    </owl:Class>

```

Max

```

    <owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#BoatRentalProvider">

    <rdfs:subClassOf>

    <owl:Restriction>

    <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#contact"/>

    <owl:maxCardinality rdf:datatype="http://www.w3.org/2001/
XMLSchema#nonNegativeInteger">1</owl:maxCardinality>

    </owl:Restriction>

    </rdfs:subClassOf>

    </owl:Class>

```

7.

```

    <owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#SailingBoat">

    <owl:equivalentClass>

    <owl:Class>

    <owl:intersectionOf rdf:parseType="Collection">

    <rdf:Description rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>

    <owl:Restriction>

```

```

        <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#hasEngine"/>
        <owl:hasValue rdf:datatype="http://www.w3.org/2001/
XMLSchema#boolean">false</owl:hasValue>
    </owl:Restriction>
</owl:intersectionOf>
</owl:Class>
</owl:equivalentClass>
<rdfs:subClassOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>
</owl:Class>

<owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#MotorBoat">
    <owl:equivalentClass>
        <owl:Class>
            <owl:intersectionOf rdf:parseType="Collection">
                <rdf:Description rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>
                <owl:Restriction>
                    <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#hasEngine"/>
                    <owl:hasValue rdf:datatype="http://www.w3.org/2001/
XMLSchema#boolean">true</owl:hasValue>
                </owl:Restriction>
            </owl:intersectionOf>
        </owl:Class>
    ...
</owl:Class>

```

8.

```

<owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Port">

```

```

    <rdfs:subClassOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Haven"/>
    <rdfs:subClassOf>
        <owl:Restriction>
            <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#acceptsBoatType"/>
                <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#CommercialBoat"/>
            </owl:Restriction>
        </rdfs:subClassOf>
    </owl:Class>

```

```

    <owl:Class rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#CommercialBoatRentalProvider">
        <rdfs:subClassOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#BoatRentalProvider"/>
        <rdfs:subClassOf>
            <owl:Restriction>
                <owl:onProperty rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#rents"/>
                    <owl:allValuesFrom rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#CommercialBoat"/>
                </owl:Restriction>
            </rdfs:subClassOf>
        </owl:Class>

```

9.

a.

```

    <owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#connectsTo">
        <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#SymmetricProperty"/>
        <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Haven"/>

```

```

    <rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Haven" />
  </owl:ObjectProperty>

  <owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#belongsTo">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#SymmetricProperty" />
    <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#BoatRentalProvider" />
    <rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat" />
  </owl:ObjectProperty>

```

b.

```

  <owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#isBiggerThan">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#TransitiveProperty" />
    <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat" />
    <rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat" />
  </owl:ObjectProperty>

```

```

  <owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#locatedIn">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#TransitiveProperty" />
    <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Berth" />
    <rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Haven" />
  </owl:ObjectProperty>

```

c.

```
<owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#isCommercial">
  <rdfs:subPropertyOf rdf:resource="http://www.w3.org/2002/07/
owl#topObjectProperty"/>
  <owl:inverseOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#isLeisure"/>
  <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>
</owl:ObjectProperty>

<owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#motors">
  <owl:inverseOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#sails"/>
  <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>
  <rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#MotorBoat"/>
</owl:ObjectProperty>
```

d.

```
<owl:DatatypeProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#berthMaxLength">
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
  <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Berth"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#int"/>
</owl:DatatypeProperty>

<owl:DatatypeProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#hasEngine">
```



```

    <rdfs:subPropertyOf rdf:resource="http://www.w3.org/2002/07/
owl#topDataProperty"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#FunctionalProperty"/>
    <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#MotorBoat"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#boolean"/>
    <owl:propertyDisjointWith rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#hasSails"/>
</owl:DatatypeProperty>

```

e.

```

<owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#motors">
    <owl:inverseOf rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#sails"/>
    <rdf:type rdf:resource="http://www.w3.org/2002/07/
owl#InverseFunctionalProperty"/>
    <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>
    <rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#MotorBoat"/>
</owl:ObjectProperty>

<owl:ObjectProperty rdf:about="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#sails">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/
owl#InverseFunctionalProperty"/>
    <rdfs:domain rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#Boat"/>
    <rdfs:range rdf:resource="http://www.co7516coursework1.com/jl571/
OntologyJl571.rdf#SailingBoat"/>
</owl:ObjectProperty>

```

f.

g.